U.S. Dairy Export Council®

MARKET RESEARCH

GLOBAL

Dairy Blends

SEPTEMBER 2007

GLOBAL DAIRY BLENDS MARKET –2006

CONTENTS

Page

Page

Page

Page

Page

GLOSSARY

A$	Australian dollars
A_w	water activity
AHECC	Australian Harmonized Export Commodity Classification
AMF	Anhydrous milk fat
BCCA	branched chain amino acids
BMP	buttermilk powder
C$	Canadian dollars
CBSA	Canadian Border Services Agency
CPP	Casein PhosphoPeptide
CCRA	Canadian Customs and Revenue Agency
CHD	coronary heart disease
CITT	Canadian International Trade Tribunal
CMR	calf milk replacer
Da	Dalton – unit expressing molecular weight
Dec	December
DFC	Dairy Farmers of Canada
e.g.	for example
EMC	enzyme-modified cheese
esp.	especially
est.	estimate
EU	European Union
FDA	Food and Drug Administration
FFA	free fatty acids
FOS	fructo-oligosaccharides
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GMP	Glycomacropeptide
GMO	genetically modified organism
GOS	galacto-oligosaccharides
HS	Harmonized Standard
ICL	Import Control List
i.e.	that is
incl.	including
Jan	January
kg	kilograms
m	meters
MAFF	Ministry of Agriculture, Forestry & Fisheries
MFGM	milk fat globule membrane
mg	milligrams
MPC	milk protein concentrate
MPI	milk protein isolate
MSG	mono sodium glutamate
MSNF	milk solids non-fat

mt	metric tons
n.a.	not available
n.e.s.	not elsewhere specified
No.	number
N.Z.	New Zealand
NZFSA	N.Z. Food Safety Authority
o/w	oil-in-water (with reference to emulsions)
p.a.	per annum
RTD	ready-to-drink
SCM	sweetened condensed milk
SMP	skim milk powder
SPI	soy protein isolate
TPN	total parenteral nutrition
TRQ	Tariff Rate Quota
TSUS	Tariff Schedule of the United States
UHT	ultra-high temperature
U.S.	United States
vs.	versus
w/o	water-in-oil (with reference to emulsions)
WCO	World Customs Organization
WPC	whey protein concentrate
WPI	whey protein isolate
WMP	whole milk powder
WPC	whey protein concentrate
WTO	World Trade Organization
YTD	year to date

1.0 EXECUTIVE SUMMARY

1.1 The Market for Dairy Blends

1.1.1 Global trade in dairy blends

This report represents the third in a series of global blends studies undertaken since 1999 by Landell Mills Consulting on behalf of the U.S. Dairy Export Council. Through the course of these studies, it is obvious that interest and activity in blends is increasing. This includes expansion in global dairy blend trade. However, reliable trade data is difficult to obtain.

Trade in dairy and related blends is notorious for its lack of available data. Regardless, through the course of this study, international trade in dairy blends has been estimated at 1.7 million mt per year.

This figure may seem high when compared to exports of conventional dairy commodities (e.g. global butter/butteroil trade 900,000 mt; SMP trade 1.1 million mt; WMP trade 1.74 million mt; cheese trade 1.58 million mt). However, it is important to keep in mind that the blend trade comprises a significant proportion of non-dairy constituents that will naturally expand the volume base being considered. For example, the case of butteroil/sugar exports to Canada represents a mix of 51% sugar, 49% butteroil. Thus, the dairy content is less than half of the total blends volume which was given as 16,125 mt in 2004.

As further substance to this volume and trend data, the report shows the following:

- Canadian imports of butteroil/sugar blends have risen steadily each year from 1,735 mt in 1994 to 16,125 mt in 2004, and has far surpassed the CITT belief that market penetration of butteroil would settle at 25% of the fat requirement for ice cream production and replaceable fat for processed cheese

- Australian dairy blend exports have been analyzed in detail—standing at more than 175,000 mt in 2005 (up from 151,500 mt in 2003). A summary of the types of blends and recent volume trends exported by Australian companies is given in the following table (note: significantly more detail, including 8 digit HS Codes, is provided in the body of the report)

Table 1.1.1a Recent volume trends – Australian dairy blends (volume, '000 mt)

HS Code	2003, '000 mt	2004, '000 mt	2005, '000 mt
0401	1.0	1.0	1.0
0402	76.9	89.0	88.7
0403	0.6	0.6	0.4
0404	2.5	3.2	4.3
0406	0.1	0.1	0.1
1517	3.0	3.0	3.0
1704	1.5	1.5	1.5
1806	11.9	12.0	12.7
1901	17.0	21.7	24.3
2102	0.05	0.05	0.05
2103	10.0	10.0	10.0
2106	23.4	24.8	22.7
2309	3.5	5.8	6.7
3501	0.1	0.01	0.1
Total – all categories	**151.5**	**172.7**	**175.5**

Source: Australian Statistics Office, Landell Mills analysis

- Within Australia, the leading dairy blender is Intermix. The company sells almost exclusively to the export market. It has a volume in excess of 36,000 mt p.a., and is widely touted as accounting for at least 20% of Australia's dairy blend exports. Included in that volume is 26,000 mt of dairy-based blends and pre-mixes exported to the Japanese market. Strong future growth is expected (albeit off a small base) in the China market

- South Korean imports of dairy blends have shown an upward trend over recent years. This is reflected in the following table (again, more detail is provided in the body of the report), where three broad commodity codes are profiled Total blend imports for these categories in 2005 stood at 36,600 mt—up from 25,200 mt in 2001

Table 1.1.1b Trends in South Korean dairy blend imports

HS Code	2001, '000 mt	2002, '000 mt	2003, '000 mt	2004, '000 mt	2005, '000 mt
1806	6.9	8.5	6.4	8.7	7.9
0404	11.5	13.9	6.3	21.6	22.3
1901	6.8	7.8	6.4	8.0	6.4
Total	**25.2**	**30.2**	**19.1**	**38.3**	**36.6**

Source: KMAF

Looking at the preceding data, one surely questions how the remainder of the 1.7 million mt is made up. In order to get a better handle on this, Landell Mills has looked at key application sectors that account for a large share of the current and potential dairy blend business.

1.1.2 Ice cream industry

Based on reasoning similar to that used in the earlier studies, the following is determined in terms of whey solids potential in the ice cream industry.

Table 1.1.2 Whey usage (1998 vs. 2005) in the ice cream industry (mt, whey solids equivalent)

	Developed Western world		Import dependent regions		Total	
Category	**1998**	**2005**	**1998**	**2005**	**1998**	**2005**
Liquid concentrated whey	43,400	53,500	2,275	2,400	45,675	55,900
WPC-34/sweet whey powder	2,175	2,700	5,075	6,170	7,250	8,870
DWP-40	975	1,200	18,600	22,780	19,575	23,980
Total	**46,550**	**57,400**	**25,950**	**31,350**	**72,500**	**88,750**

Source: Landell Mills analysis based on official statistics and trade sources

All of this volume is blended. However, the volume that is *pre-blended* (i.e. blended before reaching the manufacturing facility) is unknown. While it is plausible for 100% of these whey solids (equivalent to 88,750 mt in 2005—up from 72,500 mt in 1998) to potentially be incorporated in wet and dry pre-blends for ice cream manufacture, two important points are raised:

- Realistically, less than 25% of whey usage in the ice cream industry is expected to be pre-blended—approximately 22,000 mt
- Virtually all of this volume will be compounded with non-fat milk solids derived from skim milk; buttermilk solids will be used to a lesser extent. Other ingredients will include sugar and such additives as hydrocolloids, emulsifiers, coloring, and so on—particularly in the case of ice cream powder mix used in soft serve and related applications. Thus, the potential blended volume expands considerably beyond the 22,000 mt discussed immediately above. With 15% whey usage to replace milk solids derived from non-fat milk, the blended volume could be 145,000+ mt. Adding in sugar to a pre-blend would expand this base volume even further

1.1.3 Yogurt industry

Based on reasoning similar to that used in the earlier studies, the following is determined in terms of whey solids potential in the yogurt industry.

Table 1.1.3 Whey usage (1998 vs. 2005) in MSNF replacement yogurt industry (mt, whey solids equivalent)

	Developed Western world		Import dependent regions		Total	
Category	**1998**	**2005**	**1998**	**2005**	**1998**	**2005**
Yogurt market	5,816,000	6,350,000	3,884,000	5,180,000	9,700,000	11,530,000
MSNF content (11.0%)	639,760	698,500	427,240	569,800	1,067,000	1,268,300
Main component (8.2%)	476,900	520,700	350,340	424,760	827,240	945,460
Balancing component (2.8%)	162,860	177,800	76,900	145,040	239,760	322,840

	Developed Western world		Import dependent regions		Total	
Category	**1998**	**2005**	**1998**	**2005**	**1998**	**2005**
Main component:						
Powder	47,960	52,070	332,840	383,510	380,800	435,580
Liquid skim concentrate	405,365	442,595	17,500	20,000	422,865	462,595
WPC-34/sweet whey powder	23,845	26,035	insignificant	21,250	23,845	47,285
Balancing component:						
SMP	146,860	160,020	69,200	130,440	216,060	290,460
WPC-34/sweet whey powder	16,000	17,780	7,700	14,600	23,700	32,380

Source: Landell Mills based on official statistics and trade sources

Thus, the annual global potential for whey solids equivalent in the yogurt sector currently stands at 79,665 mt—up from 35,850 mt in 1998. All of this volume could potentially be incorporated into blends for yogurt manufacturers. The natural approach would be to blend it with non-fat milk solids as follows:

- For incorporation in main component: a blend consisting of 90% SMP solids:10% whey solids
- For incorporation in balancing component: a blend consisting of 90% SMP solids: 10% whey solids; however, as it is a balancing component, this will entirely depend on the final specification, composition and chemical analysis of the main component

1.1.4 Infant formula

The infant formula analysis undertaken in the earlier studies has been expanded upon further. This is because infant formula is one of the classic dairy blends, and has a large consumption volume throughout the world.

Ingredient composition between different infant formula will change depending on a range of factors. However, a template for the two main Asian infant formula categories is used for analysis in the

body of this report, based on the data and analysis in the following table.

Note: The average product mix in the Asian regional infant formula market is as follows:

- Starter formula 63.4%
- Follow-on formula 33.5%
- Special formula 3.1%

Table 1.1.4a Template for infant formula in key market categories – Asia

Component	Volume composition (%)	
	Starter formula	Follow-on formula
Demineralized WPC	2.9	3.7
Casein	11.6	14.6
Non-fat milk powder	2.3	2.2
Lactose	53.6	47.9
Sucrose	-	8.4
Amino acids	0.1	0.1
Fat source	25.9	19.0
Vitamins	0.2	0.2
Minerals	3.4	3.9

Source: Landell Mills based on industry sources

Crudely extrapolating Asian data to a global situation, the following is estimated for 2006.

Table 1.1.4b Regional characteristics of the global infant formula market (volume, '000 mt)

Region	Total, '000 mt	Starter, '000 mt	Follow-on, '000 mt	Special, '000 mt
Asia	516.9	327.7	173.2	16.0
Americas	244.8	151.8	83.2	9.8
Europe	104.3	52.1	35.5	16.6
Africa / Middle East	36.3	24.7	10.8	0.7
Oceania	4.5	2.7	1.6	0.2
World Total	**906.8**	**559.0**	**304.3**	**43.3**

Source: Landell Mills based on official statistics and trade sources

Thus, the global infant formula market demand is estimated at almost 910,000 mt annually. On the basis that up to 70.4% of Starter formula and 68.4% of Follow-on formula could be composed of dairy protein and dairy carbohydrate, the opportunity for blend supply into the global infant formula market is estimated for 2006 as follows.

Table 1.1.4c Estimated dairy blend component of global infant formula market

Region	Total blends, mt	Starter Blends, mt	Follow-on blends, mt
Asia	349,132	230,698	118,434
Americas	163,808	106,900	56,908
Europe	60,992	36,710	24,282
Africa/M. East	24,806	17,388	7,418
Oceania	3,030	1,915	1,115
World total	**601,768**	**393,611**	**208,157**

Source: Landell Mills analysis

Landell Mills estimates that the share of the global infant formula market comprised of dairy proteins and dairy carbohydrates that are traded internationally could be as high as indicated in the table below.

Table 1.1.4d Estimated internationally traded volume of dairy protein and carbohydrates in infant formula

Region	Volume, mt
Asia	350,000
Americas (incl dairy export nations)	134,500
Africa / Middle East	24,800
Total	**509,300**

Source: Landell Mills analysis

This entire volume has the potential to be dairy blends. However, a significant quantity currently is being shipped to markets as discrete ingredients for blending in-market or at point of manufacture.

1.1.5 Bakery goods

Based on reasoning similar to that used in the earlier studies, the following is determined in terms of dairy blend potential in the bakery industry.

Table 1.1.5 Potential usage of dairy blends in global bakery industry

	Annual market size (million mt)	Potential for dairy blend usage ('000 mt)
1998	66.7	533.4
2006	74.2	593.6

Source: Landell Mills based on official statistics and trade sources

1.2 Summary of Key Findings

Apart from the volume analysis conducted in the preceding section, a number of key findings were determined through the course of the study:

- Landell Mills' perception of dairy blends, especially as they are understood in global trade terms, can be taken from three perspectives. These, and the way a dairy exporter gets involved, are outlined in the following table

Table 1.2 Understanding of dairy blends

Blending practice	How a dairy exporter gets involved	Commentary
Blends that are composed at or close to the point of manufacture of one of the key ingredients. These blends in various formats are shipped to foreign markets	The dairy exporter supplies to the blender, or establishes itself as the blender/exporter in its own right	Various examples are given through the report using the Australian example—e.g. Intermix exports 36,000 mt of dairy blends p.a.
Blends that are composed in-market, close to point of arrival. In such cases there are blenders in the market that collect and assemble ingredients as blends for further sale to downstream customers	The dairy exporter ships to the foreign blender, or establishes a foreign in-market blending operation	Kerry Ingredients has developed such a position in the Malaysian market
Blends that are assembled in situ—at the factory as an upstream part of the manufacturing process	The dairy exporter acts as a passive partner in the blending activity, supplying product to traders or directly to the end manufacturer	The dairy exporter can secure a more positive role in this type of situation by developing tailored ingredients to go into manufacturer blends

Source: Landell Mills analysis

- The market for dairy blends is expanding; however, the rate of expansion fails to account for the huge potential for dairy blends
- Blends are being used for various reasons, many of which are inter-related:
  - High import duties for standard dairy commodities, and therefore an opportunity for more cost-effective market access by changing the definition of the product
  - Importers/users see lower duties leading to lower product costs, and lower cost of manufacture is a prime motivator for all food processors—particularly in times of high dairy commodity prices. The butteroil/sugar blend trade into Canada is a case in point, with levels of substitution in ice cream and processed cheese industries far surpassing all expectations
  - Blends are well accepted by manufacturers in many markets (the case of South Korea is given in the body of the report)
  - Blends present an opportunity to introduce milk solids and/or milk solids replacers in a cost-effective manner when costs are high or competitive pressure leads to the need for strategies at the bottom end of the market. Filled milk products are a traditional way of doing this; filled whey products and whey replacers are more recent innovations
  - There is a surplus of whey and whey permeate, and whey in various formats is being increasingly perceived as an important blending ingredient
  - The functional role of dairy ingredients means that they are increasingly being considered as additives in a rapidly expanding food additives market. Many of these additives are readily introduced as blends and to blend formulations (examples given in the body of the report refer to the role of GOS in prebiotic blends, as well as opportunities for discrete dairy ingredients to be used as emulsifiers, fat replacers and compounded concentrated flavors in food additive blends). The outstanding co-functionality of many dairy ingredients heightens their appeal in these terms

- The U.S. industry has two areas of blending expertise with which it appears to be at the forefront of innovation with, although to date there is little active evidence of a strong export focus being developed:

  - Protein blends—this relates to dairy/dairy, dairy/non-dairy and non-dairy blends—mostly for the large and growing nutritionals market, with a current concentration of activity in North America. Wider scope will exist in Europe and Japan. The interest of dairy companies should be in the wide range of milk protein sources that are used in such blends—MPI, MPC, WPI, WPC, caseinates, casein, hydrolyzed proteins, whey derivatives, bioactive peptides, etc
  - Cheese blends—building on the popularity of food service, along with consumer interest in new flavors, a large number of products (pizzas, sauces, pasta dishes, soups, breadsticks, savory biscuits, savory snacks, etc.) are using cheese combinations to develop new and exciting flavor combinations. This is just the tip of the iceberg, and it is thought that the U.S. could use its domestic market experience to establish a prime position developing cheese blends as flavor and texture enhancers for a range of international markets

- The market appears to be undergoing a new round of interest and innovation related to fat-filled milk powders, SMP replacers, whey replacers and the like—particularly by the European dairy sector. In particular, the following activity is highlighted:

  - Euroserum—manufacturing and marketing a range of fat-filled whey powders as SMP/whey powder replacers
  - Confranlait—high fat/fat-filled dairy powders
  - Kievit—fat-filled powder manufacture (up to 80% fat content)
  - Armor Proteines—fat-filled powders made from palm oil, coconut oil and hydrogenated soy oil
  - Ingredia—filled dairy products, substituting for anything from 50-100% of conventional dairy solids
  - Kerry Ingredients—specialty lipids/dairy blends; probably a more advanced stage of development than the companies above

- South Korea is an example of a key blend market. The outcome of the FTA negotiations between South Korea and the U.S. is expected to open up further opportunities for U.S. dairy exporters

1.3 Implications and Recommendations

The market for dairy blends is alive and well. Its fullest potential is yet to be realized, however, with a great deal of further developments possible in terms of supplying fully intact blends for the dairy, yogurt and infant formula markets. A lesser opportunity seems to be apparent in the bakery industry.

These broad statements aside, this section touches on the key areas for focus for the U.S. dairy industry in terms of developing a greater export potential in dairy blends. More particularly, the U.S. dairy industry has an intrinsic interest in developing its presence in the blends market from a number of perspectives:

- As the fourth largest global dairy commodity exporter, the U.S. must be performing on this basis in key markets with blends
- Many of the markets the U.S. services with whey, lactose and SMP in Asia and South America are large (and potentially larger) blends markets that could be targeted by the U.S. dairy industry
- As a major global whey producer, and recognizing the potential for almost all whey products to be used in blends, it is vitally important for the U.S. industry to be amongst the leaders in developing applications for whey—in blends as well as other formats
- Whey permeate disposal is an ongoing issue for the U.S. industry (and other producers); a blend-based solution would therefore provide a strategic benefit
- Similarly, as a major global cheese producer with a growing presence in important cheese markets, the U.S. industry could develop a strong presence in the cheese blend market

Opportunities for the U.S. dairy industry exist in a select range of areas, as follows. It is highly recommended that specific analysis is undertaken to precisely assess opportunities in these priority sectors:

- Protein blends
- Cheese blends
- Filled milk powder products
- Whey-based SMP replacers

- Whey permeate-based whey replacers
- Dairy blend exports into the South Korean market under a widely anticipated FTA between the two countries

- **Protein blends/cheese blends**

  Of greatest interest here is the fact that the U.S. has a strong domestic market for a range of protein blends and cheese blends. These are two high-profile areas that are expected to grow further in terms of global blends trade, with likely market potential existing as follows (in order of likely potential priority):

  - Protein blends—Europe, Japan, Canada, other East Asia
  - Cheese blends—Mexico, South America, East Asia, South East Asia, China

  Given the excellent track record that the U.S. industry has in developing these products and succeeding with them in its own domestic market, it can piggy-back off this expertise by either exporting intact blends, or licensing offshore blenders to use the technology on the basis of sourcing ingredients from U.S. suppliers.

  Thus, an immediate competitive advantage is available by virtue of a successful track record. This potentially provides a platform for building these businesses.

- **Filled milk powder products/SMP replacers/whey replacers**

  The opportunity for filled milk powder, SMP replacers and whey replacer products has not been specifically assessed from a quantitative basis in this report. However, it is known that:

  - SMP replacers are the pioneering fundaments of the blend market
  - Fat-filled whey and whey replacers are coming into play as companies seek novel and more cost-effective ways of utilizing ingredients for performance and profit (cost) reasons
  - The need for SMP replacers, fat-filled dairy powders, and the recent advent of whey replacers is especially evident during this period of high dairy commodity prices
  - Whey replacers offer an opportunity for a great variety of formulation options, largely based on objective (cost) and target application
  - Of major interest is the opportunity to use whey permeate as a basic carbohydrate source to be built upon. Dairy and/or

non-dairy proteins would be added for cost/functionality, along with the addition of selected (low-cost) non-dairy fats, with possible micro-nutrient fortification, to provide:

- A low-cost, nutritionally-balanced formulation base for the food industry
- A very low-cost milk powder replacer for markets where WMP and traditional replacers are not gaining purchase for reasons such as availability, price, taste, etc.

➢ Greater demand is also expected in the short- to medium-term in poorer nations (e.g. the African continent, Bangladesh) where conventional dairy commodities are prohibitively priced to a large sector of the community, whereas fat-filled milk powder, whey replacers and the like could be effectively used in two presentation formats:

- In formulated low-cost, nutritionally-balanced consumer presentations (powder, pre-mixes for RTD beverages, low-end market nutritionals, etc.)
- As dairy ingredients (SMP replacers, WMP replacers, whey replacers) for the food processing industries

1.4 South Korea

The outcome of the current FTA negotiations between South Korea and the U.S. has the potential to affect the dairy blend market significantly. The U.S. is seeking an opening to the South Korean dairy market through lower tariffs, and this should prove an opportunity to seize a share of dairy imports from New Zealand, the EU and Canada. A successfully implemented FTA will position the U.S. industry to overcome the low ceilings related to the TRQs—particularly with regard to the two relevant HS Codes, 0404.90.0000 and 1901.90.2000.

1.5 Dairy Companies Thinking About a Future as Food Additives Companies

In the body of this report, it is clearly stated that many dairy ingredients, dairy compounds and dairy derivatives have attributes that effectively position them as food additives. These may be available in their own right (e.g. D-tagatose as a sweetener), or by virtue of their natural role as a constituent in a recognized dairy product (e.g. the naturally high lecithin content of buttermilk powder, with its emulsifying characteristics).

However, the essence of this is that by virtue of these credentials, dairy ingredients, dairy compounds and dairy derivatives are unabashedly

legitimate and primary candidates to be presented as food additive compounds in dairy and non-dairy blends that are used in food formulations. Furthermore, the notion of blends is in no small way about bringing such components together.

A range of examples is given in the report (GMP, CPP, D-tagatose, fatty acids/esters, lactoperoxidase, lactose derivatives, milk mineral complex, caseinates, WPC, etc.). The discussion centers on dairy being used as a food additive in three key areas, all of which show strong growth prospects:

- Emulsifiers
- Compounded dairy flavors
- Fat replacers

Indeed, the example of Simplesse WPC – both on its own and as a blend (WPC combined with an emulsifier) is given in the report. The notion of co-functionality whereby the use of dairy ingredients provides more than one physico-chemical property is delivered by such blend-based products as Simplesse by virtue of their role as emulsifiers and fat replacers.

Thus, it is recommended that U.S. dairy companies expand their vision and perspective on their market opportunities. Dairy commodity companies that have raised their view to consider their role as food ingredient companies can step up further and start taking on the role as food additive companies.

Hence the final recommendation in this report aims at re-orientating the thinking of dairy companies. Many have raised their profile from dairy commodity marketers to food ingredient marketers. However, it is time for innovative, far-sighted dairy companies to expand their horizons beyond the notion of food ingredients and to take on the mantle as food additive companies. Such a role will squarely position them in the function of tailoring solutions to the food industry by developing and supplying dairy blend-based food additives.

2.0 GLOBAL DAIRY BLENDS—AN INTRODUCTION TO THE STUDY

- The perspective on dairy blends is expanding
- This is driven by various factors, including:
  - Competitive pressures that are driving companies to consider opportunities to gain a technological and/or cost advantage
  - Price pressures that are driving companies to substitute expensive dairy ingredients with low-cost milk solids or non-dairy alternatives (e.g. filled milk)
  - Tariff busting opportunities, in order to gain market access
- There is a growing understanding that any product that has a mix of two or more components is in reality a blend; thus, the simple addition of food additives to base dairy commodities provides us with a blend
- Blends can be grouped as follows:
  - Dairy mixtures—a conventional application where two or more dairy commodities are mixed together for whatever reason
  - Dairy/non-dairy mixtures—the first stage in a dairy replacement strategy, with a portion of the dairy component replaced by non-dairy component(s) for price or functional reasons
  - Mixes of products in which a dairy ingredient is included as a functional ingredient. The use of sodium caseinate in beverage whiteners is a conventional view on this
  - Dairy as a carrier in blends, as in the case of Simplesse WPC carrying xanthan gum as a hydrocolloid
  - A combination of two or more products formulated for tariff busting reasons, rather than food design considerations. The example of butteroil/sugar shipped into Canada is discussed at length in this report
- Data is updated in this chapter from the previous reports. More specifically:
  - There is potential for up to 88,750 mt of whey solids to be used in the global ice cream industry as a substitution strategy in wet or dry blends. Of this, it is estimated that a mere 22,000 mt is pre-blended before delivery to the ice cream plant
  - The potential for whey solids to be used in the global yogurt industry is estimated at almost 80,000 mt
  - The potential for dairy solids to be used in the global bakery industry in mixes and blends is estimated at almost 600,000 mt

2.1 Background

The continued development of the global market for dairy blends has presented new profit opportunities for international dairy marketers. The development of the market has been driven by a number of factors, including such things as the increasing popularity of certain food products, manufacturers' desires for end product (and raw material) consistency,

changing global trade rules, and an increasing awareness and appreciation of the opportunities in the nutraceutical food sector.

The increasing popularity of the market also presents interesting challenges; traditional product definitions no longer apply in this market which makes understanding and analyzing the global trade in dairy blends a challenging exercise.

Over the past seven years, Landell Mills has undertaken two detailed studies into the global dairy blends sector on behalf of USDEC. The first study defined the industry and assessed end-user sectors and market sizes for dairy/dairy and dairy/non-dairy blends. The second study provided a partial update to the initial work, but was heavily international trade-oriented—specifically concentrating on Mexico and South Korea, two key markets for dairy blends.

USDEC has acknowledged a need to update and build on certain sections of the earlier reports (Phase 1 completed in 1999, Phase 2 completed in 2003) to gain an understanding of whether the sectors in this complex market have grown, as well as to understand where future opportunities may arise and what prospects this presents to savvy U.S.-based dairy exporters.

While the previous studies give an exceptional base of work to build upon, in some respects there is a need to revisit some of the key drivers of the industry to determine what market factors have changed or been newly introduced in the past few years. One key advantage of the previous studies is that they provide an assessment of sectoral market sizes as they stood in 1999; the current work will reassess these market sizes and provide the basis of forecasts for the key sectors in the future.

2.2 Report Objectives

Given the foregoing, the project objectives are understood as follows:

- Update market information relating to global market volumes in the product sectors targeting each of the dairy blend user areas, including bakery, nutritionals, ice cream, dairy desserts, processed meats, convenience foods, beverages and others
- Provide an informed update on market developments in each user sector and determine how sectoral changes have impacted blend usage in the past and what are the likely trends in the future
- Provide a detailed analysis and assessment of the South Korean market for dairy blends: profiling key importers, identifying product user sectors and assessing key drivers and their likely impact on the future of this trade

- Assess the likely future developments in the global dairy blends industry and analyze what opportunities do and will exist for the U.S. dairy industry

2.3 Market Definitions

As with any study of this nature, the perspective on blends is expanding. This is due to a number of factors, for example:

- The changing nature of the blend market, based on competitive pressures that are forcing companies to consider the opportunity to offer blends in order to secure a market advantage
- Continuing price pressures. Dairy commodity prices are at a recent high, and this is making conventional commodities expensive to use in many applications. Thus, substitution of milk solids by cheaper sources (e.g. whey-derived solids) is being undertaken, as are more extreme approaches where low-cost dairy commodities (SWP, WPC-34) and non-dairy (e.g. soy, field peas) constituents are being introduced in the form of SMP and WMP replacers
- A growing perception that any product that has a mix of two or more components is in reality a blend; thus, the addition of emulsifiers and stabilizers to dairy and other commodities effectively creates a blend. Similarly, the introduction of flavoring components to a product creates a blend. A renewed interest in various dairy components for their emulsifying capacity, and the technology that allows flavors to be extracted from dairy feedstock, are two examples of dairy material being used in food ingredients that deserve to be included in any consideration of dairy blends

Based on the above, blends can be considered in the context of the following table.

Table 2.3 Different ways of perceiving dairy blends

Type of blend	Description	Example of Product	Example of Company
Dairy/dairy mixtures	The conventional view on blends where two or more dairy commodities are mixed together	The original skim milk replacers, comprising mixtures of non-fat milk powder, whey powder and/or buttermilk powder. Similarly, ice cream mixes for soft serve applications	Frosty Boy Pty Ltd (www.frostyboy.com.au)
Dairy/non-dairy mixtures	The first stage in a dairy replacement strategy – a dairy portion may be substituted by non-dairy components for functional, price or other reasons	Filled milk powders, with vegetable oil substituting for milk fat in order to deliver lower cost	Clover Products South Africa, with its range of creamers (fat-filled milk powders) with 50%, 34%, 30%, 24% & 20% fat content
Dairy as a functional ingredient in blends	The use of a dairy component in what could otherwise be a non-dairy product in order to achieve a functional advantage	The addition of sodium caseinate to beverage whiteners, where the sodium caseinate has stabilizing And emulsifying properties along with flavor enhancement	Kerry Ingredients with beverage whiteners
Dairy as a carrier in blends	The introduction of functional components to a dairy base in order to deliver a product with superior functionality	WPC fortified with xanthan gum	CP Kelco's Simplesse (WPC) product
A combination of two or more products formulated primarily for market access rather than food design purposes	Any combination of products that, when blended together, further a competitive position in a market	Butteroil/sugar blends supplied into Canada	Fonterra Co-operative Group's predecessor companies were engaged in supply of butteroil/sugar blends to Canada

Source: Landell Mills analysis

2.4 Update on Market Data from Previous Studies

2.4.1 Introduction

The two previous studies addressed a number of specific market sectors, estimating the potential size of the dairy blends market for each. Rather than repeating the comprehensive data available in the earlier reports for blends for these sectors, this section of the report will provide an update on quantitative aspects of the market.

The infant formula sector has not been addressed in this section. It is so important for blends that it is analyzed in detail in Chapter 7.

2.4.2 Ice cream

Global ice cream consumption is estimated to have grown from around 13 billion liters in 1998 to a current volume of 15.9 billion liters. Assuming an average MSNF content of 11.5% in finished product, annual demand for MSNF components by the ice cream industry is estimated at 986,000 mt annually.

The replacement of MSNF by whey solids will likely be undertaken by one of four approaches:

- Concentrated whey (typically around 45 to 50% concentration level)
- 40% DWP
- WPC-34
- SWP

In reality, not all companies will substitute—particularly when prices are low (they are currently extremely high), or when a premium ice cream is manufactured and/or the use of (declared) whey solids is considered detrimental to the product positioning.

Of those companies that do substitute whey solids for part of the MSNF component, the rate of replacement is likely to range from 10% (anything less would hardly be worthwhile) to a maximum of 25%.

Landell Mills' assumption is that 60% of the global ice cream volume contains some whey solids. This is particularly likely in the current situation given the high dairy commodity prices in late 2006.

The average rate of substitution is 15% of MSNF equivalent. Therefore, the annual potential for whey solids to be included in ice cream as a pre-blended or blended in situ product is 88,740 mt of whey solids equivalent.

It is difficult to determine the potential for each of the various whey options (concentrated whey, WPC-34, SWP, DWP 40%) within the level of usage. It is assumed that WPC/SWP usage is less widespread than other forms of whey solids, and that only 10% of the whey substitution is in the form of WPC/SWP, with this split 70% in the developing world, and 30% in the developed (dairy-producing) Western nations.

Furthermore, an estimate of the global use of whey concentrate versus 40% DWP suggests that the proportion could be as much as 70:30 whey solids equivalent in favor of the liquid whey concentrate—with a spatial skewing of liquid whey concentrate heavily favoring Europe, Australasia and North America.

An estimate of whey solids usage by type and region is therefore given as follows, with growth areas in italics.

Table 2.4.2 Whey solids, annual consumption, ice cream industry (mt, whey solids equivalent)

Category	Developed western world	Import dependent regions	Total, mt
Liquid concentrated whey	*53,500*	2,400	55,900
WPC-34/sweet whey powder	*2,700*	6,170	8,870 (max.)
DWP-40	1,200	*22,780*	23,980
Total	**57,400**	**31,350**	**88,750**

Source: Landell Mills analysis

By the nature of ice cream manufacture, this entire product is blended. However, the volume that is pre-blended (i.e. blended before reaching the manufacturing facility) is unknown.

While it is plausible for 100% of these whey solids (equivalent to 88,750 mt) to be potentially incorporated in wet and dry pre-blends for ice cream manufacture, two points are considered:

- Realistically, less than 25% of total whey usage in the ice cream industry (ca. 22,000 mt) is expected to be pre-blended
- Virtually all of this volume will be compounded with non-fat milk solids derived from skim milk. Buttermilk solids will be used to a lesser extent. Any other ingredients will include sugar, and such additives as hydrocolloids, emulsifiers, colorings, etc.—particularly in the case of ice cream powder mix used in soft serve ice cream applications

2.4.3 Yogurt

Global yogurt consumption is estimated to have grown from 9.7 million mt in 1998 to current levels of 11.53 million mt. As with the

ice cream market discussed in the preceding section, there are two clear regional markets:

- The developed Western world and Eastern Europe, largely self-sufficient in dairy products, with annual consumption of 6.35 million mt
- The developing world, with fast-growing yogurt consumption dependent upon imports of milk solids, with annual consumption of 5.18 million mt

An average MSNF content of 11% is assumed, comprising 8.2% standard (liquid or powdered) non-fat milk solids, and 2.8% SMP for standardization.

The likely demand for whey derivatives in this manufacturing sector is summarized in the following table.

Table 2.4.3 Estimate of MSNF replacement, yogurt industry

Category	Developed Western world, mt	Import dependent regions, mt	Total, mt
Yogurt market	6,350,000	5,180,000	11,530,000
MSNF content (11.0%)	698,500	569,800	1,268,300
Main component (8.2%)	520,700	424,760	945,460
Balancing component (2.8%)	177,800	145,040	322,840
Main component:			
Powder	52,070	383,510	435,580
Liquid skim concentrate	442,595	20,000 [1]	462,595
WPC34/SWP	26,035	21,250	47,285
Balancing component:			
SMP	160,020	130,440	290,460
WPC34/SWP	17,780	14,600	32,380

Note: [1] Mainly used in China
Source: Landell Mills analysis

Therefore, the annual global potential for whey solids equivalent in the yogurt sector is 79,665 mt. All of this could potentially be incorporated into blends for yogurt manufacturers.

2.4.4 Bakery

The European bakery industry is estimated at 31.9 million mt, and this is considered to be 43% of the total global bakery production. Therefore, global bakery volume is estimated in the order of 74.2 million mt.

One suggestion is that 60% of the volume includes dairy components (including AMF/other milk fat, SMP, sodium caseinate, WMP, WPC, SWP, buttermilk powder, lactose, etc.), and that the dairy content of this would be on the order of 1.5 to 2.5%.

About 80% of that dairy volume is potentially dairy blends (e.g. dairy/dairy blends & dairy/non-dairy blends such as shortening powders, WMP replacers, etc.).

Therefore, a reasonable assumption on the potential for dairy blends is:

- 2% usage level in 40% of the overall global volume
- Overall volume thus being 593,600 mt potential usage of dairy blends in the global bakery market

3.0 THE SOUTH KOREAN DAIRY BLEND MARKET

- The Korean market for dairy blends continues to be strong due to high import duties for standard dairy products. The current volume of the dairy blends market in South Korea is estimated to be on the order of 30,000 to 32,000 mt. While not overly large in dairy market terms, this market is nevertheless attractive given its stable nature and the ready acceptance of dairy blends by industrial users
- Nevertheless, the dairy blends market is to some extent affected by the surplus of locally-manufactured dairy products. However, a tight production quota system is in place to combat oversupply, so the effect on dairy blends is forecast to lessen
- Dairy blend customers are concentrated – several large companies are the key purchasers of the major share of dairy blends sold in Korea
- Cocoa preparations are the key dairy blend variety in the Korean market, accounting for nearly 25% of the total volume. New Zealand and the Netherlands dominate the supply of cocoa preparations and are traditionally strong suppliers into the Korean market, which makes market entry difficult for new comers. An additional obstacle to new suppliers is the fact that only four major companies (Lotte Confectionery, Orion Confectionery, Lotte Samkang and Haitai Confectionery) account for 80% of cocoa preparation usage
- In the case of dairy (whey)-based blends, the key purchasers are slightly less concentrated. For this segment of the blends market, around 70% of the imported volume is purchased by six major players (Lotte Confectionery, Korea Yakult, Binggrae Company, Lotte Samkang, Haitai Confectionery and T S Corporation); thus, good volume sales could be achieved even when gaining business with just one or two of these key buyers
- The outcome of the current Free Trade Agreement (FTA) negotiations between South Korea and the U.S. has the potential to affect the dairy blend market significantly. The U.S. is continuing to ask for an opening of the market through lower tariffs

3.1 Background on the South Korean Dairy Industry

Historically the South Korean dairy industry has been highly protected by import bans or complicated quota systems. The Uruguay Round of trade negotiations brought significant change, with most dairy product imports being liberalized from 1996 onwards. However, imports of standard dairy ingredients such as SMP, WMP, whey products, lactose and butter are still limited by high import duty rates combined with low ceilings for tariff rate quotas (TRQs). The import of dairy blends, on the other hand, can occur under a very liberal regime put in place following the Uruguay round. It is entirely possible that this relative liberalization occurred through the Korean Government not appreciating the possible impact on the local

industry by imports under the two HS Codes describing dairy blends—0404.90.0000 and 1901.90.2000.

Because the price of these products was very competitive compared to the price of local dairy products, imports showed an immediate increase in 1996, leading to a surplus of local milk powder. This led to complaints from local dairy farmers, in response to which the Korean Government limited imports under these two HS Codes from 7 March 1997 to 28 February 2001. Several dairy export countries lodged complaints against this safeguard with the WTO disputes panel. The end result has been that the safeguards had to be lifted from 20 May 2000 onwards. Since then, the import of these products has been fully liberalized, and the duty rate applied to these products is 36.0% on CIF value.

The failure of the Doha Development Agenda (DDA) means that no changes have been made to the general dairy import regime since 2004. All the quotas and tariffs/duties are exactly the same as they were then. The outcome of the FTA between South Korea and the U.S. will affect the import regime on dairy products; however, this FTA is still under negotiation. Most Korean companies do not expect a drastic change to the dairy import regime, believing that they have no limitations in the use of dairy ingredients anyway, as WMP and SMP can be replaced with dairy-based blended products. Whey and lactose import quotas are perceived as sufficient.

However, if the importation of WMP and SMP were to be liberalized and duty rates were to come down to the same level as those for dairy blends, then the expectation is that the dairy blend market would disappear, with the exception of cocoa preparations. (Currently dairy blends attract an import duty of 36% whereas cocoa preparations are only subject to 8% import duty.)

Table 3.1 South Korea's import regime on standard, non-blend dairy products and ingredients since 2004

Product / ingredient	Quota, mt	Duty, in quota, %	Duty, out-of-quota, %
SMP	1,034	20.0	176.0
WMP	573	40.0	176.0
SCM	130	40.0	89.0
Whey and whey products	54,233	20.0	49.5
Butter	420	40.0	89.0
Lactose	9,400	20.0	49.5

Source: Korea Customs, Korea MAF
Note: While no change was made to the basic quota for lactose, it was increased to 18,000 mt with a 20% duty in 2004. The

reason for that appears to be that the Korean MAF suggested a small quota for lactose imports when the Uruguay Round negotiations started. However, actual demand was found to be much higher than the basic quota; therefore, KMAF allowed local demand to be met without actually increasing the lactose quota in the WTO scheme.

3.2 Product—Definitions and Variety

3.2.1 Background

In the Korean market, there are several types of blended dairy ingredients which are imported from a variety of origins. These can be segmented into the following categories:

- Cocoa preparations—HS codes 1806.20.9010 and 1806.90.9010
- Dairy blends—HS codes 0404.90.0000 and 1901.90.2000

As the HS Code structure is very hierarchical, it is difficult to give brief product descriptions. For more detailed descriptions of these codes, please see Appendix I.

3.2.2 Cocoa Preparations

In terms of market access, the importation of these products has been liberalized since before 1984. The applicable tariff rate is 8% on a CIF basis.

As the name implies, cocoa preparations have to contain a certain proportion of cocoa—usually no less than 15%. The nature of the cocoa makes no difference to their classification – it can be in the form of cocoa mass, cocoa liquor, or partially or fully defatted cocoa powders.

The major application for cocoa preparations is for the use in chocolate products, including choco pie, chocolate-flavored beverages, chocolate milk and chocolate-flavored ice cream products. Clearly, the use of cocoa preparations is limited to those types of end products containing cocoa and its derivatives.

Some companies, particularly ice cream manufacturers, who in the past imported cocoa preparations, have now changed the formulation of their products and are using dairy blends (under the 0404.90.0000 HS Code) and cocoa products to produce chocolate-flavored beverages, chocolate milk and ice cream. One of the key reasons for switching is so that the companies can manage stock in a simpler manner and have flexibility of ingredient and product utilization.

With regard to cocoa preparations, two different HS Codes are used to classify them, with the difference between them based on pack sizes:

- HS Code 1806.20.9010: pack sizes greater than 2kg
- HS Code 1806.90.9010: pack sizes less than 2kg

The classification used is not critical to Korean Customs as both pack sizes attract the same duty rate. Effectively these two codes are used without distinction in Korea. Nevertheless, Korea Customs are trying to apply the correct HS Code consistently, which is one of the reasons import volumes in the official statistics for HS Code 1806.90.9010 have been decreasing.

3.2.3 Dairy Blends

As mentioned previously, dairy blends are imported under two HS Codes: 0404.90.0000 and 1901.90.2000. The product characteristics are as follows:

- 0404.90.0000 are dairy/dairy blends, such as SMP/WMP plus whey, whey permeate, MPC, milk permeate, etc. Over the last five years, this heading number has also been covering dairy specialty products such as complex milk lipids, processed whey protein, organic dairy blends, goat milk preparations, yogurt powder, colostrums, etc. Usually the invoice value of these products is very high compared to the “standard” dairy blends, hence import statistics can be easily misinterpreted

- 1901.90.2000 are dairy/non-dairy blends (e.g. containing dextrin, fiber, hydrogenated coconut oils/flour, etc). Over the last five years, this heading has also been covering various functional dairy/non-dairy product preparations. It is hard to pin down which products may typically be contained in this heading as the product variety is simply too great. For example, new products include yogurt soft ices, ice cream mix powder, condensed milk base with various flavors, whipped topping cream, cream with various flavors, and others

- The development of these preparations has been vigorous in recent years, whereas imports of the typical dairy/non-dairy blends—in particular blends containing dextrin—have contracted in relative terms during the last five years. Again, the invoice value of functional blends tends to be much higher than for the standard blends, leading to a distortion of import statistics

Key applications for dairy blends include:

- Ice cream
- Fermented milks (Yakult-type), thick drinking yogurt
- Flavored milk and fortified milk
- Canned coffee
- Re-export business (e.g. TS Corporation)
- Retail coffee business (e.g. Starbucks)
- Functional applications in bakery, health food products, etc.

3.3 The Economics of Using Dairy Blends

In the past when the import of dairy blends was restricted to the final users, the use of dairy blends gave the users an economic advantage. Now, however, these dairy blends can be imported by any user without difficulty. This is the reason they now present a good alternative to using SMP or WMP. Even when surplus local milk powder is available in the market, there is no reason for any users to purchase it unless it can compete on price with imported dairy blends.

Table 3.3a Examples of local blends pricing in comparison to milk powder

Source	Products	Indicative pricing in Korea Won/mt	Cost converted into US$/mt	Remarks
Local	SMP	7,500,000 – 8,000,000	US$ 7,800 – 8,300	Ex-factory
	WMP	7,500,000 – 8,000,000	US$ 7,800 – 8,300	Ex-factory
Imported	Typical product	N/A	US$ 2,300 – 2,500	CIF Pusan
		N/A	US$ 3,220 – 3,500 (40% added)	Ex-warehouse After customs clearance
Current market pricing for local products	SMP/WMP	3,500,000 – 4,000,000	US$ 3,645 – 4,160	Ex-middle man

Source: Landell Mills based on trade sources

Assumptions: 1) KRW 960 = US$ 1

2) Ex-warehouse price include 36% tariff and 4% additional expenses covering storage cost, customs clearance cost and inland trucking cost from the ports to the customers. No margin included.

3) The above-mentioned pricing are indications only.

The gap between production cost and sales price has been subsidized by the Korean Government. However, the government wishes to reduce these subsidies to a minimum through applying a tight milk production quota system in order to reduce the funds it has to spend on these subsidies.

Essentially, the Korean Government relaxed the regulations governing which companies can import blends so that now any company can bring blends into the country. The Korean Government cannot change this and ban imports again for certain companies as it lost a WTO dispute in this regard.

The stock surplus has developed over the last few years as follows:

Table 3.3b Stock of dairy blends and milk powder in Korea, 1997 – 2005

Year	mt (at the end of March)
1997	13,875
1998	14,244
1999	9,593
2000	9,756
2001	11,247
2002	16,216
2003	17,161
2004	9,664
2005	11,826

Source: KMAF and industry sources
Notes: 1) Includes SSMP and SWMP (above 86% is SSMP)
2) The level of appropriate stock is supposed to be 7,000 to 8,000 mt

With regard to milk and milk powder production, there is no fixed scheme on production quotas. All involved parties are seriously discussing a scheme. In the past, individual dairy organizations have cut milk production. Basically, KMAF would like to maintain milk production at around 2.1-2.2 millionn mt per annum of raw milk, just to meet the demand of the fresh milk product sector.

Actual milk production has developed as follows:

Table 3.3c Milk production, 1997 – 2001

Year	mt
1997	1,985,875
1998	2,028,374
1999	2,246,296
2000	2,253,635
2001	2,339,792
2002	2,537,917
2003	2,367,419
2004	2,356,428
2005	2,229,783

Source: KMAF

Milk prices are high and currently stand as follows:

Table 3.3d Korean milk prices

	Somatic cell count	S. plate count	Milkfat	Pricing	Remarks
	5 grades	25 grades (every somatic cell grade has 5 grades of spc)	0.1% +/-		
Price difference	Higher quality, higher paid	Higher quality, higher paid	+/- 10.3krw/liter		
Basic milk price	Grade 4	1b grade	3.3% milkfat	Krw584/liter (US$ 0.61)	
Average paid				krw693.45/liter (US$ 0.72)	
Example 1	Grade 1 (top grade)	Grade 1A (top grade)	3.3% milkfat	Krw677.73/liter (US$ 0.71)	Higher milkfat, higher paid
Example 2	Grade 5 (lowest)	Grade 4	3.3% milkfat	Krw441.86/liter (US$ 0.46)	Higher milkfat, higher paid

Source: Landell Mills based on trade sources

3.4 Trade Data 2000 – 2005

3.4.1 Imports of Cocoa Preparations

Cocoa preparations can be divided into two types, as follows:

- Milk powder (mainly WMP) plus cocoa mass
- Milk powder (mainly SMP) plus various types of cocoa powder or similar

In 2005, the dominant supplying country of cocoa preparations was New Zealand, followed by the Netherlands, France and Belgium.

Table 3.4.1a HS Code: 1806.20.9010—Cocoa preparation containing 50% or more by weight of milk powder, other preparations in blocks, slabs or bars weighing more than 2 kg or in liquid, paste, powder, granular or other bulk form in containers or immediate packings, of a content exceeding 2 kg

Country		2001	2002	2003	2004	2005
Australia	mt	711	1,925	1,390	755	0
	US$'000	1,638	4,177	2,631	1,659	0
Aruba	mt	32	0	0	0	0
	US$'000	83	0	0	0	0
Belgium	mt	203	851	378	990	1,183
	US$'000	435	1,692	747	2,165	2,828
Canada	mt	220	119	200	200	0
	US$'000	448	244	457	461	0
Germany	mt	12	0	0	0	0
	US$'000	28	0	0	0	0
Spain	mt	0	15	0	0	0
	US$'000	0	29	0	0	0
France	mt	1,244	684	487	1,186	1,332
	US$'000	2,836	1,569	1,050	3,002	3,632
Japan	mt	0	0	13	0	0
	US$'000	0	0	36	0	0
Ireland	mt	0	0	0	0	0
	US$'000	0	0	0	0	0
Netherlands	mt	2,033	2,120	1,913	1,908	1,995
	US$'000	4,564	4,014	3,983	4,406	4,991
Norway	mt	120	30	0	0	0
	US$'000	284	68	0	0	0
New Zealand	mt	1,550	1,471	1,539	2,090	2,619
	US$'000	3,282	3,206	3,121	4,576	6,386
Poland	mt	0	0	0	0	0
	US$'000	0	0	0	0	0
Sweden	mt	30	15	15	0	0
	US$'000	67	29	27	0	0
Singapore	mt	17	0	0	0	166
	US$'000	39	0	0	0	386
USA	mt	415	613	239	812	595
	US$'000	1,656	2,386	961	2,700	2,324
Total	**mt**	**6,587**	**7,968**	**6,174**	**7,941**	**7,889**
	US$'000	**15,360**	**17,727**	**13,012**	**18,971**	**20,547**

Source: Korea Customs

Table 3.4.1b HS Code 1806.90.9010—Cocoa preparation containing 50% or more by weight of milk powder, in packs of less than 2kg

Country		2001	2002	2003	2004	2005
Australia	mt	100	0	0	371	0
	US$'000	232	0	0	817	0
Belgium	mt	20	60	0	11	0
	US$'000	41	120	0	26	0
France	mt	8	0	0	260	0
	US$'000	22	0	0	572	0
Netherlands	mt	164	423	247	97	53
	US$'000	362	893	509	217	119
New Zealand	mt	54	0	0	0	0
	US$'000	124	0	0	0	0
Germany	mt	0	0	0	0	0
	US$'000	0	1	0	0	0
India	mt	0	0	20	0	0
	US$'000	0	0	30	0	0
Norway	mt	0	0	0	0	0
	US$'000	0	0	1	0	0
USA	mt	0	0	2	0	0
	US$'000	0	0	4	0	0
Japan	mt	0	0	0	1	0
	US$'000	0	0	0	2	0
Spain	mt	0	0	0	0	4
	US$'000	0	0	0	0	11
Total	**mt**	**346**	**483**	**269**	**740**	**57**
	US$'000	**781**	**1,013**	**544**	**1,633**	**130**

Source: Korea Customs

There are large numbers of importers and users of cocoa preparations, as outlined below; however, four key companies account for approximately 80% of total imports. These are:

- Lotte Confectionery
- Orion Corporation (formerly Tong Yang Confectionery)
- Haitai Confectionery
- Lotte Samkang Co

Other key importers include:

- Maeil Dairy Co
- Donglim Trading Co

- Crown Confectionery
- Meelip Mulsan
- Royal Confectionery
- Colombang Confectionery
- Chungwoo Foods
- Sun Business

Detailed profiles of these are given in Section 3.6.

3.4.2 Imports of dairy blends

Regarding HS Code 0404.90.0000—dairy/dairy blends, the dominant suppliers in 2005 were the Netherlands and Canada. From 2001 to 2003, total imports decreased compared to other years as some local surplus milk powder was substituted for imported blends.

For HS Code 1901.90.2000—dairy/non-dairy blends, the dominant supplier country is France. This volume consists of mainly vegetable oil-filled milk powder purchased by TS Corporation for re-export business.

As mentioned before, the 0404.90.0000 HS Code covers a multitude of blends. Nevertheless, the majority is still dairy and dairy derivatives-based blends.

Table 3.4.2a HS Code 0404.90.0000 imports, 2001 – 2005

Country		2001	2002	2003	2004	2005
Australia	mt	80	0	16	53	634
	US$'000	181	0	26	106	1,791
Belgium	mt	1,361	1,020	140	963	2,560
	US$'000	2,823	2,099	280	1,795	5,780
Canada	mt	3,015	1,743	2,076	7,098	5,821
	US$'000	5,818	3,149	3,570	13,112	12,723
Chile	mt	36	50	60	72	60
	US$'000	67	104	115	138	122
Germany	mt	212	583	282	1,476	417
	US$'000	508	1,475	925	1,273	1,197
Denmark	mt	226	167	125	254	125
	US$'000	1,226	911	0	1,394	707

Country		2001	2002	2003	2004	2005
Spain	mt	15	73	0	0	0
	US$'000	27	117	0	0	0
Finland	mt	0	40	0	0	0
	US$'000	0	83	0	0	0
France	mt	264	335	222	217	288
	US$'000	548	631	401	434	693
Hungary	mt	40	0	0	0	0
	US$'000	73	0	0	0	0
India	mt	242	537	0	20	125
	US$'000	443	886	0	39	250
Japan	mt	0	0	0	0	1
	US$'000	0	0	3	13	72
Netherlands	mt	5,634	8,342	3,109	12,137	9,118
	US$'000	11,627	13,936	4,945	25,303	21,108
NZ	mt	87	986	223	179	1,437
	US$'000	1,229	2,734	1,593	1,083	4,418
Poland	mt	234	54	54	36	0
	US$'000	453	87	84	68	0
Singapore	mt	0	0	0	0	184
	US$'000	0	0	0	0	388
USA	mt	5	0	1	82	1,407
	US$'000	20	4	63	194	3,379
Austria	mt	0	13	3	0	33
	US$'000	0	49	10	0	363
Georgia	mt	0	4	0	0	0
	US$'000	0	11	0	0	0
Italy	mt	0	0	0	81	74
	US$'000	0	0	0	1,117	1,007
Uruguay	mt	0	0	0	0	46
	US$'000	0	0	0	0	92
Total	**mt**	**11,450**	**13,946**	**6,312**	**21,643**	**22,331**
	US$'000	**25,043**	**26,277**	**12,696**	**46,067**	**54,092**

Source: Korea Customs

Note: Included in HS Code 0404: Whey, whether or not concentrated or containing added sugar or other sweetening matter; products consisting of natural milk constituents, whether or not containing added sugar or other sweetening matter, not elsewhere specified or included – other

Table 3.4.2b HS Code 1901.90.2000 imports, 2001 – 2005

Country		2001	2002	2003	2004	2005
Australia	mt	60	37	20	65	119
	US$'000	125	85	53	231	450
Belgium	mt	40	103	107	114	37
	US$'000	88	328	350	411	172
Switzerland	mt	0	0	0	4	47
	US$'000	0	0	0	31	260
Canada	mt	0	0	0	16	0
	US$'000	0	0	0	64	0
Germany	mt	469	1,783	631	3,871	955
	US$'000	815	2,645	979	6553	1,856
Denmark	mt	0	0	58	89	94
	US$'000	0	0	448	637	659
France	mt	5,478	4,635	4,823	2,722	3,273
	US$'000	9,507	6,283	7,208	4,872	6,438
UK	mt	0	0	0	0	0
	US$'000	0	4	0	0	0
Italy	mt	8	25	26	406	627
	US$'000	28	83	163	2,376	3,650
Japan	mt	1	9	34	20	429
	US$'000	8	138	550	337	2,412
Netherlands	mt	501	656	241	133	95
	US$'000	1,060	1,273	450	275	230
NZ	mt	14	209	140	21	17
	US$'000	1,834	3,220	975	713	458
Singapore	mt	0	5	0	0	0
	US$'000	0	8	0	0	0
USA	mt	19	29	29	47	51
	US$'000	5	8	8	1	0
Philippines	mt	41	79	1,10	1,357	1,685
	US$'000	1	9	3	1	0
Austria	mt	0	6	0	2	0
	US$'000	0	10	0	0	0
Indonesia	mt	0	9	0	0	0
	US$'000	0	0	0	34	46
India	mt	0	0	13	28	46
	US$'000	0	0	15	1	12
Argentina	mt	0	0	0	1	6
	US$'000	0	0	1	0	24
Ghana	mt	0	0	9	0	6
	US$'000	0	0	9	0	0
Total	**mt**	**6,765**	**7,766**	**6,401**	**7,968**	**6,377**
	US$'000	**13,876**	**14,887**	**12,304**	**17,886**	**18,565**

Source: Korea Customs

Note: Included in HS Code 0108: malt extract; food preparations of flour, meal, starch or malt extract, not containing cocoa powder or containing cocoa powder

in a proportion by weight of less than 50%, not elsewhere specified or included; food preparations of goods of heading Nos. 0401 to 0404, not containing cocoa powder or containing cocoa powder in a proportion by weight of less than 10%, not elsewhere specified or included – other

Importers of dairy blends under this HS Code in 2005 were as follows:

- Lotte Confectionery
- Korea Yakult
- Binggrae Co
- Lotte Samkang
- Lotte Chilsung Beverage
- BR Korea (Baskin Robbins JV)
- Lotte Ham and Lotte Milk
- Meelip Mulsan
- Pasteur Milk
- Daeshin Food Co
- Hapdong Industry
- Sam Yang Food
- Crown Confectionery
- Whanhee Co
- Nam Yang Dairy
- Bookook Distribution Co
- Maeil Dairy
- Concord Trading
- Samilk Dairy
- TS Corporation
- SungPoong YangHaeng
- Ildong Foods
- MS Trading Co
- DM Food

- Orion
- Sung Bu Trading
- Seokang Dairy
- Daesang Food
- Wonhee Trading
- Dairy Food Korea
- Heechang Dairy

Importers of products under the HS Code 1901.90.2000 in 2005 were as follows:

- TS Corporation
- Korea Nestlé
- BR Korea
- Starbucks Korea
- New Tech Co
- Maeil Dairy
- Dong Suh Foods
- Nam Yang Dairy
- Seokang Dairy
- Crown Confectionery
- Ildong Foods
- Costco Korea
- Diamond Enterprise
- Fine Korea
- Global Life

3.5 Trends in Major Application Sectors

3.5.1 Chocolate and confectionery

According to market and industry sources, the volume of locally produced chocolate products apparently is showing little or no growth, with some industry sources even commenting that the local production of chocolate is in decline. This is put down to the increasing importance of imported consumer goods in the Korean

market, as well as market saturation. Industry participants do not expect significant future market growth. However, recent research has shown that cocoa is good for human health. As Koreans are very keen on healthy living and diet plays a huge part in this, chocolate with a higher cocoa content is becoming more popular. This only affects the premium end of the chocolate market.

The volume of cocoa preparation imports will vary based on the following factors:

- Local economic growth
- The price of local surplus milk powder; in the case that local milk powder prices are competitive, this can and will be a substitute for imported cocoa preparations
- The market activity of imported foreign brands from Mars, Nestlé, etc.
- Trends for healthy and wellness foods
- Exports of final products to Asia, mainly China

Table 3.5.1 HS Code 1806.20.9010 and 1806.90.9010 – import volume trends, 1997 – 2005

Year	1806.20.9010, mt	1806.90.9010, mt	Total, mt
1997	7,920	2,667	10,587
1998	6,016	1,545	7,561
1999	5,698	1,289	6,987
2000	6,021	1,362	7,383
2001	6,587	346	6,933
2002	7,968	483	8,451
2003	6,174	269	6,443
2004	7,941	740	8,681
2005	7,889	57	7,946

Source: Korea Customs

3.5.2 Fermented milk

During the 1990s the fermented milk market grew by approximately 7 to 8% per annum—with the exception of 1998 during the Asian financial crisis. However, the growth of typical fermented milk products has slowed down in the last couple of years. Many industry and market participants believe that this particular market segment is saturated. As an alternative, the leading companies are

now competing hard to develop new products which are more functional and focused on specific health benefits. They expect that this market will grow in the future, whereas the traditional market will demonstrate slower growth and possibly even contract. Accordingly, most companies will try to develop more functional products focused on specific health benefits and therapy areas.

3.5.3 Ice cream

Demand for premium-grade ice cream is expected to be strong, since many foreign imported products are sold in consumer retail. However, it is a difficult market due to severe competition. Trade sources generally feel that growth in the overall ice cream sector will be very slow as there are a number of substitute products which are becoming more popular, such as fresh fruit, other refreshments and snack products.

Accordingly, the requirement for imported dairy blends for this sector will vary depending on the performance of the Korean economy, the success of local brands versus pressure from imported brands and the degree of local milk shortage or surplus.

3.5.4 Fat-filled powders for re-export

Due to the re-export business to Japan, the demand for fat-filled milk powder will absolutely depend on the strength of the Japanese market. The benefits of blending in Korea for re-export to Japan are unclear; it is not obvious why blending should not take place in other locations where fat-filled powders and other key ingredients such as sugar are available at international prices.

3.5.5 Trends in dairy blend imports for the above key applications

Imports of dairy blends—mainly destined for the above mentioned applications—have developed as follows over the last few years:

Table 3.5.5 HS Code 0404.90.0000 and 1901.90.2000 – import volume trends, 1997 – 2005

Year	0404.90.000, mt	1901.90.2000, mt	Total, mt
1997	17,273	6,279	23,552
1998	9,245	3,040	12,285
1999	15,980	5,815	21,795
2000	17,238	7,391	24,626
2001	11,450	6,765	18,215
2002	13,946	7,766	21,712
2003	6,312	6,401	12,713
2004	21,643	7,968	29,611
2005	22,331	6,377	28,608

Source: Korea Customs

3.6 Key Customer Review

3.6.1 Overview

Table 3.6.1 Purchases of dairy blends by the key customers, 2005

Company	Cocoa preparations, mt	Dairy blends, mt	Total, mt	Suppliers / comments
Lotte Confectionery	3,500-4,000	4,000-4,500	7,500-8,500	Cocoa preparation: Fonterra (NZ), Ingredia (F) Dairy blends: Agropur (Ca), EPI (F), Peemex (NL)
Orion Corporation	1,000-1,200		1,000-1,200	Sodiaal (F), Schils Food (NL), Havero Hoogwegt (NL)
Haitai Confectionery	800-1,000	1,000-1,200	1,800-2,200	Cocoa preparations: Havero Hoogwegt (NL), Agri Best (NL) Dairy blends: Agri Best (NL), Schils (NL), Melkweg (L), Agropur (Ca)
Lotte Samkang Co	1,000	1,200-1,600	2,200-2,600	Cocoa preparations: Peemex (NL), Havero Hoogwegt (NL), Vreugdenhil (NL) Dairy blends: Agropur (Ca), EPI (F), Peemex (NL)

Company	Cocoa preparations, mt	Dairy blends, mt	Total, mt	Suppliers / comments
Maeil Dairy	400-500		400-500	Cocoa preparations: Hershey (USA)
Korea Yakult		3,000-3,500	3,000-3,500	Schils (NL), Agri Best (NL), Interfood (NL), Westland (NZ)
Binggrae Co		2,000-2,500	2,000-2,500	Schils (NL), Vreugdenhil (NL), Peemex (NL), Havero Hoogwegt (NL)
TS Corporation		2,500-3,000	2,500-3,000	SILL Dairy Exports (F), Sodiaal (F), EPI (F), Ingredia (F), Matines (F), Oldenburger (D)
TOTAL	**6,700-7,700**	**13,700-16,300**	**20,400-24,000**	

Source: Landell Mills analysis

The above analysis illustrates the concentration of customers for dairy blends in Korea. The customers profiled in this report account for more than 80% of cocoa preparation imports and approximately 50% of dairy blend imports. The remainder of dairy blend imports are brought into the country and used in small volumes by a multitude of companies, as mentioned above.

3.6.2 Key users of cocoa preparations

- **Lotte Confectionery**
  No 23, 4ka Yang Pyung-Dong
  Young Deung Po-Ku
  Seoul
  South Korea
  Tel: +82 2 2670 6290
  Contact: Mr. Jin, Heon-Tak, Purchasing Manager for Imports

  Lotte Confectionery is one of the largest confectionery companies in Korea. It is part of the Lotte Group and enjoys a dominant market share in confectionery goods such as chocolates, ice cream, chewing gum, biscuits and similar.

  The major product lines in which Lotte confectionery uses cocoa preparations are choco pie and chocolates. The company utilizes a formulation that consists of 85% SWMP and 15% cocoa mass—this is the company's own processed cocoa mass. It uses around 3,500 to 4,000 mt of its own formulation cocoa preparation. Its existing suppliers are

Fonterra in New Zealand (the number-one supplier) and Ingredia in France. Tatura in Australia used to supply Lotte Confectionery with cocoa preparations, but has given up this business. In fact, Lotte sells its own cocoa mass preparation to the cocoa preparation manufacturers such as Fonterra and Ingredia. It then imports the mixed cocoa preparation. Tatura only received small volumes of these orders (300 to 400 mt per annum of cocoa preparation) and hence gave up supplying Lotte.

Lotte Confectionery's trading terms are document against payment, 60 days after the B/L date. Lotte Confectionery has the following purchasing criteria:

- Product R&D approval by Lotte Group Central R&D is a must
- Suppliers must achieve a good working relationship with the key people at Lotte—especially in R&D and purchasing
- Lotte Confectionery wishes to deal with ingredient manufacturers rather than traders
- Lotte Confectionery prefers to have at least two suppliers for each ingredient in order to balance the supply
- If the price of local milk is competitive because of stock surpluses, Lotte buys local milk and reduces its imports of cocoa preparations. Accordingly, it is quite difficult to manage the company's shipment program
- Lotte confectionery supplies its own cocoa mass, which is processed by the company to cocoa preparation manufacturers. Ingredia in France has insisted on a minimum supply of 1,000 mt per annum, stating that it would otherwise consider dropping the business due to poor manufacturing efficiency

One factor that is very important to Lotte Confectionery is that WMP is fresh; it does not accept slightly older WMP.

- **Orion Corporation (formerly Tong Yang Confectionery)**
  30-10, MoonBae-Dong
  YongSan-Ku
  Seoul
  South Korea
  Tel: +82 2 710 6166
  Contact: Mr Yoo, Eun-Chul, Purchasing Assistant Manager for Imports

  Orion is one of the largest confectionery companies in South Korea and has a dominant market share in choco pies. Indeed, choco pie is the company's key application in which cocoa preparations are used.

  The company used about 1,000 to 1,200 mt of cocoa preparation in 2005. Key suppliers of cocoa preparations are Sodiaal Industrie in France, Schils Food BV in the Netherlands and Havero Hoogwegt in the Netherlands. Orion's trading terms are L/C at sight (CFR).

  Key purchasing criteria include:

  - Any product must be approved by the company's R&D team
  - It is very important for the company that suppliers have a good relationship with the key R&D and purchasing people
  - South Koreans describe Orion Corporation as a "very closed company," meaning it is difficult to get a foothold as a new supplier. Often it can be hard for new suppliers to find out why they are not making any progress or inroads into the company
  - The company, however, is trying to diversify its supply sources. One way in which it has chosen to do this is to source a part of their cocoa preparation requirements from Southern Hemisphere suppliers (such as New Zealand and Australia) via a reputable supplier. This is done to minimize the perceived risk of quarantine issues that were experienced in the past with Northern Hemisphere suppliers (e.g. foot and mouth disease, BSE, dioxin, etc.). This strategy does not seem to be very successful to date

- **Haitai Confectionery**
  No 131-1, NamYoung-Dong
  YongSan-Ku
  Seoul
  South Korea
  Tel: +82 2 709 7586
  Contact: Mr. Kim, Jong Wan, Assistant Purchasing Manager

  Haitai was formerly one of the largest confectionery companies in the country, competing strongly with Lotte confectionery. It used to have strong market shares in confectionery goods such as chocolate, ice cream, chewing gum and biscuits. However, during the Asian financial crisis, the company went bankrupt. In 2001, a consortium comprising of J P Morgan, CVC and UBS Capital took over Haitai Confectionery. In 2005, the Crown Confectionery consortium in turn took the company over from the previous, above-mentioned consortium.

  Today the key products which include cocoa preparations are chocolates and choco pie.

  Haitai uses a typical formulation consisting of 85% SMP and 15% cocoa powder (the cocoa powder type is not known), and has a demand of around 800 to 1,000 mt per annum. Existing cocoa preparation suppliers are Havero Hoogwegt and Agri Best Dairy Products, both in the Netherlands.

  Haitai's trading terms are L/C at sight.

  Haitai Confectionery has several key purchasing criteria:

  - Product R&D approval is necessary
  - The new management team is currently struggling to set up new purchasing policies and systems. Reform is required owing to a lack of trust in the old purchasing system
  - The new management team is focusing on cost savings and wishes to deal directly with suppliers rather than agents

- **Lotte Samkang Co**
  No 12, 2Ka YangPyung-Dong
  Seoul
  South Korea
  Tel: +82 2 2629 0220
  Contact: Mr. Yoon, Beom-He, General Manager Purchasing Division

  Lotte Samkang is one of the largest oil processors and ice cream manufacturers in Korea. It is a sister company of Lotte Confectionery. The company has a reasonable market share in the ice cream market. It uses a formulation of 85% SMP and 15% cocoa powder (the cocoa powder type is D-11-A Type ex De Zaan), and uses around 1,000 mt per annum of this cocoa preparation in its ice cream manufacture. Existing suppliers are Peemex International BV, Havero Hoogwegt and Vreugdenhil BV, all in the Netherlands.

  The company's trade terms are L/C at sight. Key purchasing issues include:

  - Product approval from Lotte Group's central R&D department
  - The company uses a Dutch tender style purchasing system, where the lowest bidder gets awarded the largest volume
  - The company has less experienced purchasing staff

- **Maeil Dairy**
  No 98-5, 5th Fl. Sam Whan Building
  Woon Nee-Dong
  Jong Ro-Ku
  Seoul
  South Korea
  Tel: +82 2 2127 2055
  Contact: Mr. Park, Byung-Doo, Purchasing Manager

  Maeil Dairy is one of the largest food (including dairy) companies in the country, and has a robust market share in milk products, including infant formula. The major application for the use of cocoa preparations is chocolate milk drinks.

  The exact formulation of the cocoa preparation used is not known, as it is Hershey's drink premix. Maeil Dairy uses 400

to 500 mt of this and exclusively sources it from Hershey Company in the U.S. Maeil Dairy produces the chocolate milk drink under license from Hershey Company, and therefore has no interest in other cocoa preparation suppliers for this product.

3.6.3 Key users of dairy blends

The following six major customers account for around 70% of total demand.

- **Lotte Confectionery**
  No 23, 4ka Yang Pyung-Dong
  Young Deung Po-Ku
  Seoul
  South Korea
  Tel: +82 2 2670 6290
  Contact: Mr. Jin, Heon-Tak, Purchasing Manager for Import

  Lotte's major application area for dairy blends is ice cream.

  Typical formulations are 88% SMP plus 12 % DWP90 – the company uses 4,000 to 4,500 mt of this annually.

  Existing suppliers include:

  - Agropur Cooperative—a major Canadian supplier accounting for more than 80% of supply
  - EPI in France
  - Peemex in the Netherlands

  Lotte Confectionery's trading terms are payment against documents 60 days after B/L date.

  Purchasing criteria correspond to those for cocoa preparations and hence include:

  - Product must be approved by Lotte Group's central R&D division
  - It is very important for suppliers to achieve good relationship with key people in purchasing and R&D
  - Lotte wants to deal with manufacturers rather than traders
  - Wet blends are preferred to dry blends

- At least two suppliers are preferred to balance the business
- In 2005, Lotte Confectionery purchased dairy blends jointly with Lotte SamKang
- Reliable suppliers are preferred
- If the price of local milk is competitive owing to surplus stock, Lotte Confectionery will buy this and hence reduce the purchase of dairy blends

- **Korea Yakult**
  No 28-10, JamWon-Dong
  SeoCho-Ku
  Seoul
  South Korea
  Tel: +82 2 3449 6385
  Contact: Mr. Oh, Seung-Ju, Purchasing Manager

  Yakult is the largest fermented milk manufacturer in Korea. The Korean business is a joint venture with Japan Yakult, and has a dominant market share in fermented milk products.

  The major applications for dairy blends are fermented milks (Yakult type) and a thicker drinking yogurt.

  Korea Yakult uses a formulation of 88% SMP plus 12% MPC70. Korea Yakult's volume requirement for this dairy blend can differ depending on local milk supply because Korea Yakult has its own raw milk-producing subsidiary dairy companies, Vilac and Pasteur Dairy, which was taken over. On average, Korea Yakult requires 3,000 to 3,500 mt of dairy blend per annum.

  This is currently sourced from the following suppliers:

  - Schils, Agri Best Dairy Products, Interfood BV—all in the Netherlands—and Westland Milk Products in New Zealand

  Trading terms are L/C at sight.

  Major purchasing issues include:

  - Product R&D approval is necessary

- This is another company which Koreans would describe as “very closed” and where it is hard to make progress as a new supplier
- The company presently buys exclusively through a company called Excel International Inc in Korea
- Invoice prices seem to be much higher than for blends provided by other suppliers. The reason for this is not immediately apparent, but it is likely that this is MPC which is used for its specific functionality

- **Binggrae Co**
  No 34-5, Paichai JeongDong Building
  Jeong-Dong
  Jung-Ku
  Seoul
  South Korea
  Tel: +82 2 2022 6383
  Contact: Mr. Baek, Sang-Hyun, Purchasing Manager

  Binggrae is one of the largest food companies (including dairy) in Korea. It has a robust market share in the ice cream sector. The major applications for dairy blends are ice cream and fortified milk. The company uses a dairy blend which is made up from 88% SMP plus 12% demineralized whey permeate (40% demineralized). As Binggrae is also a major dairy company, the requirement for dairy blends depends on raw milk supply and thus can vary, but tends to average out at around 2,000 to 2,500 mt annually for ice cream production.

  Dairy blends are presently procured from Schils, Vreugdenhil BV, Peemex and Havero Hoogwegt, all in the Netherlands.

  Trade terms are L/C at sight.

  The following issues are important for Binggrae in purchasing dairy ingredients:

  - Product R&D approval is a must
  - The company has a very open purchasing system. The lowest bidder among approved suppliers wins the highest volumes of business
  - The company tends to have direct contact with its suppliers (more than 70%)

- **Lotte Samkang Co**
  No 12, 2Ka Yangpyong-Dong
  YoungDeungPo-Ku
  Seoul
  South Korea
  Tel: +82 2 2629 0220
  Contact: Mr. Yoon, Beom-Hee, Purchasing Manager

  As mentioned earlier in this report, Lotte Samkang is one of the largest oil processors and an ice cream manufacturer in Korea. It is a sister company of the Lotte Confectionery Company. The company has a reasonable share of the ice cream market, and ice cream is indeed the key application for the use of dairy blends.

  Lotte Samkang uses a formulation based on 88% SMP plus 12% demineralized whey powder (90% demineralized)—the same as Lotte Confectionery. Lotte Samkang uses 1,200 to 1,600 mt of this per annum.

  Existing suppliers are:

  - Agropur Cooperative—a major Canadian supplier accounting for more than 80% of the supply
  - EPI in France
  - Peemex in the Netherlands

  Trade terms are L/C at sight.

  Purchasing characteristics are:

  - Product R&D approval by Lotte Group central R&D is a must
  - Lotte Samkang purchases jointly with its sister company, Lotte Confectionery
  - It has less experienced purchasing staff

- **Haitai Confectionery**
  No 131-1, NamYoung-Dong
  YongSan-Ku
  Seoul
  South Korea
  Tel: +82 2 709 7766 (Rep), 709-7586 (Dir)
  Contact: Mr. Kim, Jong – Wan, Purchasing Manager

This report has already detailed the recent history of Haitai Confectionery, through its bankruptcy and takeover by different consortia, before ending up in the hands of Crown Confectionery. It uses dairy blends primarily in the production of ice cream. The formulation used consists of 88% SMP plus 6% MPC50 plus 6% DWP90, of which Haiitai uses 1,000 to 1,200 mt annually.

Existing suppliers include Agri Best Dairy Products, Schils, Melkweg Holland BV—all based in the Netherlands—and Agropur Cooperative in Canada.

Trading terms are L/C at sight.

Purchasing criteria include:

- Product R&D approval is a must
- New management team is focusing on the cost savings. They wish to deal directly with suppliers rather than with the agents

- **TS Corporation**
  No 7-23, SinChun-Dong
  SongPa-ku
  Seoul
  South Korea
  Tel: +82 2 410 6147 for Mr. Kim
  Contact: Mr. Kim, Yong – Hwan, Assistant Manager, Premix & Trade Team

  TS Corporation is one of the largest sugar manufacturers in Korea. For dairy blends, its main business is re-export to Japan after blending with other ingredients—mainly sugar. The company's financial status is good.

  For its re-exports, the company uses a formulation based on fat filled powder: 57% SMP plus 43% hydrogenated coconut oil. The company requires 2,500 to 3,000 mt of this every year and tends to source the blend mainly in France, from the following suppliers:

  - SILL Dairy Export in France
  - Sodiaal Industrie SA in France
  - EPI Ingredients, Ingredia SA in France
  - Matines in France

- Oldenburger in Germany

Trade terms are T/T 30 days after B/L date.

Purchasing criteria include:

- The specification of fat-filled powder is nominated by the Japanese partners (e.g. Lacto Japan)
- The company does not go through agents but rather has direct contact with the above suppliers except for Ingredia SA
- The demand depends on Japanese market, hence any sales approach is required to be at the level of the Japanese partners
- TS Corporation tends to have supply contracts spanning three to six months

3.7 Conclusions / Implications and Opportunities for the U.S. Dairy Industry

To re-cap, the total import volume of all cocoa preparations and dairy blends in 2005 stood at just over 36,500 mt.

Table 3.7 Total dairy blends imports, 1997 – 2005

Year	Dairy blends	Cocoa preparations	TOTAL
1997	23,552	10,587	34,139
1998	12,285	7,561	19,846
1999	21,795	6,987	28,782
2000	24,626	7,383	32,009
2001	18,215	6,933	25,148
2002	21,712	8,451	30,163
2003	12,713	6,443	19,156
2004	29,611	8,681	38,293
2005	28,608	7,946	36,554
	(4,800)		(4,800)

Source: Korea Customs
Note: The 4,800 mt above are included in the overall volume, not additional

A summary of the Korean blends market reveals the following points:

- There is a clear and secure market for imported dairy blends in Korea
- In 2005, the market totaled around 30,000 mt, including approximately 8,000 mt of cocoa preparations. Growth in demand is likely to be steady at best
- It is quite unlikely that significant new users will appear over and above the customer base already identified by the current suppliers and their agents, unless multinationals such as Nestlé move production facilities to Korea. This is considered unlikely when the import of their finished products is relatively open and liberalized
- The market is concentrated – several large customers purchase the vast majority of the blends volume
- While the size of the South Korean blends market is substantial, an entry by a new supplier will not necessarily be easy. As a general statement, Korean customers are conservative and do not readily move away from established supply relationships without significant consideration and demonstrable benefits
- Perhaps the only opportunity for new suppliers is to selectively approach a couple of key customers, according to their attractiveness, and be very persistent over a period of time with products based on aggressive commodity pricing

4.0 CANADIAN BUTTEROIL/SUGAR BLEND IMPORTS—REVIEW AND UPDATE

- A detailed review is undertaken of the imports of butteroil/sugar blends into Canada
- The example of Ingredia's PROMILK 872B milk protein blend is discussed, and there is mention of the CITT ruling on butteroil/glucose and an earlier attempt to blend SMP and coarse salt for international trade
- International trade in butteroil/sugar blends, and more recently milk protein blends, are outcomes of the tariff system that was instituted as a result of the Uruguay Round in order to open up markets and liberalize trade—an initiative underpinned by a goal of better distributing the world's agri-food resources
- Before such can be fully implemented, a transition process is undertaken, and tariffs are used to help to facilitate this event
- While the rules are clear, some players are finding it difficult to adjust to the new situation
- Regardless of the outcome of the Canadian dairy fraternity's protracted consternation about the butteroil/sugar trade, the underlying fact is that global trade in blends is not going to diminish; if anything, it is intending to escalate yet further
- Indeed, CITT's forecast that market penetration by butteroil blends could reach 25% of the fat requirement for ice cream and replaceable fat for processed cheese was severely under-estimated. By 2004, 47% of the fat market for ice cream has been penetrated by butteroil/sugar blends
- A further dimension to this issue is that blends have an economic benefit for end users—they lower the cost of production
- This means that any domestic industry subject to the threat of blends will need to continually appraise its position with regards to more cost-competitive imports
- The use of TRQs will provide buffers; nevertheless, there will always be a situation where blended imports can compete strongly against local dairy manufacture
- Thus, Canada is bracing itself for a new wave of dairy blends—more specifically, butter blends that contain up to 70% vegetable oil, a popular formulation in the U.S.
- Despite a 200% TRQ for butter blends of this nature, regulations are in place to permit manufacture in some of the Canadian provinces

4.1 Background

In the 1999 *Global Dairy Blends Report*, butteroil/sugar blends entering the Canadian market were discussed in some detail. Indeed, as will be noted further on in the present chapter, that report was produced as the major antagonist, Dairy Farmers of Canada, was appealing various tariff rulings. This chapter of the current report provides a quick summary of that case, and looks into further developments in the business since 1999.

The situation was predicated on the fact that imports of butteroil/sugar blends into Canada increased from US$ 3.1 million to US$ 20.7 million per year over the period 1995 to 1997. This caused a concern with Dairy Farmers of Canada on the basis of substitutability versus domestic butterfat production. This blend—comprised of 49% butteroil and 51% sugar—entered the Canadian market under tariff code 2106.90.95, ensuring a more favorable duty rating, and thereby allowing end users (e.g. ice cream manufacturers, processed cheese manufacturers) to reduce their cost of production.

The product was formulated with the following attributes:

- It ceased to qualify as a dairy product
- It ceased to be subject to the tariff protection normally extended to "true" dairy products under prevailing regulations

As a result, some manufacturers purchased the ingredient and used it in place of domestic milk fat, thereby disrupting local marketing arrangements.

This is an example of a substitute, innovative product that was developed specifically to circumvent the prevailing Canadian tariff protocols. This issue has its roots in a system established prior to the Uruguay Round. The ongoing imports of butteroil/sugar blends into Canada through 2004 are provided in the following table. Moreover, a discussion prevails throughout the rest of this chapter on the recent contentious history surrounding these imports, and towards the end introduces a further product concept (PROMILK imported from Ingredia S.A.), which has undergone its own dramas with regards to tariff classification.

Table 4.1a Canadian imports of butteroil/sugar blends (volume, '000 kg)

Year	Volume ('000 kg)
1994	1,735
1995	1,349
1996	3,804
1997	8,604
1998	6,580
1999	6,340
2000	8,400

Year	Volume ('000 kg)
2001	8,860
2002	8,016
2003	10,870
2004	16,125

Source: Dairy Farmers of Canada, based on Statistics Canada data

Various tariff numbers are referred to throughout this section. For ease of reference, the key ones as they relate to this discussion are described in the following table.

Table 4.1b Tariff number descriptions – Canada

Tariff No.	Description
2106.90.95	Other preparations that contain in the dry state over 10% by weight of milk solids but less than 50% by weight of dairy content
2106.90.34	Preparations, other than tariff number 2106.90.31 or 2106.90.32, containing greater than 15% by weight of milk fat, suitable for use as butter substitutes, over access commitments
0404	Whey, whether or not concentrated or containing added sugar or other sweetening matter; products consisting of natural milk constituents, whether or not containing added sugar or other sweetening matter, n.e.s. or included
0404.90	Other products consisting of natural milk constituents, whether or not containing added sugar or other sweetening matter, n.e.s. or included
3504.00.00	Peptones and their derivatives; other protein substances and their derivatives, not elsewhere specified or included; hide powder, whether or not chromed

Source: Service d'Information et de Rechercher Parliamentaires, Canadian Bibliotheque du Parlement

4.2 Pre- Uruguay Round

Before the Uruguay Round agreements, Canada's *Export and Imports Permit Act* allowed for the determination of an ICL. It was therefore provided that dairy product imports were governed by a permit system. This import system controlled and limited product entry into the Canadian market through import quotas.

The Canadians provided that all standard dairy products were identified in specific terms under the protocols of the ICL. In cases of unspecified dairy products, there was a more general provision that controlled the entry of fat and oil sources.

Thus, products on the ICL were identified by name. The general nature of the interpretation was that any product with a dairy content equal to or greater than 50% would be considered to be a dairy product.

Thus, dairy products, along with products that were composed entirely or primarily of milk, came under the auspices of the *Canadian Dairy Commission Act*; however, disputes in terms of interpretation were possible, as the ICL was also covered by the *Export and Import Permits* Act and the *Agricultural Stabilization Act.*

Dairy Farmers of Canada realized that this situation meant that different interpretations were possible – and therefore requested that the definition of ”dairy products” be narrowed, specifically with regard to the word “primarily.”

Following the 1988 signing of the Canada-U.S. FTA, three further dairy products were added to the ICL. These were:

- Ice cream
- Yogurt
- Dairy blends—i.e. products containing at least 50% skim milk, casein, caseinate, buttermilk or whey, used alone or in any combination

Thus, the threshold of 50% for dairy blends became an established protocol. Two major outcomes arose:

- The U.S. put forward a case that took issue with yogurt and ice cream being added to the ICL on the basis that they were outcomes at some distance along the value chain and therefore should not be construed as dairy products that posed a threat to Canada’s domestic milk supply management. A GATT ruling ruled against this U.S. interpretation
- The Canadian Government was successful in blocking trade into Canada of dry blends containing less than 50% dairy content

With specific regard to this last point, there was the case of one importer buying a dry blend comprised of 49% SMP and 51% coarse salt—the product sifted so that the SMP could be harvested and used. The product was banned on the basis that it was considered to have been produced specifically to circumvent the regulations.

4.3 Post-Uruguay Round

Following the establishment of multi-lateral trade agreements arising from the Uruguay Round, tariff-rate quotas replaced dairy product import quotas. This allowed for tariffs to be established on a sliding-scale basis, associating tariff rates with different levels of market access, and allowing protection over specific markets. In some cases the tariff rates were prohibitive to trade.

In the lead up to finalizing tariff numbers for GATT, Canada's federal Government wanted to ensure that products were described along with their name, to ensure that they would be allocated to the correct tariff number. Thus, many dairy products that were not on the ICL now have a tariff number allocated to them.

When the tariff lists were tabled, the difficulty of describing dairy blends was understood. Such difficulty is based on two predominant issues:

- The very nature of blends, which may have multiple (dairy and non-dairy) constituents, with very minor changes in any constituent apparent
- The fact that many different tariff numbers applied to various blends, such as:
  - Milk and cream powders, whether or not they contain added sweeteners, come under tariff number 0402
  - Dairy blends with less than 50% dairy content are covered by tariff number 2106.90.33/44
  - Products consisting of natural milk constituents, whether or not they contain added sweeteners, are covered by 0404.90

In 1994, during the final phase of the Uruguay Round, Canada included tariff number 0404.90, which no longer referred to the 50% dairy content threshold. In doing so, Canada was signaling its intent to counteract any attempts to circumvent dairy blend imports that may be formulated specifically to get around the regulatory situation.

Indeed, on 19 August 1996, following a review of the conversion of import quotas to TRQs, the following mention with regards to blends was made:

> *43. Tariff Subheading 0404.90 is a residual category that covers products not specified elsewhere. The removal of the fifty percent threshold from the portion of this Tariff Subheading that was formerly subject to ICL Item 21 allowed Canada to respond to a problem that had developed contemporaneously with the Uruguay Round: concerted efforts by some private firms to import mixtures specifically designed to circumvent the import controls on dairy products* Source: Dairy Farmers of Canada, legal brief submitted to the Hon. Lyle Vanclief, Ottawa, Nov., 1997

Regardless of the intent, time would tell that despite all due care and consideration with which tariff numbers are written, there could never be complete assurance that descriptions would comply in practice.

4.4 Revenue Canada's Determination of Butteroil/Sugar Blend Classification

During the early 1990s, there was a steady trade into Canada of butteroil/sugar blends, based on a 49/51 composition ratio, and as allowed by the ICL. Because they were only in the order of US$ 2.1 million worth of imports per year, there was no concern expressed by the Canadian dairy industry.

Following the promulgation of the TRQ system in 1995, one importer sought clarification from Revenue Canada that the butteroil/sugar blend was classified under tariff number 2106.90.95. Revenue Canada confirmed this, thus allowing the blend to be imported without having to hold an import license. Moreover, the product was not subject to any TRQ protocols. Revenue Canada's decision was based on an analysis and understanding of the product. Most especially, such blends were interpreted as not being butter substitutes by any practical meaning, for the following reasons:

- Such blends cannot be spread
- They caramelize when used as cooking fat
- Their high sugar content severely restricts their use in product formulations

Thus, Revenue Canada's determination that butteroil/sugar blends of this nature came under 2106.90.95 rather than 2106.90.33/43 raised an issue between the dairy farmers of Canada, and the nation's dairy ingredient importers.

4.5 Canadian Dairy Producers Raise the Issue

During 1996, Dairy Farmers of Canada noted recent imports of butteroil/sugar blends stood at about 600 mt per annum, valued at the equivalent of US$1.7 million in milk fat. However, by October of that year, Revenue Canada reported imports for the category on a YTD basis had achieved almost 3,150 mt. Major suppliers were noted as:

- U.S.
- Mexico
- N.Z.
- Europe

Thus, in 1997, Dairy Farmers of Canada actively pursued Revenue Canada, the Department of Finance, the Department of International Trade & Agriculture and Agri-food Canada to have blends reclassified in tariff number terms from 2106.90.95 to 2106.90.33/34 (butter substitute).

Concerns over reclassification were held to harbor two main issues:

- A possible challenge being set before the WTO
- A direct challenge being raised by the U.S.

Following this, Dairy Farmers of Canada refined its appeal—seeking reclassification to tariff number 0404.90 on the basis that it was originally set up to limit dairy blend imports, many of which were developed in order to circumvent the prevailing regulations. This created pressure on Revenue Canada to undertake a comprehensive review of the classification of butteroil/sugar blends, on the basis of the TRQ system that was in force.

Revenue Canada returned with a decisive conclusion that the situation be maintained—i.e. that butteroil/sugar blends be classified under 2106.90.95—and this received overwhelming support from the dairy product importers. This decision was based on an expressed view that:

> The WCO had previously explored the options re classification of butteroil/sugar blends under 0404, but had determined that butteroil/sugar blends '[*were] not natural milk constituents because they're processed to get butter and butteroil. So it's not a basic constituent if you separate it in the normal fashion*'. Source: House of Commons Standing Committee on Agriculture and Agri-Food, *Evidence*, 20 Nov., 1997, Ottawa, pp.19-20

Following further pressure from Dairy Farmers of Canada, three ministers of Canada's Federal Government announced during late 1997 that the Governor in Council would ask the CITT to review the situation of blends

that contain dairy ingredients. This was being undertaken on the basis that:

> *Dairy blends are mixtures of dairy products and other food substances for use in the preparation of products such as ice cream, confectionery and bakery goods. In the context of imports into Canada, dairy blends are often created in a manner intended to avoid entering under tariff-rate quota descriptions covering the importation of most dairy products.* Source: Government of Canada Press Release, 17 Dec., 1997

4.6 CITT Determination of Dairy Blends

During the course of its investigation, the CITT produced a variety of documents regarding butteroil/sugar blends. These covered such diverse aspects as:

- The Canadian and international legal framework – especially as it pertains to international trade
- The impact of continuing butteroil/sugar blend imports on milk production in Canada
- The need for such blends and their use in ice cream manufacturing

Some of the facts raised by the CITT included:

- Ice cream manufacturers contended that dairy blends offered technical advantages and helped to stabilize stock; however, "*[that] the price advantage of the butterfat in the imported butteroil blends [was] the most important factor influencing the demand in the domestic market for butteroil blends*"
- The use of butteroil/sugar blends is not limited to ice cream manufacture – there was seen to be a growing volume of the product directed towards processed cheese manufacture

In usage terms, the CITT revealed the following:

- Canadian manufacturers of ice cream and processed cheese used 6.3 million kg of butteroil blends in 1997—equivalent to 3.1 million kg of milk fat
- Canadian requirements for fat used in ice cream manufacture and "replaceable" fat for processed cheese totaled 25.639 million kg in 1997 (note: standard processed cheese manufacture limits the amount of milk fat that can be replaced to 5% of the total volume of product)

- Thus, the 3.1 million kg of fat from the 6.3 million kg of butteroil/sugar blends represented 12% of the fat required in ice cream manufacture and replaceable fat in processed cheese manufacture (note*:* conversion of butteroil/sugar blend quantities to milk fat equivalent (quantity x 49% x 99.3%))
- CITT estimated that the cost of this was US$ 13.2 to 31.9 million, depending on whether production had been maintained and surpluses exported, or whether milk production had decreased in proportion to the fat equivalent in blend imports
- The CITT felt that market penetration of butteroil could eventually rise to a maximum 25% of the fat requirement for ice cream production and replaceable fat for processed cheese (the equivalent of 6.4 million kg of milk fat based on 1997 data)

The CITT considered but rejected some options, on the basis that they were not consistent with Canada's domestic or international rights and obligations, or because they were not considered viable alternatives. These options were advised as follows:

- Reclassification by the Government
- Imposition of an excise tax
- Bilateral negotiation with N.Z.
- Removal of anti-dumping and countervailing duties on refined sugar
- An increase in milk prices
- A change in labeling requirements

Further options were considered to have greater potential, and were considered to be more consistent with Canada's obligations. These options were advised as follows:

- An appeal to the Tribunal by DFC regarding the classification of butteroil blends
- An inquiry into safety measures by the Tribunal
- A special class price for butterfat to be used in ice cream and processed cheese manufacture
- A special class price for butterfat for domestic butteroil blends
- Compensation for Canadian dairy producers

- A new tariff number for butteroil blends negotiated under Article XXVIII of GATT

Of interest, the CITT also emphasized the very real option of maintaining the status quo.

The following comment in the CITT report highlights the conflicting issues relating to the situation:

> *It is clear to the Tribunal that there is no option available that comes without a cost to one or more of the stakeholders. The dilemma is that there are economic consequences for the dairy farmers from imports of butteroil blends, and yet the international rules limit the types of action now available*. Source: CITT Report, 1998, p. vi

4.7 Government of Canada Response to CITT Inquiry

In August 1998, it was announced that the Government of Canada had requested a review of the current tariff classification for butteroil blends.

As background to this review:

- Revenue Canada classifies butteroil/sugar blends under tariff number 2106.90.95; thus, they are deemed not to be butter substitutes
- That perspective is challenged by Dairy Farmers of Canada – stating that because the blends are used to manufacture ice cream, they are indeed dairy blends and should be classified under tariff number 2106.90.33 (as dairy blends) or, more preferably, under tariff number 0404.90 (which was initially instituted to curtail dairy blends developed to circumvent trade protocols)

The CITT handed down its decision in March 1999:

> *Butteroil blends comprising less than 50 percent butteroil and more than 50 percent sugar (sucrose) are classifiable under tariff item No. 2106.90.95. Blends comprising less than 50 percent butteroil and more than 50 percent glucose are also classifiable under tariff item No. 2106.90.95* Source: CITT Unofficial Summary, decision on tariff classification of certain butteroil blends, Ottawa, 26 Mar., 1999, p.1

Thus, the CITT outcome reflected four previous Revenue Canada findings and a WCO decision.

4.8 Dairy Farmers of Canada Response

The Federal Court of Appeal rejected an application by DFC to review the CITT decision. Moreover, DFC resisted an option of appeal to the Supreme Court, preferring to look at a strategy that involved:

- Lobbying importers and/or
- Requesting special labeling for butteroil-based products

By 2002, DFC had instituted a program of supply chain management whereby it would undertake to (among other things) regulate milk blend imports into the Canadian market.

4.9 Further Issue: Ingredia S.A.'s PROMILK 872 B

In 2005, the CITT instituted a decision on the classification of PROMILK 872 B imports. More specifically, PROMILK 872 B is considered a natural milk product, specially adapted to sugar-free confectionery products. It is made in Switzerland by Ingredia S.A., and is imported into Canada by Les Produits Advidia Inc. The relevant product attributes include:

- Comprised predominantly of milk proteins (total 87.5% milk proteins (dry weight basis) with 92% of this content attributed to casein
- High in calcium
- Low in sugar (2% lactose)
- Low in fat (1.5% milk fat)
- Tailored and suited for the low carbohydrate section of the nutritional and dairy products markets

As background to the review of PROMILK status:

- Identical products had been imported into Canada under tariff number 3502.20.00
- Advidia saw this as beneficial in tariff terms, since the tariff was only 6.5% when it started importing PROMILK from 10 August 2001

In April 2003, the CCRA altered the classification of the product from 3502.20.00 to 0404.90.10—the latter subject to a TRQ of 270% above the access commitment level.

Advidia then established that an equivalent product imported from N.Z. was coming into the Canadian market under tariff number 3504.00.00. CCRA upheld its decision, but determined that the correct tariff number should indeed be 0404.90.20.90 – also carrying a prohibitive tariff.

Advidia then further appealed – the outcome being that CITT determined that PROMILK 872 B should be imported under 3504.00.00, on the basis that, "uncontested evidence shows that the product consists of 87.5% protein matter on a dry weight basis," and that, "*protein substances* are more specific than *products consisting of natural milk constituents*."

Thus, the findings of the case meant that PROMILK 872 B could be imported into Canada with a minimal tariff applied to it.

4.10 Concluding Summary

A number of issues arise from the foregoing:

- The economic importance of imports of butteroil/sugar blends into Canada under tariff number 2106.90.95 goes beyond the displacement of 3.086 million kg of Canadian milk fat production (~2% of Canada's market sharing quota)
- Imports of butteroil/sugar blends, and more recently milk protein blends, are an outcome of the tariff system that was instituted as a result of the Uruguay Round in order to open up markets and liberalize trade – an initiative that is underpinned by a goal of better distributing the world's agri-food resources
- Before that goal can be achieved, there is a necessary transition phase during which tariffs are used to help make the process more progressive
- While all countries and all industries know the rules, some are finding it more difficult to adjust
- Regardless of the outcome of the string of reviews and challenges pertaining to the Canadian butteroil/sugar blends issue, there remains an indisputable fact that there will be a growing number of dairy blends – and that much of these will enter international trade in the future
- CITT's forecast that market penetration by butteroil blends could reach 25% of the fat requirement for ice cream and replaceable fat for processed cheese was severely under-estimated. Indeed, CBSA data reveals that 47% of the fat market for the production of ice cream has been penetrated by butteroil/sugar blends by 2004

- Blends have an economic value for end users—i.e. they lower the cost of production
- This ensures that a realistic Canadian milk producing sector will need to re-evaluate on a continuing basis its position with regard to more cost-competitive imports, especially in terms of whether they are prepared to provide milk fat to the domestic market at more competitive prices
- A realistic perspective acknowledges that the current TRQ and market access system will continue to provide a buffer against a wholesale inflow of massive volumes of dairy products into the Canadian market. Regardless, there will still be instances where dairy blends will compete with locally manufactured dairy products
- This will be the case regardless of whether the blends are developed purposefully for circumventing trade and regulatory protocols
- Other examples besides the butteroil/sugar blend are touched on:
  - An early attempt to blend SMP and coarse salt
  - CITT ruling on butteroil/glucose on the same basis as butteroil/sugar (sucrose)
  - The example of PROMILK 872 B, a milk protein isolate (not strictly a blend, as it is derived by filtration and spray drying), although the example further testifies to the intrinsic complexities related to tariff number determination
- Canada is bracing itself for a new wave of dairy blends—more specifically butter blends that contain up to 70% vegetable oil. These blends are increasingly popular in the neighboring U.S. market, where they are for all intents and purposes dairy products (although more closely related to margarine)
- However, in the case of Canada butter blends of this nature carry a 200% TRQ. Regulations are in place to permit manufacture in some of the Canadian provinces, which may help level the playing field

5.0 WHEY USAGE IN BLENDS

- Global whey production is estimated at 94 million mt
- Up to 75% of this volume is used in feed applications
- Much of the whey powder used in feed applications is used in blends (pre-blended, or blended in situ)
- Value-added whey products are typically used in dairy and non-dairy blends in one of three ways:
  - Blended as part of a primary mix
  - As a secondary blend, supplied in pre-blended fashion to users
  - Supplied in its own right for pre-blending at point of manufacture
- Annual whey powder production > 2 million mt
- Global trade in whey is estimated at > 780,000 mt (note: excludes trade within the EU), reflecting strong growth over recent years
- While data on trade in whey blends is not freely available, it is thought that with whey incorporated in blends that fall outside the whey tariff classification codes, whey trade could be as much as 10 to 20% higher than the reported volume
- Key whey markets will reflect key whey blend markets—just as the key suppliers of whey are expected to be key suppliers of whey blends
- Key markets for whey/whey blends are:
  - China
  - Canada
  - Mexico
  - Japan
  - South Korea
  - Thailand
- Value-added whey derivatives are highlighted in this chapter, including an estimate of market demand
- Much of this value-added whey volume is used in blending applications, including:
  - Infant formula
  - Dry mixes
  - Dairy formulations
  - Bakery
  - Enriching other dairy products e.g. WPC, WPI
  - Nutritional bars/nutritional formula
  - Oral care products
  - Confectionery

5.1 Whey Production Trends

Trends in global liquid whey production are estimated as follows (FAOSTATS):

- 2002 93.8 million mt
- 2003 92.5 million mt
- 2004 92.8 million mt
- 2005 94.0 million mt

FAO and trade data correlates that up to 75% of total whey production is used in feed applications, down from 86% in 1996. Such a drop is consistent with increased demand for whey products in the food and pharmaceutical industries. Apart from liquid whey applied directly (single strength, most of the concentrated whey), much of the powdered whey used in feed applications is supplied either pre-blended, or blended on site.

Other than blends where the whey content is significantly higher than 50%, whey that enters into international trade blended with or incorporated into another product is generally poorly accounted for in trade statistics. As a result, whey trade data may be understated by as much as 10 to 20%.

5.2 Whey Powder

In 2005, annual global whey production, utilized in further whey processing, was estimated at 94.0 million mt, with whey powder and related products accounting for 2.06 million mt. The EU trading bloc is the largest producer of whey and whey powders, with the expanded EU now accounting for over two-thirds of total whey powder output. The U.S. remains the second largest whey producer and processor, accounting for almost a quarter of overall volume. Together, the EU, U.S. and Oceania account for an overwhelming 96% of total whey powder production.

Table 5.2 Global whey powder production

Region	2001, '000 mt	2002, '000 mt	2003, '000 mt	2004, '000 mt	2005, '000 mt
EU(25)	1,330	1,350	1,340	1,350	1,370
U.S.	475	505	490	470	475
Oceania	75	80	110	105	120
Canada	45	45	50	50	25
All others	10	90	60	40	70
Total	**1,935**	**2,070**	**2,050**	**2,015**	**2,060**

Source: FAOSTATS; U.S. Dept. of Commerce; Landell Mills estimates

5.3 Whey Trade

International trade in whey and related products (excluding lactose) achieved over 780,000 mt in 2005, continuing a strong growth occurring over recent times. While this and the forthcoming data are not definitive with regards to global trade flows for whey-based blends, the key features are:

- A significant amount of whey is either shipped in a blended state, or alternatively used in blends in the country of destination, or at point of application
- Blends comprising > 50% whey content are traded as whey products, and will be captured within these trade flows

Thus, it is widely considered that whey volumes used in blends in import-dependent markets are reflected in this macro trade data.

Table 5.3a Whey: key global import markets – supply volume trends

Destination	2003, '000 mt	2004, '000 mt	2005, '000 mt
China	162	179	189
Canada	66	74	91
Mexico	53	60	69
Japan	58	59	64
S. Korea	47	59	64
Thailand	48	48	48
All others	233	258	257
Total	**667**	**737**	**782**

Source: Country data trade sources

Market shares of the major suppliers into key markets are given in the following table.

Table 5.3b Market shares in the key whey product markets

Market	U.S., %	EU, %	Australia, %	NZ, %	All others, %
China	41.0	44.3	6.8	1.9	6.0
Canada	90.4	2.6	2.5	4.3	0.2
Mexico	95.6	1.2	1.8	0.4	1.0
Japan	43.2	25.1	16.9	8.3	6.5
S. Korea	49.9	30.4	5.8	3.0	10.9
Philippines	28.0	24.2	27.4	0.9	19.5
Thailand	34.5	41.7	20.5	1.0	2.3
Indonesia	12.0	55.7	28.2	2.9	1.2
Malaysia	16.0	55.2	26.5	1.8	0.5
Brazil	19.2	30.0	3.7	Negligible	47.1
Singapore	11.5	33.4	40.6	12.5	2.0
Taiwan	50.7	24.9	13.6	1.5	10.7
Vietnam	37.7	47.3	13.8	Negligible	1.2
Colombia	39.9	50.5	Negligible	Negligible	9.6
Chile	33.8	13.4	6.1	2.9	43.8

Source: Country data trade sources

Value-added whey products are typically used in dairy and non-dairy blends, in one of three fashions:

- Blended as part of a primary mix that is sold to manufacturers
- As a secondary blend, pre-blended and supplied to manufacturers
- Supplied in its own right and blended at point of manufacture

5.4 Value-Added Whey

Current estimates of the annual world volume of value-added whey and whey derivatives produced is given as follows:

Table 5.4a Value-added whey derivatives – annual demand and usage in blends

Product	Market demand, mt	Comments re usage in blends
Demineralized whey	450,000	DWP-90 used in infant formula DWP-50 in dry mixes, dairy, bakery applications
WPC-35	270,000	Used in SMP replacers – most attractive when price is more than 20% below prevailing SMP price
WPC 50-75	80,000	Used by sophisticated formulators and end users involved in dietetics, infant formula and sports nutrition
WPC 80-85	60,000	Used by sophisticated formulators and end users involved in dietetics, infant formula and sports nutrition
WPI	40,000	Used by sophisticated formulators and end users involved in dietetics, infant formula and sports nutrition
Whey protein hydrolyzates/bioactive peptides	16,000	100% used in blends, including infant formula, nutritional bars, dietetics, and protein blends with non-dairy proteins
Lactoferrin	100	Used in various applications, including infant formula
Lactoperoxidase	5	Used in oral care and related applications
IgG	50	Used in infant formula, nutraceuticals, sport formula
Alpha-lac	1,500	> 200 mt p.a. high purity alpha-lac used for enriching WPC, WPI
Beta-lac	800	> 150 mt p.a. high purity beta-lac used for enriching WPC, WPI
GMP	130	Used for enriching WPI, WPC – used in infant formula, as an appetite suppressant, sports nutrition and in oral care formulations
Lactulose	31,500	A large volume is consumed in-house by the manufacturers
GOS	4,000	A large volume is used in-house by the manufacturers
Lactosucrose	1,300	A large volume is used in-house by the manufacturers
D-tagatose	20	Usage directed largely to confectionery and related products

Product	Market demand, mt	Comments re usage in blends
Proteose-peptone	1.5 mt	Small volume, used in novel food nutraceuticals
CPP	480 mt	Used largely in confectionery and oral care products
Milk-derived growth factors	< 5 mt	Used in cosmeceuticals
MFGM	5 mt	Used in infant formula and nutraceutical applications

Source: Trade interviews

DWP usage, including application in infant formula in key markets is estimated as follows:

Table 5.4b Usage of DWP in key markets

Market	Estimated usage	Usage in infant formula blends
Japan	35,000 mt	6,500 mt
S. Korea	5,000 mt	2,000 mt
China	40,000 mt	12,000 mt
The Philippines	2,500 mt	2,200 mt
Indonesia	5,200 mt	4,300 mt
Mexico	12,500 mt	7,000 mt
Argentina	n.a.	750 mt
Brazil	n.a.	600 mt

Source: Trade interviews

Some key features from the preceding data include:

- Manufacturers are starting to differentiate WPC supply, which makes it particularly attractive for new blend applications. For example:
  - Heat stable WPC—used particularly in UHT beverage products
  - WPC with controlled levels of protein denaturation—used in bakery applications

- Whey protein hydrolyzate usage in blends is estimated as follows:
  - Clinical nutrition 3.0%
  - Sports nutrition 4.0%
  - Nutraceuticals 1.0%
  - Infant formula 91.0%

- European WPC usage—5% used in sports nutrition (mainly WPC 80)
- European WPI usage—25% used in sports nutrition (especially powders, RTD formulations)

6.0 THE GLOBAL FOOD ADDITIVES MARKET

- World trade in food additives is estimated at US$25 billion p.a., with market growth in different sectors ranging from 0.6 to 8.9% p.a. since 1998
- Further growth is expected, based on:
  - Functional food ingredients enjoying strong market acceptance
  - Fat replacers buoyed on by the obesity crisis
  - Strong growth in flavors as consumers seek new, natural and wholesome flavors
  - Continuing growth in emulsifiers, including natural emulsifiers, as concerns about E-numbers, GMO and artificial ingredients become more obvious
- A selection of dairy components and ingredients could be classified as food additives, for example:
  - Casein glycomacropeptide – satiety agent
  - Casein phosphopeptide – anti-cariogenic properties
  - D-tagatose – sweetener
  - Fatty acids & esters derived from butterfat – flavorings
  - Lactoperoxidase – preservative
  - Lactose & lactose derivatives – fat replacers
  - Lecithin – emulsifier
  - Milk mineral complex – vitamins & minerals
  - Sodium caseinate – emulsifier, stabilizer
  - WPC – fat mimetic, hydrocolloid (pre-emulsion gelation)
- The current chapter illustrates the opportunities for dairy in three core food additive areas:
  - As emulsifiers
  - As concentrated dairy flavorings
  - As fat replacers
- Whereas the economics of using dairy as the only emulsifier in a food system may come under scrutiny, there are co-functionalities that make dairy proteins (for example) compelling formulatory aids in various food system
- The development of food design solutions using such dairy ingredients as components of technologically superior food blends is an opportunity that should be grasped and taken forward by innovative, forward-thinking dairy companies

6.1 Food Additives Defined

Food additives are generally used to facilitate or complement a diversity of functions in food system formulation. This is based on four primary aspects:

- To ensure that food is made safer up to the point of consumption. This can be through preservation methods, or countering oxidation and other chemical changes that would otherwise occur
- To improve the organoleptic attributes and thus the consumer appeal and marketable properties of a food product. This can involve enhancing texture, developing visual appetite appeal, or improving the taste and mouthfeel of a product
- To improve the micro-nutrient status of a product. This is best understood as vitamin and mineral fortification
- To add a health benefit to a food product. This perspective is very much the realm of the recent introduction to the market of nutraceutical and functional foods that deliver physiological enhancing properties for the consumer

The following table summarizes the different food additives commonly understood to be part of the food industry.

Table 6.1 The different types of food additives

Category	Definition
Acidulants	A range of food acids used in food systems
Antioxidants	Food additives that can be used to reduce oxidative stress on a product that in turn would lead to such undesirable traits as rancidity, flavor loss, color loss, nutrient loss
Colors	A range of synthetic, natural and nature-identical coloring agents used in food systems
Emulsifiers	A food additive that facilitates dispersion of o/w and w/o formulations
Enzymes	Organic biocatalysts that are used in food systems to induce reactions in various processes
Fat replacers	Fat substitutes and fat mimetics used to reduce fat levels in formulated foods
Flavor enhancers	Food additives which may be practically tasteless in their own right but which boost or enhance the flavor impact of food products
Flavors	Essences that are used in concentrated means as a flavoring tool in food formulations
Functional food ingredients	A range of food ingredients that confer physiologically enhancing properties to a food product

Category	Definition
Hydrocolloids	A range of food additives that have as their primary function such physico-chemical properties as gelling, setting, stabilizing, suspending & thickening
Preservatives	Chemical agents added to foods in order to extend shelf-life and prevent product deterioration
Sweeteners	This category encompasses bulk sweeteners and intense sweeteners
Vitamins & minerals	Micro-nutrients used as nutrient fortification agents

Source: Landell Mills Management Consulting

6.2 Food Additives Market – Composition, Size and Current Trends

World trade in food additives is significant and quite diversified, covering a wide range of products and applications. Leatherhead estimated the market to be valued at almost US$ 25 billion in 2004.

Leatherhead's market breakdown and growth trends by key category are provided in the following table.

Table 6.2 International Food Additives Market by Category (Value, Volume & Growth Trends)

Category [4]	Value (US$ millions, 2004)	Volume ('000 mt, 2004) [3]	Market growth (% value change p.a.)	
			1998-2001	2001-2004
Flavors	6,000	n.a.	3.2	2.9
Functional food ingredients	3,600	n.a.	n.a.	n.a.
Hydrocolloids	3,260	1,650.0	1.8	3.2
Flavor enhancers	2,820	1,597.0	8.9	1.0
Acidulants	2,176	1,575.0	4.2	(4.0)
Sweeteners	1,750	725.0	2.7	1.0
Colors	1,085	n.a.	3.0	2.8
Fat replacers	1,000	n.a.	0.6	6.8
Enzymes	760	n .a.	4.1	2.8

Category [4]	Value (US$ millions, 2004)	Volume ('000 mt, 2004) [3]	Market growth (% value change p.a.)	
			1998-2001	2001-2004
Emulsifiers	700	650.0	2.7	5.6
Preservatives	649	288.0	5.0	2.5
Vitamins & minerals	400	50.0 [1]	(13.6)	0.4
Antioxidants	290	25.0 [2]	2.7	3.7
Total	24,490			

Source: Leatherhead Food International (2005)

Notes: [1] Volume estimate for 'vitamins & minerals' only include vitamins, due to difficulty extracting reliable information on global mineral volume
[2] Market estimate based on extrapolation of Japanese industry data, given at 2,600 mt p.a.
[3] A number of categories have no volume estimates
[4] There is a degree of overlap between various categories, with some additives undertaking multiple functions in a food formulation. Within this report, categories are not mutually exclusive

There are some key drivers to the food additives market. These include:

- A global trend towards increased consumption of prepared and processed foods and beverages, with economic prosperity pushing ahead consumer demand and developments in fast-emerging markets (e.g. China, India and Latin America). As food and beverage manufacturers are striving to develop a strong competitive platform, they are increasingly working with food additive companies to tailor solutions to new product development and product improvement. This includes the development of proprietary blends
- Growth in demand for convenience foods, which impinges on issues like extended shelf-life for food products
- A counter-traditional food culture trend manifest by growth in demand for Western foods in fast developing Asian markets, and ethnic food demand increasing through much of the Western world
- A rapid uptake in health and nutritional positioning platforms for food and beverage products. This is putting new pressure on food

formulators to deliver novel solutions to market opportunities (e.g. nutritional bars, meal replacement beverage mixes, medical foods, healthy snacks, sports performance enhancement foods)

- Developing markets for natural and organic foods, with pressure on additive manufacturers to develop ingredients from natural sources
- Continuing pressure by consumers on taste and quality. This means that manufacturers that are developing substitute products (e.g. the raft of soy formulations that are competing head-on with traditional dairy products such as cheese, milk, butter, yogurt, ice cream, etc.), need to address taste, texture and nutritional shortfalls

6.3 Future Prospects for Food Additives

The global food additives market is expected to increase to almost US$ 27.3 million by 2007. A summary of this situation is provided by the following table.

Table 6.3 Forecast market size and growth trends for food additives by category

Category	Forecast market value (US$ millions, 2007)	Projected annual growth (% value change p.a., 2004-2007)
Flavors	6,550	3.0
Functional food ingredients	4,870	10.4
Hydrocolloids	3,500	2.4
Flavor enhancers	2,860	0.7
Acidulants	2,250	1.1
Sweeteners	1,800	0.9
Colors	1,155	2.1
Fat replacers	1,250	6.3
Enzymes	820	2.6
Emulsifiers	775	3.5
Preservatives	720	3.5
Vitamins & minerals	410	0.4
Antioxidants	325	3.9
Total	27,285	

Source: Leatherhead Food International (2005)

- This growth forecast is based on key trends identified as follows:
  - Functional food ingredients enjoying market growth at an average annual rate of 10.4% over the period 2004-2007
  - Strong performance from fat replacers, buoyed on by the obesity crisis, with annual growth over the period averaging 6.3%
  - Antioxidants growing at an average of 3.9% p.a.
  - Emulsifiers and preservatives each enjoying annual growth rates of 3.5%

- Continued growth beyond 2007 is expected, with a total global food additives market of US$ 30.5 billion expected by 2010

6.4 Food Additive Trends by Sector

The following table highlights major trends in the food additive market by key sector.

Table 6.4 Food additive market – trends by key sector

Category	Trends
Flavors	• Ongoing steady growth • Emphasis on natural flavors • Ethnic flavors remain strong • Sour/acidic flavors growing in importance • More sophisticated tastes leading to demand for more authentic and exotic flavors
Functional food ingredients	• A strong and outstanding growth market • Established categories (e.g. vitamins & minerals) are benefiting • Key therapy areas address obesity, CHD, diabetics, immune system (incl. cancer), performance foods, oral care
Hydrocolloids	• Growth varies within sector (5% p.a. for gelatin & pectin, 4% seaweed derivatives) • Fat replacement a growing consideration for hydrocolloids

Category	Trends
Flavor enhancers	• Sector remains dominated by MSG • Growth in MSG in China, decline in Japan • Asia still accounts for 75% of MSG usage • Yeast extract developing as preferred flavor enhancer in U.S., Europe • Demand driven by growth in processed convenience foods, highly flavored ethnic dishes
Acidulants	• Citric acid comprises > 50% of market volume • Chinese competition has forced down prices • Phosphoric acid suffering as cola beverages come under pressure from fruit-based beverages
Sweeteners	• Intense sweeteners represent > 65% of market value, 10% market volume • Bulk sweeteners (xylitol, lactitol, isomalt) benefit from growth in sugar-free confectionery market • Sorbitol growth waning with decline in low-carb fashion • Whole sector affected by concerns over weight control, dental health, diabetes
Colors	• Synthetic 41%, natural 30%, nature identical 19%, caramel 10% • Natural growing at 5% p.a. (important in Europe, Asia) • Food safety concerns regarding carcinogenic colorings
Fat replacers	• Growth fuelled by global obesity pandemic • Hydrocolloids gaining importance as fat replacers • Adverse publicity versus *trans* fats has led to replacement of hydrogenated oils/fats
Enzymes	• Starch, bakery & dairy remain key user sectors • Growth in newly emerging specialty applications
Emulsifiers	• Lecithin accounts for one-third of market • Types used vary from region to region • Non-GMO lecithin may become short in supply based on Brazilian Government approving GMO soy
Preservatives	• Difficult to find natural alternatives to synthetic preservatives • Market features organic preservatives derived from acidulants, natural anti-microbials, mineral-based preservatives • Growth in soft beverage market driving demand and opening up new opportunities

Category	Trends
Vitamins & minerals	• Micro-nutrient fortification to replace product lost through processing continues to be needed • Consumer awareness of health benefits drives sales • Growing demand for pre-mixes • Chinese supply leading to price pressure (esp. ascorbic acid)
Antioxidants	• Natural antioxidants (incl. herbal extracts) show greater growth • U.S. and Europe usage in poultry processing is important (45% share of market) • Natural antioxidants allow an 'additive free' claim

Source: Landell Mills Management Consulting, adapted from Leatherhead Food International (2005)

6.5 Why Consider Food Additives in a Global Blends Study?

Given all the foregoing, one may well ask why a section on food additives would be included in a global dairy blends study. The reason is that many dairy ingredients, dairy compounds and dairy derivatives have attributes that effectively position them as food additives. These may be available as additives in their own right (e.g. D-tagatose as a sweetener), or by virtue of their natural role as a constituent in a recognized dairy product (e.g. the naturally high lecithin content of buttermilk powder, with its emulsifying properties).

But the essence of this response is that by virtue of this status, dairy ingredients, dairy compounds and dairy derivatives are unabashedly legitimate and primary candidates to be presented as food additive components in dairy and non-dairy blends that are used in food formulations. Furthermore, the notion of blends is in no small way about bringing such components together.

In order to further elaborate on this response, the following table identifies a selected range of discrete dairy components and dairy products that may be perceived as food additives in the context of this report. The selection is by no means complete, but it has been assembled in order to illustrate the breadth and depth in the range of dairy products that could be used as food additives. Moreover, this shows that while dairy products are finding ready acceptance as functional food ingredients, their role should be much more widely recognized and embraced.

Table 6.5 A selection of dairy components and ingredients that could be classified as food additives

Dairy product	Food additive category
Casein glycomacropeptide	Functional food ingredient (satiety properties)
Casein phosphopeptide	Functional food ingredient (anti-cariogenic attributes)
D-tagatose	Sweetener
Fatty acids & esters (derived by enzymatic process from butterfat)	Flavors
Lactoperoxidase	Preservative
Lactose & lactose derivatives (lactitol, lactulose, fatty acid esters of lactose)	Fat replacers (that also have emulsification and stabilizing properties in some food systems)
Lecithin (e.g. as an ingredient in buttermilk powder)	Emulsifier
Milk mineral complex	Vitamins & minerals
Sodium caseinate	Emulsifier (e.g. in cream liqueurs)
Sodium caseinate	Hydrocolloid (e.g. stabilizer in frozen desserts)
Whey protein concentrate	Fat mimetic, emulsifier (e.g. CP Kelco's Simplesse)
Whey protein concentrate	Hydrocolloid (pre-emulsion gelation)

Source: Landell Mills analysis

With all this in mind, the present chapter sets the scene for further analysis and discussion in the following few chapters on dairy products and compounds as food additives in dairy and non-dairy blends.

6.6 Dairy Emulsifiers

6.6.1 What are emulsifiers?

Emulsifiers are classified within a wider category of industrial (food, non-food) additives that are broadly termed surfactants. Surfactants are industrial processing aids that are used for their emulsifying action and ability with specific regard to their capacity to form and stabilize emulsions.

From a usage and terminology perspective, 'surfactant' is a term that is typically used when referring to non-food applications (e.g. detergents, soap products, cosmetics), whereas 'emulsifier' relates to food formulations (especially relevant in bread, other bakery goods, margarine, confectionery, chocolate, ice cream and dairy foods).

Examples of industrial non-food applications for surfactants include the following:

- Use of polysorbates and sorbitan in pharmaceutical emulsions or dispersions containing vitamins or hormones
- Lipophilic surfactants such as monoglycerides, propylene glycol ester or sorbitan ester used as suppository bases
- Monoglycerides and other lipophilic surfactants typically used in w/o and o/w creams, lotions, gels, etc.
- Hydrophilic surfactants used to solubilize perfume oils in various cosmetic oils and lotions
- Use of surfactants in the plastics industry as lubricants—especially in products made from polyvinyl chloride and polystyrene
- Use of surfactants as anti-fogging and anti-static agents
- Use of surfactants as fabric softeners in laundry detergents

Danisco Ingredients, the largest supplier of food emulsifiers, provides the following overview on emulsifiers:

- An emulsifier is a molecule consisting of two parts:
  - The hydrophobic component—typically consisting of a fatty acid which has a natural affinity for oil in which it dissolves
  - The hydrophilic component—typically comprised of a glycerol (which in turn may be esterified with acetic acid, lactic acid, tartaric acid, or citric acid) and has a natural affinity for water in which it dissolves
- An emulsion is a dispersion of droplets of one immiscible liquid with another
- Other immiscible substances may also be dispersed in liquids, resulting in either a foam (liquid and gas) or a suspension (liquid and solid)
- Emulsifiers concentrate at the interface between immiscible liquids, where they form interfacial films
- This makes emulsifiers indispensable in the contemporary food processing industry, where foams, suspensions and in particular emulsions are frequently used

- The ability of emulsifiers to concentrate at the interface between two immiscible liquids is due to their hydrophilic/lipophilic structure
- Food emulsifiers are classified as one of two:
  - Oil-in-water (o/w) emulsions. Examples include liquid cream and milk, in which oil is the dispersed phase and water the continuous phase
  - Water-in-oil (w/o) emulsions. An example is margarine, in which water is the dispersed phase and oil the continuous phase

6.6.2 Emulsifier market—global overview

The global emulsifier market is estimated at US$ 928 million (note, the market values and volumes in this chapter vary from the market information provided in Chapter 3, due to different data sources). A geographic composition of this market is provided by the following table.

Table 6.6.2a Global emulsifier market size—estimates by region (value, 2005)

Region	Value (US$ millions)	Value (% share)
U.S.	465.0	50.1
Europe	300.0	32.3
Asia	95.0	10.2
South America	35.0	3.8
Australasia	18.0	1.9
All others	15.0	1.6
Total	**928.0**	**100.0**

Source: Landell Mills Management Consultants, from various trade sources

Key features arising from this table include:

- The U.S. is the single major market for emulsifiers, accounting for 50.1% of total value sales
- Europe accounts for almost one-third of total emulsifier sales

- Asia has 10.2% value share. However, it is widely held that Asia is a prime growth market for emulsifiers—especially China, and, to a lesser extent, India—which have fast-developing packaged, prepared and processed food industries

The global (non-food) emulsifier market has two distinct categories:

- Synthetic emulsifiers (e.g. monoglycerides) accounting for almost 80% of the value of the market
- Natural emulsifiers (principally lecithin), representing the remainder of this market

However, in volume terms, the natural emulsifiers have a significantly higher share at almost 40%, due to higher unit pricing. An overview of major emulsifier types by volume, and principal fields of application are provided in the following table.

Table 6.6.2b Emulsifier market segmentation—major emulsifier types and key fields of application (2005)

Type of emulsifier & application field	Volume ('000 mt)	Volume (share, %)
Synthetic emulsifiers:		
Yeast raised baked goods	44.0	8.2
Icings, cakes & related products	42.0	7.9
Other bakery products	83.0	15.4
Sub-total – bakery	*169.0*	*31.5*
Table spreads & margarine	16.0	3.0
All other applications	153.0	28.7
All applications – synthetic emulsifiers	***338.0***	***63.2***
Natural emulsifiers:		
All applications – natural emulsifiers	***196.0***	***36.8***
Total – all emulsifiers, all applications	**534.0**	**100.0**

Source: Landell Mills Management Consultants, from various trade sources

6.6.3 Emulsifier end use applications

Food formulators are invariably faced with formulating where there is an interface between discrete and often disparate ingredients. There are three types of interfaces that directly affect the processing characteristics and the end quality attributes of commercial food preparations. These are:

- Emulsions—liquid-liquid interfaces
- Foams—air-liquid interfaces
- Dispersions—solid-liquid interfaces

By optimizing processing control at the interface, food formulators are able to develop and commercialize products that are close to matching market expectations. Emulsifiers play a key role in this process and goal.

Emulsifiers are delivered to and used by the food industry in one of two ways:

- As a component of another ingredient (e.g. the phospholipids in egg yolk, comprising ~20%, and useful as an emulsifier in mayonnaise and similar products) (note: isolated egg lecithin is considered non-economic to be used in most food applications as an emulsifier in its own right, and thus most lecithin used as an emulsifier additive is derived from the processing of crude soybean oil)
- As a discrete ingredient selected and used in its own right (e.g. monoglyceride, soy lecithin)

Functional properties for emulsifiers are based on at least one of the following primary attributes:

- An ability to stabilize water-in-oil emulsions (e.g. margarine)
- To promote successful aeration in products. In the case of ice cream, the selection of emulsifier is due to a desire for controlled destabilization of the emulsions
- To extend shelf-life of starch-based foods (wheat bread, cereal products) due to interactions with the amylase or amylopectin
- To control viscosity of products (e.g. peanut butter, mayonnaise)

Indeed, significant technological progress in terms of reduced-fat and low-calorie foods has only really been made possible because of the technological know-how and applications associated with food emulsifiers.

There is a targeted role for emulsifiers in various foods that goes beyond the simple perception of emulsification. This is based on knowledge that emulsifiers can contribute to tailored food system solutions by virtue of their ability to deliver higher level functionality in food systems. Examples include:

- Starch complexing—some emulsifiers do form complexes with amylase, and these retard the process of retrogradation in bread and bakery products. Thus, the emulsifier can deliver shelf-life enhancing properties through its anti-staling properties (also recognized as improving crumb softness) in bread. Similar outcomes include anti-sticking in pasta products, instant mashed potatoes and cereal foods
- Dough strengthening—some emulsifiers are used to improve the visco-elasticity of wheat gluten in yeast-raised dough
- Protein strengthening—food design and development is increasingly realizing the stabilizing effect of proteins in food emulsions. This relates to the extent that proteins contribute to the formation of a protective film around the fat globules present in the food formulation, with outcomes related to one of two processes:
  - When the emulsifier:protein ratio is low, synergism occurs, enhancing the stabilization of the formulation (e.g. in recombined milk products)
  - When the emulsifier:protein ratio is high, the formula is destabilized due to the desorption of proteins from the fat globules (e.g. in ice cream, whippable emulsions)
- Aeration & foam stabilization—in a number of foods, emulsions are aerated into foams (e.g. whipped cream, cream analogs, rehydrated spray dried toppings). When emulsifiers are used in such circumstances, they enhance the whipping rate and contribute a range of physical properties (e.g. stiffness, yield, foam stability). In the case of baked goods, emulsifiers can encourage foam formation that is important in cake production (especially layer cakes) as well as in the generation of fine-grained crumb in bread

- Crystal modification—some emulsifiers (e.g. sorbitan esters of fatty acids) enable some retardation of the crystal transition process undertaken by fats

Thus, it is seen that the functions and applications of emulsifiers can be quite diverse. The majority of synthetic emulsifiers were developed to promote the stabilization of emulsions. While still of importance, the functionality of emulsifying molecules have been recognized as being much broader, with secondary characteristics apart from emulsification coming into play.

In some applications, this co-functionality may be preferred over the emulsifying attributes. The range of other physico-chemical functionalities that different emulsifiers can contribute to in food systems includes:

Aeration	Agglomeration	Amylose complexing
Anti-spattering	Coating	Creaming
Crumb softening	Crystal modification	Dough conditioning
Emulsifying	Emulsion stabilization	Extrusion aid
Fat distribution	Fat sparing	Foam stabilization
Foam stiffening	Texturizing	Texture consistency
Increased heat stability	Lubrication	Moisture retention
Plasticity	Protein interaction	Reduced stickiness
Release	Viscosity enhancement	Wetting

6.6.4 CP Kelco's Simplesse WPC—emulsification and co-functionality vs. alternatives

CP Kelco identifies emulsification properties along with co-functional attributes in its leading emulsifier products group. Of specific interest in the context of the current report, CP Kelco includes its Simplesse microparticulated WPC in this range. An overview is provided in the following table, and this illustrates how well Simplesse WPC stacks up against CP Kelco's other prime emulsifiers in terms of co-functionalities.

Table 6.6.4a CP Kelco emulsifier product group—emulsification and other key physico-chemical attributes

Functionality	GENU Carrageenan	GENU Pectin	Keltrol Xanthan gum	Kelcogel Gellan gum	Kelgum Xanthan gum	Simplesse Micro-particulated WPC
Emulsion stabilization	√	√	√	√	√	√
Thickening	√	√	√	√	√	
Gelling	√	√		√	√	
Dispersed phase/network interruption						√
Syneresis control	√	√	√		√	√
pH stability			√	√		√
Heat stability			√	√		√
Salt tolerance			√			√
Suspension	√	√	√	√	√	
Ease of use	√	√	√	√	√	√
Clarity	√	√	√	√		
Opacity						√
Coating			√	√	√	
Binding	√	√	√	√	√	√
Protein fortification						√
Melt resistance						√

Source: CP Kelco

There is a range within the Simplesse WPC stable. CP Kelco offers the following selection guidelines for its Simplesse range of product.

Table 6.6.4b Selection Guidelines for Simplesse Micro-particulated WPC

Product	Ingredient label	Functionality	Applications
Simplesse 100	Microparticulated whey protein concentrate (54% protein)	Moisture retention, network interruption, emulsification, opacity, protein fortification, heat stability, smoothness, creamy mouthfeel	Cakes, muffins, brownies, natural & processed cheeses, ice cream & frozen desserts, retorted nutritional drinks, margarines & table spreads, cheesecake, coffee creamers, dressings, creamy sauces & soups, sports nutrition beverages, adult nutrition, acidified milk drinks, meal replacement, sour cream & dips, cottage cheese, dressings, fluid milk
Simplesse 500	Microparticulated whey protein concentrate (35% protein content)	Moisture retention, network interruption, emulsification	Natural & processed cheeses, cream cheese, frozen desserts (fat free, no sugar added), dips, puddings, cheesecakes, processed meat
Simplesse 730	Microparticulated whey protein concentrate, emulsifier blend	Moisture retention, network interruption, emulsification	Pastry crusts, biscuit dough, cookies, cakes
Simplesse CC	Microparticulated whey protein concentrate, xanthan gum blend	Emulsion stabilization, heat stability, acid stability, abuse tolerance	Cream sauces, soups, compound butter

Source: CP Kelco

Of interest in the context of the present study is the fact that CP Kelco uses its Simplesse WPC as a blending base in the case of both:

- Simplesse 730 – a blend of microparticulated WPC and an unnamed emulsifier; and
- Simplesse CC – a blend of WPC and xanthan gum

6.6.5 Establishing and Understanding about Dairy-Based Proteins as Emulsifiers

In terms of the role of milk derivatives as emulsifiers, the example of CP Kelco's Simplesse microparticulated WPC range – including blends was provided in the preceding section.

There is a strong understanding of milk derivatives and emulsifiers, based on a knowledge of the emulsifying proteins in milk. These allow the milk fat to disperse, thus exhibiting a classic natural emulsifying system – and one that must be recognized by the food

processing industry as having intrinsic properties and attributes for developing milk-based emulsifiers.

Indeed, the earliest years of the emulsifier industry were based on two naturally occurring materials. These were:

- Egg lipoproteins, used in mayonnaise
- Casein proteins, used extensively in meat and formulated dairy products

It is abundantly clear that there is a growing range of dairy ingredients variously derived and isolated from milk – generally categorized as milk proteins, milk fat, lactose and milk minerals. With the development of separation technologies, more specific protein fractions are being obtained, along with a range of milk fat fractions that display within a range of melting points. Some of these dairy derivatives have been used as emulsifiers. Others are coming under consideration due to their co-functionalities—including prospective applications as emulsifiers.

Many dairy foods and dairy analogs are complex food emulsions in their own right. These include whippable creams, ice cream, and coffee whiteners. Two types of molecules exhibit a strong tendency to absorb at the surface of the fat globule, or at the air-water interface, making them ideal candidates as emulsifiers in appropriate food systems:

- Surface active milk lipids, especially native polar lipids such as milk phospholipids
- Milk proteins

6.6.6 Dairy proteins as emulsifiers

Dairy proteins, and in particular SMP, caseinates, whey powder, and WPCs, have enjoyed a strong tradition of application in food systems—especially in the bakery industry. The functions that are provided by dairy proteins in bakery applications are wide-ranging, and include such desirable actions as:

- Water and fat binding
- Encapsulating
- Foaming
- Viscosity enhancement
- Gelation
- Yield improvement (e.g. through extension of loaf volume)
- Color enhancement
- Flavor enhancement
- Nutritional agents
- Nutraceutical ingredients

Because milk proteins are readily available in pure forms, and have such good surface activity, they have been widely studied as industrial surfactants/food emulsifiers. In as much as proteins are polypeptide chains in which some of the amino acids are hydrophilic and some are hydrophobic, as surface active molecules, these proteins can denature at water-air and water-oil interfaces. Such activity results in interfacial adsorption and foam or emulsion stabilization.

The emulsifying properties of milk proteins are important in several food systems. Soup formulations, coffee whiteners, comminuted meat products, and recombined milk traditionally use SMP as the dairy protein and MSNF source. However, more recently newer and more versatile milk protein products (e.g. MPCs, WPC, caseinates) are evident in these formulations—including selection on the basis of their co-functionalities specifically relating to emulsifying properties.

Other features of milk proteins in terms of an emulsifying function include:

- Milk proteins having a key role in the emulsification of fat in recombined milk products
- High-temperature processing enhancing the emulsifying properties of whey proteins

Where milk proteins exist in a mix or blend with other emulsifying agents, there may be one or more outcomes related to:

- Competitive adsorption—competition occurs for the available interfacial area
- Displacement—the compound with the greatest surface activity displaces the material with lesser surface-active attributes (e.g. the displacement of gelatin by casein)
- Enhancement—a synergistic relationship can occur, by complexing with the protein to increase interfacial action of the protein
- Reinforcement—a more efficient outcome occurs in which the total interfacial concentration increases and there is a commensurate decrease in interfacial tension

Most simply, due to their inherent nature (i.e. casein vs. whey proteins), manufacturing techniques, degree of purity, process modifications (e.g. milk protein hydrolyzates), companionship in a mix or blend, and/or specific food systems they are introduced to, there are differences in the basic emulsifying potential of different milk proteins.

In general:

- SMP shows good emulsifying properties over a range of pH values and ionic concentrations
- The emulsifying capacity of SMP is greater than caseinates at pH 5.4, regardless of the ionic strength. However, caseinates have greater emulsifying strength in the alkaline pH range
- Caseins exhibit excellent solubility and heat stability above pH 6.0. Due to their unique amphiphilic structure, these proteins also have very good emulsifying attributes
- Whey proteins lack an amphiphilic structure. They are therefore generally inferior to caseins in terms of emulsification
- A good quality whey protein (e.g. beta-lactoglobulin) can provide excellent stability in situations such as low pH food systems

- Unless care is taken, heat treatment can aggregate whey proteins during production. The proteins would then polymerize and interact with small-molecule emulsifiers and/or casein and cause unexpected and possibly undesired effects

- Bovine β-casein characterizes an effective surface-active agent and polymeric stabilizer. As with β-casein, there is a strong adsorption of α_{s1}-casein at hydrophobic solid and liquid surfaces to form an effective stabilizing monolayer. Compared with the caseins, β-lactoglobulin gives an adsorbed monolayer that is thinner and of protein surface coverage

- Sodium caseinate is a more effective interfacial tension depressor than whey protein, blood plasma, gelatin or soy protein. It diffuses more quickly to an interface and on reaching the interface adsorbs more quickly than the other proteins

- The order of surface activity reported for individual milk proteins is:

  β-casein > monodispersed casein micelles > serum albumin > α-lactalbumin > α_{s1}-casein = κ-casein > β-lactoglobulin

  - Highly dispersed caseinates have higher emulsifying capacities than the more aggregated caseins and caseinates
  - Notwithstanding this phenomenon, emulsions formed using aggregated caseins and caseinates are more stable than those stabilized by the highly dispersed caseinates
  - Fat surface area formed on emulsification increased (i.e. globule size decreased) as the power input during emulsification increased for all these proteins, with the extent of the increase inversely related to the degree of aggregation of the emulsifying caseins/caseinates
  - The protein loads (mg/m^2) of the emulsion formed using aggregated caseins/caseinates were greater than for the dispersed caseinates, and protein load was directly related to emulsion stability
  - Milk protein products, and especially caseinates, are very good fat emulsifiers

- With regard to foaming properties, important characteristics are foam volume (overrun) and foam stability. Caseinates generally give higher foam overruns but produce less stable foams than egg white or whey protein concentrates. Whey protein-enriched products are widely used in food foaming applications, with whipping properties affected by protein content, ionic environment, pre-heat treatment, level of denaturation, and presence of lipids

6.6.7 Specific Opportunities for dairy proteins as emulsifiers

Due to the numerous types of proteins and emulsifiers, there are almost limitless combinations in which these can be used in air-water and oil-water interfaces. Milk proteins are not exempt from such opportunity—in purified and more generic modes, casein and whey proteins have current and future applications as emulsifiers.

Some examples follow:

- The addition of β-casein plus a surfactant such as SDS at low concentrations results in a surface tension that is comparable to using the protein in isolation to a more purified emulsifying agent. By raising the concentration of SDS, it becomes the dominant surface-active molecule, with surface-tension at levels as though SDS was used on its own
- Altering the hydrophobicity of casein enhances the ability of α_{s1}-casein to form and stabilize emulsions. Co-functional benefits include an increase in foam capacity and foam stability
- Studies of whey protein concentrates derived from cheddar cheese show that:
  - Free fat and bound fat were negatively related to foaming and emulsifying properties
  - Ash, calcium and denaturation enthalpy were positively correlated with foaming and emulsifying properties
- In ice cream manufacture, the milk fat composition of the starting mix initially exists as minute globules. The milk proteins on the surface of these milk fat globules have an emulsifying action that ensures that the milk fat stays in

solution. In order to form the structural objectives of the ice cream, these fats need to be destabilized so that they coalesce into larger networks. Ice cream manufacturers have chosen to use a different emulsifier than the natural milk protein content in an ice cream mix in order to replace the functionality of the surface proteins and thereby aid in forming this network. Egg yolks were traditionally used in this endeavor as a destabilizing emulsifier. More recently, mono- and di-glycerides have taken on this role, as well as sorbitan esters

- Casein, in the form of sodium caseinate, has a ready use in the manufacture and formulation of cream liqueurs. Sodium caseinate acts as an emulsifier in such applications
- Similarly, sodium caseinate has been used to encapsulate and emulsify the fat in powders with a very high (> 70%) fat content
- Sodium caseinate functions in ice cream and frozen desserts as a stabilizer, improves the whipping properties of the mix, and imparts ”body” to the final product. The properties of sodium caseinate in such applications include emulsification, foam stability and film formation
- Casein can be used in the manufacture of processed cheese, cheese analogs and similar cheese-like products. The functional attributes of casein in such formulations include provision of body and texture to the formulation through the emulsification of the fat
- Casein can be used in comminuted meat products (e.g. sausages, mincemeat) to emulsify fat, bind water and generally improve consistency of the final product
- Sodium caseinate can be used in spreads to stabilize the water phase and improve the texture of the product
- Sodium caseinate is used in whipped toppings in that it forms a film to trap aerating gases. It also functions in fat encapsulation, as a bodying agent, and as a stabilizer
- Dairy glycoconjugates, and specifically casein-maltodextrin conjugates, are recognized by the Faculty of Science, University of Technology (Sydney) in collaboration with New Zealand’s Industrial Research Limited (funded by New Zealand Foundation for Research, Science & Technology) as effective food emulsifiers and soluble protein additives at low pH. The improved solubility was reported as largely

responsible for the greater emulsification properties compared with unmodified casein

- Cheese is an o/w emulsion maintained by natural surfactants – the cheese proteins. However, processing affects the functionality of the proteins, and emulsifying salts (e.g. sodium phosphates) are typically used in the case of processed cheese in order to overcome this shortfall. Studies have shown a possibility to replace phosphates with casein hydrolysates for use as an emulsifier in processed cheese manufacture

6.6.8 Co-functionalities of dairy proteins in various food systems

The following table highlights that dairy proteins do have emulsification properties in particular food systems. Possibly of more importance is the fact that dairy proteins possess co-functionalities, and these may help underpin the attraction of dairy proteins in food formulations.

Table 6.6.8 Dairy proteins & food systems—emulsification and co-functionalities

Food system	Dairy protein ingredient	Types of food products	Emulsifying effect	Co-functionalities
Bakery goods	*Casein, caseinates, co-precipitates*	Bread, biscuits/cookies, breakfast cereals, cake mixes, pastries, frozen cakes, frozen pastries, pastry glaze	Primary	Nutritional, sensory, dough consistency, texture enhancer, volume/yield improver
	Whey proteins	Bread, cakes, muffins, croissants	Primary	Nutritional, egg replacer
Dairy products & dairy analogs	*Casein, caseinates, co-precipitates*	Imitation cheese	Secondary	Fat & water binding, texture enhancing, melting properties, stringiness & shredding properties
		Coffee creamers	Primary	Whitener, enhances body & texture, promotes resistance to feathering, sensory properties
		Cultured milk products (e.g. yogurt)	Secondary	Increases gel firmness, reduces syneresis
		Milk beverages, milk analogs, fortified milk, milk shakes	Primary	Nutritional, foaming properties

Food system	Dairy protein ingredient	Types of food products	Emulsifying effect	Co-functionalities
		High fat powders, shortening, whipped toppings, table spreads	Primary	Texture enhancer, sensory properties
	Whey proteins	Yogurt, Quarg cheese, Ricotta cheese	Secondary	Nutritional, curd cohesiveness, textural consistency
		Cream cheeses, cream cheese spreads, sliceable/squeezable cheeses, cheese fillings & dips	Primary	Gelling, sensory properties
Beverages	*Casein, caseinates, co-precipitate*	Drinking chocolate, carbonated drinks, fruit beverages	Secondary	Stabilizer, whipping & foaming properties
		Cream liqueurs, wine aperitifs	Primary	Negligible
		Wine & beer products	Secondary	Fines removal, clarification, reduces color & astringency
	Whey proteins	Soft drinks, fruit juices, powdered & frozen fruit beverages	Secondary	Nutritional
		Milk-based flavored beverages	Secondary	Viscosity, colloidal stability
Dessert-style products	*Casein, caseinates, co-precipitate*	Ice cream, frozen dessert	Secondary	Whipping properties, body & texture enhancer
		Mousses, instant pudding, whipped topping	Primary	Whipping properties, film formation, imparts body & flavor
	Whey proteins	Ice cream, frozen juice bars, frozen dessert coatings	Primary	Skim milk replacer, whipping properties, body & texture enhancer
Pasta products	*Low calcium co-precipitate, caseinates, whey protein concentrate*	Macaroni, pasta, imitation pasta, pasta flours	Secondary	Nutritional, texture enhancer, freeze-thaw stability, microwaveable
Confectionery products	*Casein, caseinates, co-precipitates*	Toffee, caramel, fudges	Primary	Confers firm resilient & chewy texture, water binding
		Marshmallow & nougat	Secondary	Foaming, high temperature stability, flavor improver, browning

Food system	Dairy protein ingredient	Types of food products	Emulsifying effect	Co-functionalities
	Whey proteins	Aerated candy mixes, meringues, sponge cakes	Primary	Whipping properties
Meat products	*Casein, caseinates, co-precipitate*	Comminuted meat products	Primary	Water binding, improves product consistency, releases meat proteins for gel formation & water binding
	Whey proteins	Frankfurters, luncheon rolls	Pre-emulsion	Gelation
		Injection brine for fortification of whole meat products (e.g. cooked hams)	Secondary	Gelation, yield enhancement

Source: Landell Mills Management Consultants

6.6.9 The influence of dairy protein molecular weight on emulsification

A key difference between milk proteins and other emulsifiers relates to molecular size. Milk protein exhibits a molecular weight ranging from < 20,000 Da to >200,000 Da, compared to sodium oleate at 307.

Thus, when milk protein is added to a formulation, it will generally be slow in terms of its diffusion to the interfacial region. The addition of oil to a dilute milk protein solution can further retard this process.

Other factors such as salt concentration, pH and temperature have an influence on the time it takes for a milk protein to complete its adsorption at the interface.

An overview of key attributes of proteins in cheese whey, including molecular weight, is provided in the following table.

Table 6.6.9 Key characteristics of proteins in cheese whey

Protein	Abundance (%)	Molecular weight, Da	Isoelectric point
Beta-lactoglobulin	48	18,400-36,900	5.2
Alpha-lactalbumin	19	14,200	5.1
Proteose-Peptone	20	4,000-80,000	5.1-6.0
Serum albumin	6	69,000	4.8
Immunoglobulins	8	160,000	5.5-6.8

Source: Landell Mills Management Consultants, from various published sources

Note, gum arabic is widely regarded as an excellent emulsifier, yielding solutions of low viscosity despite its relatively high molecular mass (~400,000 Da). The performance of gum arabic as an emulsifying agent is quite converse to that naturally expected of a polysaccharide, and is entirely related to the molecular characteristics of the three main fractions of this material—specifically, its glycoprotein, arabinogalactan-protein complex and arabinogalactan fractions.

6.6.10 Dairy phospolipids as emulsifiers

Phospholipids have been known to science since the 1700s, with commercial availability (in the form of lecithin) since the 1930s. Phospholipids are widely available as part of the cellular membrane of all living cells. They comprise a complex mixture of glycerophospholipids, including:

- Triglycerides
- Fatty acids
- Glycolipids
- Sterols
- Sphingo-phospholipids

To the extent that lecithin is a natural emulsifier with a multi-functional profile, and naturally occurs in relatively high concentrations in buttermilk powder, there should be a high level of interest in dairy-based lecithin as an emulsifying ingredient, either in its own right or as a component of buttermilk powder.

The co-functionalities of lecithin are worthy of note, as they may help to justify feasibility of application in food systems. Applications for lecithin are wide-ranging, and include:

- Emulsifiers—typically used as amphoteric emulsifiers that promote stable formation of oil-in-water and water-in-oil emulsions by reducing the interfacial surface tension between immiscible liquids
- Anti-dusting agents—reduce the static electricity by wetting dusty particles. These can be used alone or in combination with vegetable oils, with the oils variously selected dependent upon the length of shelf-life required
- Crystal formation modifiers—lecithin retards nucleation in fats and mono-glycerides, reducing the tendency for a grainy texture
- Mixing & blending aids—lecithin decreases time and increases efficiency in the mixing of unlike ingredients (e.g. sugar and shortening) by providing lubricity as well as viscosity reduction at the contact surfaces of the incompatible solids
- Release agents—lecithin provides easy release from metallic surfaces by attaching to the metal surface during hot or cold cooking. It assists in the cleaning of hot surfaces where proteins or batters are applied. It also reduces sticking between frozen food products
- Separating agents—lecithin prevents the adhesion of products that normally stick when in contact (e.g. cheese slices, caramel confectionery)
- Viscosity modifiers—lecithin reduces viscosity by coating particles to reduce particle-matrix friction (e.g. in chocolate)
- Wetting agents—lecithin provides complete wetting of fatty or hydrophilic powder in aqueous systems. The fatty acids are attracted to the fatty portion and the hydrophilic portions of the molecules actively imbibe water and control powder hydration. Lecithin is typically suitable as oil in water or water in oil emulsions. Those with a high hydrophilic/lipophilic balance exhibit good properties as a wetting agent, and thus lecithin is frequently used for this purpose

Buttermilk powder is frequently used in the manufacture of recombined milk products, including evaporated milk and sweetened condensed milk. Its use as an emulsifying aid in these types of applications is important. This is because buttermilk powder contains a relatively large quantity of phospholipids which are otherwise lost in the separation process in the manufacture of SMP and AMF. For such applications, sweet buttermilk is preferred.

The use of buttermilk powder in chocolate is of particular interest from the perspective that its intermediary fat level (8 to 12%) enables it to be used as both a SMP and WMP replacer. Of importance in the current report is the high level of dairy phospholipids contained in BMP, and thus its promising ability to have a role in chocolate manufacture as an emulsifier – in particular, replacing some of the functional attributes of soy lecithin (lecithin is typically included at 0.5% by weight in sweet chocolate formulations, and at 0.3% in milk chocolate).

Phospholipids have an ability to form bilayers and micelles, and this is critical in their role as emulsifiers in total parenteral nutrition (TPN) and in the formation of liposomes employed as drug carriers. Fat emulsions in TPN usually contain egg or soy lecithin as the emulsifying agent plus some form of triaglycerol. The phospholipids content is critical for the stability of the fat emulsion. More particularly, the small amount of phosphatidylserine, phosphatidic acid, lysophosphatidylcholine and sphingomyelin ionize at the oil-water interface and stabilize the emulsion. These same fat emulsions can also be used to administer lipid-soluble drugs – advantages include the protection of the drug from hydrolysis, lower incidence of side effects, and good tolerance owing to their resemblance to chylomicrons.

6.6.11 The promise of lactose as an emulsifier

Lactose is unique as a carbohydrate in that it has a range of physico-chemical properties that set it apart from other commonly available carbohydrates. In particular, the physical properties of lactose do influence its ability to impact the textural qualities of the products in the formulations into which it is incorporated. For example, with lower solubility than sucrose, it can be a key factor in modifying the viscosity and crystallization properties of formula—which in turn can be a desirable or undesirable outcome depending on the final product under consideration.

Given that the control of moisture sorption and water activity in food formulations is often deemed a critical requirement for the stability and quality of the finished goods, lactose can have a critical role to play. For example:

- In its pure crystalline state, lactose takes up very little water, and is therefore useful in dry food formulations
- Amorphous lactose has a decidedly different set of characteristics in this regard, and needs to be considered in terms of its use in humid environments and in wet formulations where issues of crystallization can occur

Thus, the use of lactose as an emulsifier in food formulations can bring other related benefits to the food system. Some considerations for lactose in respect to the current study are highlighted as follows:

- Wide-ranging use and further potential in the bakery industry for lactose:
  - Increasing the baked volume of cakes due to the greater expansion of gases leading to a more tender structure in the final product
  - An improvement to mouthfeel for creams and icings
  - The humectant properties of lactose contributing to enhanced shelf life
- Exhibiting a stabilizing effect on proteins, and thereby preventing syneresis in such products as mayonnaise, dressings and sauces
- The prospective use of lactose and lactose derivatives (lactitol, lactulose, and fatty acid esters of lactose) as fat replacers that have emulsification and stabilizing properties in food formulations
- Non-ionic surfactants can be prepared from lactose, and these are of general interest as a new area of opportunity for food and non-food applications. The application is made possible by the addition of a lipophilic tail to lactose or lactose derivatives, with possible applications as a surfactant in:
  - Laundry and dish-washing detergents
  - Cosmetics and cosmeceuticals

- Pharmaceuticals
- Food products
- Paints
- Plastic products

Carbohydrate-based surfactants are of particular interest because raw material is abundant and the starting value of the raw material is generally low. Two specific areas of interest have been identified in Europe. These relate to:

- Studies undertaken at the Dutch-based University of Groningen in collaboration with TNO Voeding on the prospects for lactose-based surfactants prepared by amino-glycosylation or reductive aminoalkylation of lactose. Due to the saccharide head group (lactose or lactitol) these surfactants dissolve in water at room temperature. TNO Voeding is keen to attract commercial interest in this type of surfactant
- Solvay Germany is studying lactose-based surfactants. Their product is derived from an intermediary of lactobionic acid production, and potential applications are purported in cosmetic products

6.6.12 Dairy emulsifiers in blends

Arising from all this is a very real opportunity for dairy ingredients to raise their profile as emulsifiers in a variety of ways:

- First, in their own right
- In terms of their co-functionalities
- In various blends for their emulsifying and co-functional attributes

The opportunities are almost limitless. There can be three approaches:

- Dairy companies developing off-the-shelf solutions
- Dairy companies working closely with end users to offer solutions to specific formulation issues
- Dairy companies being engaged to help develop and supply proprietary blends to meet the purposes and demands of a specific customer

Some examples of how dairy emulsifiers can be used in blends are as follows:

- Simplesse microparticulated WPC is offered as a blend in the forms of Simplesse 730 and Simplesse CC
- Research has shown that the addition of 2 to 6 mg of MFGM to solutions of beta-lactoglobulin increases the strength of thermally induced gels made from this protein. Thus, the opportunity exists to introduce MFGM as a discrete co-ingredient in beta-lactoglobulin applications where thermal gelling is a desired outcome
- Sodium caseinate is well-known as an ingredient in beverage whiteners and non-dairy dairy creamers. These can be presented in vegetable oil-based blends (off-the-shelf or proprietary versions developed by dairy companies for this market)
- Opportunities for development of casein-maltodextrin conjugates as effective food emulsifiers and soluble protein additives for low pH food systems
- The use of casein hydrolyzates, perhaps incorporated in a MPC blend, as a phosphate alternative in processed cheese manufacture
- Incorporating BMP in recombining blends for the manufacture of evaporated milk and SCM
- Co-blending of lactose with milk (or other) proteins used in mixes for mayonnaise, dressing and sauce manufacture whereby the lactose acts as a stabilizing influence on the proteins

6.7 Compounded Dairy Flavors

6.7.1 Concentrated dairy flavoring

Traditional means of achieving natural, authentic dairy flavors in food products has been achieved by using such ingredients as milk powders, dried butter, butteroil, buttermilk solids, dried cheese, yogurt powder and EMC. However, the key downfall is that a significant quantity of the flavoring agent needs to be incorporated in the mix if the desired level of flavor impact sought is to be achieved. In addition, many of these ingredients, in their conventional form, have a relatively short shelf-life, or need

refrigeration. These sorts of requirements place severe restrictions on their use and supply in pre-mixes for food system formulations.

As one means of overcoming such limitations, flavor scientists have developed means of concentrating dairy flavors in compound dairy derivatives. As a result of this, food developers are able to obtain natural, flavorsome, dairy-derived flavor compounds for food formulations. This has considerable market appeal, including:

- Helping with all natural claims
- Enabling food products to be marketed on a 100% dairy platform
- Consumers readily identify with the various dairy flavors that can be produced
- Allowing formulators to introduce matching, authentic dairy flavors to non-dairy products

These compounded concentrated dairy flavors can come in a variety of product formats, including:

- Liquid concentrates
- Pastes
- Emulsions
- Powders

The use of these compounded concentrated dairy flavors is quite widespread throughout different food system, including:

- Imparting a characteristic dairy flavor—for example, a creamy Italian cheese flavor emulsion at inclusion levels of 0.6 to 1.25% can add sour dairy notes to a product
- Boosting the flavor profile of a food product—use of these products can counter-intuitively boost the savory flavor in meat and bakery applications
- Modifying the flavor attributes of a product—usage of Hispanic and Italian-based cheese powders in the range 0.5-1.0% in a formulation can desirably alter the flavor attributes in microwave sauces, popcorn, crackers and salad dressings

- Masking unwanted flavors—indeed, Butter Buds Food Ingredients (Racine, Wisconsin) advise that usage levels as low as 0.25% of its signature Butter Buds has been sufficient to camouflage the soy off-notes in applications such as low-fat ground beef and turkey formulations

These compound concentrated flavors can be used either in their own right, or in association with other dairy ingredients, depending on the task at hand.

The flavor contributors for various dairy products are shown as follows:

- Milk flavor—derived from alcohols, esters, lactones & heat-induced compounds
- Cream & butter flavors—result from acetaldehyde, diacetyl and FFAs
- Cultured buttermilk, sour cream & yogurt flavors—typically arise from acetaldehyde

6.7.2 The flavor market in the Asia Pacific region

A brief overview of relevant key trends in the flavor market in the Asia Pacific region is provided as follows:

- While growth in the U.S. and Western European markets are slowing, the Asia Pacific region is expected to continue growth at almost 8% p.a. through 2008. This is largely driven by expansion in the China market, based on aspirational taste expectation of a younger and more prosperous generation with widening food tastes and preferences
- There are two key features:
  - Development of commercial enterprises that are producing mass-scale traditional Asian fare
  - Strongly emerging exotic or Western food products
- The beverage sector has become the largest end-user sector for flavors, with concerns about health and wellness driving this sector to great heights over recent times. In particular, this is exemplified by growth in functional, ready-to-drink beverage products

- Power mints and functional candy are the key sectors in the confectionery industry, based on lifestyle aspirations such as sugar-free, low-calorie. Natural flavors that impart attributes associated with health and wellness are important, with natural dairy flavors underpinning a strong competitive positioning based on the nutritious wholesomeness of milk and dairy foods

- The baking sector is witnessing the introduction of fortification technique, including calcium-fortified products. Strong dairy flavors are helping to substantiate credentials associated with health and wellness and therefore deliver a high point of believability in the product

6.7.3 Tatua Flavor Ingredients

New Zealand's Tatua Co-operative Dairy Company formed a specialized division within its Tatua Nutritionals business—Tatua Flavor Ingredients. Tatua Flavor Ingredients was formed to produce specialty dairy flavor ingredients for the global foodservice and beverage industries. As such, it is one of only a handful of companies anywhere in the world that specializes in the manufacture and supply of New Zealand- and Australian-style dairy flavors that match milk, cream and butter flavor profiles from that part of the world.

Tatua states the following unique combination of benefits that it brings to this business:

- Natural dairy-derived flavors typical of fresh milk, cream and butter

- N.Z.-style flavors that are the benchmark for markets (users, consumers) throughout the Asia Pacific region

- Cost-reduction benefits and cost-effective solutions

- Products that contribute to and enhance mouthfeel and flavor, and provide the desired smooth, creamy richness to the final product

- An ability to mask unwanted flavors, with rich and intense dairy flavors closely matching their origins

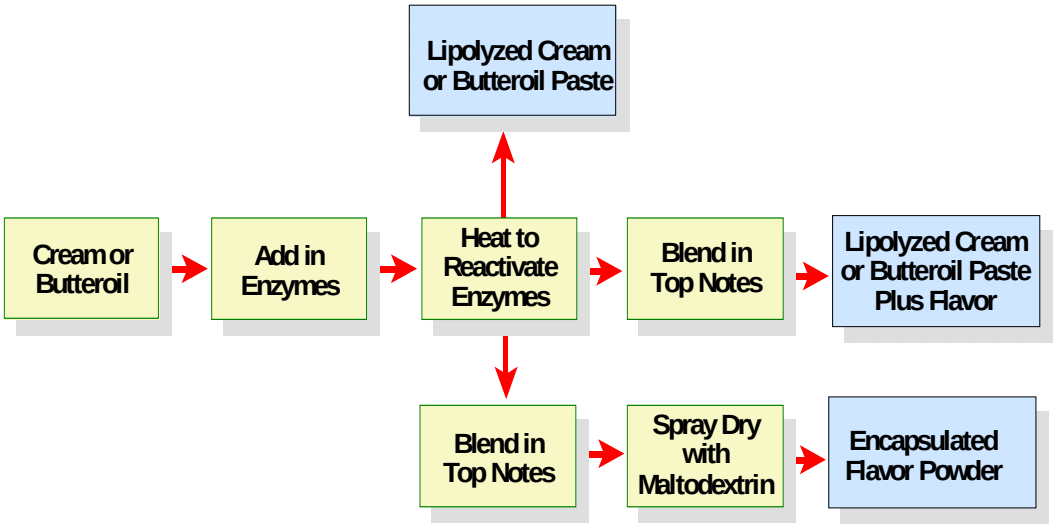
- A key criteria of rounding-out the sweetness in food products, thus making them more appealing and palatable

Tatua works closely with its customers to customize flavor solutions for the market. These flavor solutions are based on applications in a wide field of areas, including, for example:

- Cost reduction in ice cream manufacture—by reducing the butter, cream, milk requirements in dairy-heavy formulations
- Enhancing the creaminess of a dairy analog
- Adding rich buttery notes to bakery products—while improving the nutritional profile by lowering total fat and cholesterol content
- Adding a creamy mouthfeel to low-fat beverages

The products are manufactured by a process overviewed in the following diagram.

Table 6.7.3 Tatua's flavor ingredients manufacturing process



Source: Tatua Co-operative Dairy Company Ltd

The key product range supplied by Tatua includes:

- Lipolyzed Cream or Butteroil Pastes—manufactured from natural ingredients. Enzymes are added to cream or butteroil. These act to break down the milk fats, releasing fatty acids. From this, intense flavors are achieved. The pastes can then be top-noted to provide well-balanced flavor pastes that are suitable for use in any high-fat application
- Milk, cream and butter flavor powders—manufactured by encapsulation and spray drying. Intensely flavored powders are produced that are suitable for use in dry or wet applications. These powders are easily used and stored, and readily dissolve in most liquids. A wide range of dairy-based flavor profiles is produced and offered by Tatua, including:
  - Cream
  - Fresh milk
  - Sweet milk
  - Cultured cream
  - Butter
  - Cultured butter
  - Ghee
  - Yogurt
  - Sour cream

6.7.4 Key applications for dairy flavors

One of the key applications that Tatua has been pursuing with its dairy flavors is to supply compound flavor concentrates to the China market. These are used in UHT milk products along with local fresh milk products in order to deliver the benchmark Australian/New Zealand milk flavor to local manufactured fluid milk products.

There is a wide range of current and potential applications for compounded, concentrated dairy flavors in terms of blending. Some examples are given as follows:

- Blended into soy milk bases in order to deliver authentic dairy flavors and help mask the undesirable 'beanie' taste more conventionally associated with soy milk

- Blended into dairy analog bases in order to provide a taste profile more in keeping with the milk and dairy products that they are competing against
- Added to beverage whitener pre-mixes in order to enhance and complement flavor profiles
- Forming an integral part of selected bakery pre-mixes, to provide the buttery flavor that is so often identified with products such as croissants, shortbread, etc.
- Comprising a constituent of beverage pre-mixes (flavored milk, milk analogs, fruit/dairy blends, dietetics, meal replacers, protein beverages) in order to improve mouthfeel and deliver a creamy taste
- Blending into dry soup and sauce pre-mixes, in order to build the body and taste profile of the product
- Formulated into skim milk replacers, in order to enhance the dairy flavor profile
- Formulated into filled milk products (e.g. vegetable oil-based wholemilk replacers) in order to deliver a more desirable dairy flavor profile

6.8 Fat Replacers

6.8.1 What are fat replacers?

Fat is an important component in various food systems, helping to define the structural characteristics of a food product as well as determining its sensory attributes. Fat contributes to the mouthfeel, aromatic qualities, and textural properties of food.

Notwithstanding such observations, consumption of fat is linked to a number of health issues and co-morbidities, including:

- Hypertension
- Atherosclerosis
- Cancer (especially breast & colon cancer)
- Obesity
- Diabetes

General recommendations suggest that a maximum of 30% of dietary energy should come from fat, with saturated fat limited to 10%.

As a consequence of the foregoing, contemporary consumers are demanding low-fat foods, and even no-fat products. The difficulty for the food formulator is that consumers then expect the low/no-fat foods to deliver the same sensory and structural qualities of conventional full-fat alternatives. Arising from this has been a very strong movement in the food processing industry to develop and exploit fat replacers in food formulations.

There are two fat replacers that became well-known in the food industry. These are:

- Olestra—a sucrose polyester manufactured by Proctor & Gamble, comprising sucrose with six to eight fatty acids bound to it. These fatty acids are from vegetable sources (e.g. corn oil, soybean). The Olestra molecule is small compared to any triglycerides, and therefore is not hydrolyzed by the digestive enzymes. Rather, olestra passes unabsorbed, and provides no calories on consumption

- Simplesse – this WPC, first introduced to the marketplace by The NutraSweet Company in 1988, is covered extensively earlier in this report (see section 6.6.4). In that section it is discussed as a food emulsifier. During the microparticulation process, the proteins in solution are de-aerated and heated to a temperature just below the coagulation point for those proteins. The solution is then homogenized and sheared at elevated temperatures. As a consequence of this, the proteins aggregate into small, round particles, ranging in size from 0.1 to 2.0µm. These protein aggregates are so small that they are not individually perceptible in the mouth; rather, they roll over one another, creating a creamy taste and texture that resembles fat. Due to its high water content, each gram of Simplesse only yields 1 to 2 kcal. Simplesse has a range of applications as a fat replacer:

  - Dairy products such as ice cream, yogurt, cheese and sour cream
  - Dips and oil-based foods such as salad dressings and mayonnaise

- Frozen desserts. The U.S. FDA approved the use of Simplesse in frozen desserts in February 1990. The resulting product is nutritionally improved compared to a 16% milk fat ice cream, with the taste and texture of high-fat ice cream

6.8.2 Fat replacers—types and applications

The following table overviews the range of types of fat replacers and the different food systems in which they can be used.

Table 6.8.2 Types of fat replacers and food system applications

Food system	Protein-based fat replacers	Carbohydrate-based fat replacers	Fat-based fat replacers
Milk, dairy foods	Microparticulated protein, modified WPC	Cellulose, gums, inulin, maltodextrin, maltose, oatrim, polydextrose, starches	Emulsifiers
Chilled/frozen desserts	Protein blends (dairy & non-dairy), microparticulated protein, modified WPC	Cellulose, gums, inulin, maltodextrin, polydextrose, starches	Emulsifiers, salatrim, other lipid analogs
Meat & poultry products		Gums, inulin, oatrim, starches	Lipid analogs
Fish & seafood			Lipid analogs
Cooking & salad oils	Microparticulated protein		Lipid analogs
Fats & oils (e.g. margarine, pourable dressings, mayonnaise, other spreads)	Microparticulated protein, protein blends, other protein ingredients, gelatin	Cellulose, gums, inulin, maltodextrins, oatrim, polydextrose, starches	Emulsifiers, other lipid analogs
Soups, sauces, gravies	Microparticulated protein, modified WPC	Cellulose, gums, inulin, maltodextrins, oatrim, starches	Emulsifiers, other lipid analogs
Cereals & grain products (e.g. crackers, muffins, bread)	Microparticulated protein	Gums, fiber, matodextrins, starches	Emulsifiers, other lipid analogs
Confectionery & candies	Microparticulated protein	Cellulose, crystalline fructose, gums, inulin, maltodextrin, oatrim, polydextrose, polyols, starches	Caprenin, emulsifiers, lipid analogs

Food system	Protein-based fat replacers	Carbohydrate-based fat replacers	Fat-based fat replacers
Baked desserts (e.g. pizza, frozen desserts)	Microparticulated protein, protein blends, modified WPC	Cellulose, fiber, gums, inulin, maltodextrins, maltose, oatrim, polydextrose, polyols, starches	Emulsifiers, lipid analogs
Savory snacks (e.g. chips, pretzels, popcorn)		Cellulose, fiber, gums, maltodextrins, maltose, starches	Lipid analogs

Source: Landell Mills analysis

6.8.3 Top-line trends in fat replacers

Research conducted by Frost & Sullivan in the early 2000s projected growth of almost 5% per year in the fat replacer market in the U.S. Carbohydrate-based fat replacers, which made up almost 60% of the market, are losing ground with the recent practice of low-carbohydrate consumption—so much so that protein-based fat replacers that made up 22% of the market at the time currently exceed 30% of the market with continuing strong growth prospects.

Other key trends include:

- Innovative ingredient combinations (e.g. gums and protein blends) and processing technologies (e.g. microparticulation) are being used by food companies to develop and present low-fat or fat-free products that have sensory and functional properties that match their full-fat alternatives
- There is a strong trend emerging for end user companies to first try the use of conventional and “natural” ingredients (e.g. low-fat SMP) before they go to fat replacers *per se* in food system applications. This is based on a number of factors, especially:
  - A trend to decrease the number of ingredients on the label
  - A drive towards more ”natural” food formulations
  - A perception that fat replacers, regardless of origin, are synthetic or artificial

6.8.4 Protein-based fat replacers

There are essentially three types of protein fat replacers:

- Microparticulated Protein—this is how Simplesse is processed. It has a wide field of applications, including dairy products (ice cream, butter, sour cream, cheese, yogurt), salad dressings, margarine, mayonnaise-type products, baked goods, coffee creamers, soups and sauces
- Modified WPC—this is how Dairy-Lo is manufactured by Irish-based Carbery, and was manufactured under license by Parmalat Canada. Dairy-Lo arises from thermal denaturation that gives rise to a protein with fat-like properties. Applications include dairy products (cheese, yogurt, sour cream, ice cream), baked goods, frostings, salad dressing and mayonnaise-like products
- Other proteins (incl. protein blends)—this includes reduced-calorie fat substitutes based on egg whites and milk proteins. It has similar properties to microparticulated WPC. It includes blends of proteins, include dairy/non-dairy blends

Those protein-based fat replacers called protein blends combine different animal and/or vegetable sourced proteins, gums, starches, and water. For use in the U.S., they are made with FDA-approved components, and have a widening field of application in frozen desserts and baked goods. Of particular interest in the context of the current report is K-Blazer, produced by Kraft Foods and finding wide application throughout North America in the baked goods industry. This is a fat replacer comprising a blend of egg whites and milk protein.

6.8.5 Other dairy-based fat replacers

There is a range of further fat replacers that appears to be striking interest with the market. Those with a dairy component include:

- WPI-xanthan gum complex—research has shown that WPI-xanthan gum complexes have the potential to significantly reduce fat use in a wide range of food systems. In cases such as sandwich cookie fillings, the use of emulsifiers and humectants is typically required in order to maintain low A_w and prevent moisture migration to the cookie shell

- WPC-based fat replacers—WPC tends to be less expensive than alternative fat replacers, therefore offer a good starting point for fat replacer formulation, particularly given the promise that whey protein has shown as a fat replacer in low-fat meat products. WPCs have good gel-forming characteristics and water-binding properties that blend well with and add moistness to the meat matrix. By developing a blend of tripolyphosphates and lactose to a WPC base, the product acts as a fat replacer with other attributes, including:

  - Maximizes cooking yields
  - Minimizes processing shrinkage
  - Improves juiciness
  - Absorbs fat
  - Binds flavors

- Versagel whey protein gel—developed by Food Science Australia, Versagel fat replacer is being used to produce reduced-fat foods for the health-conscious market. Applications are quite wide-ranging, including reduced fat meat, seafood, bakery and dairy foods. One of the first companies to use this ingredient was Japanese-owned, Australian-based Hans Continental Smallgoods—extending its product range to include nutritious, reduced-fat meat products such as low-fat Strasburg and hot dogs. This product obviously has great potential to be used in a blend or pre-mix for meat and sausage formulations

6.8.6 Examples of Simplesse use as a fat replacer

Simplesse has wide-ranging applications, both in terms of food system applications and geographic coverage. Appendix II illustrates the use of Simplesse microparticulated WPC used as a fat replacer in current product applications, including lunches, cheese products, cooking sauces and meal replacement beverages.

7.0 DAIRY BLENDS IN INFANT FORMULA

- As has been discussed in earlier blends studies, the entire infant formula market is effectively a blending opportunity
- The Asian market for infant formula is currently > 500,000 mt p.a.
- It is therefore estimated that the world infant formula market is almost 1 billion mt p.a.
- The opportunity for dairy blend supply into the global infant formula market is estimated in this chapter at > 600,000 mt on the basis of:
  - > 390,000 mt going to starter blends
  - > 200,000 mt going to follow-on blends
- Of this, the potential for internationally traded volume supplying the infant formula market is estimated at > 500,000 mt, comprising:
  - Asia 350,000 mt
  - Americas (excludes exporters) 134,500 mt
  - Africa/M. East 24,800 mt

7.1 Infant Formula in Asia

Table 7.1a Infant formula market—selected Asian countries (volume trends, mt, 1995-2006)

Market	1995	1998	2000	2002	2006 (est.)
China	40,000	71,000	128,000	152,000	250,000
India	78,756	94,109	60,209	60,102	62,000
Japan	37,598	37,215	33,644	33,533	33,000
Thailand	25,090	25,200	30,001	30,298	32,000
Indonesia	18,010	20,019	26,111	27,122	31,000
Philippines	24,060	24,900	25,887	27,109	29,500
Malaysia	14,008	16,508	18,500	19,109	21,500
Taiwan	13,123	14,223	18,255	18,702	19,500
South Korea	26,200	18,945	25,297	18,107	18,000
Pakistan	10,070	10,333	10,958	13,001	15,000
Vietnam	3,510	3,850	4,260	4,275	5,000
Hong Kong	270	320	350	360	375
Total (selected markets)	**290,695**	**336,622**	**381,472**	**403,718**	**516,875**

Source: Trade interviews

Key points include:

- China's formulation is understated by as much as 100,000 mt; the balance is WMP and basic WMP-style blends
- Together, Nestlé (36.2%) and Meads Johnson (18.3%) account for 54.5% of the infant formula market in Asia
- Wyeth is the other global multinational with significant regional market share (11.6%)
- Meiji (7.5%) and Morinaga (6.5%) are the leading regional players
- Between them, these five companies represent over 80% of the Asian infant formula market
- However, all these volume shares are under threat as the local production in China of infant formula is increasing within the ambit of local (Chinese) dairy companies

The general composition of the infant formula market in Asia is advised as follows:

Table 7.1b Composition of the Asian infant formula market

Product	Share, %
Starter formula	63.4
Follow-on formula	33.5
Special formula	3.1
Total	**100.0**

Source: Landell Mills based on trade sources and official statistics

Thus, on a broad macro level, the Asian market (selected countries as per preceding table), is comprised of (estimate for 2006):

Table 7.1c Estimated volumes of the Asian infant formula market

Product	Volume, mt
Starter formula	327,700
Follow-on formula	173,150
Special formula	16,025
Total	**516,875**

Source: Landell Mills based on trade sources and official statistics

7.2 Typical Ingredient Composition for Infant Formula

While ingredient composition will change dependent upon a wide range of factors, the following assumptions can be used as a template for Starter formula and Follow-on formula composition in the Asian markets:

Table 7.2a Typical composition of Asian starter formula, volume share

Ingredient	Share, %
Demineralized WPC	2.9
Casein	11.6
Non-fat milk powder	2.3
Lactose	53.6
Amino acids	0.1
Fat source	25.9
Vitamins	0.2
Minerals	3.4
Total	**100.00**

Source: Landell Mills based on trade sources

Table 7.2b Typical composition of Asian follow-on formula, volume share

Ingredient	Share, %
Demineralized WPC	3.7
Casein	14.6
Non-fat milk powder	2.2
Lactose	47.9
Sucrose	8.4
Amino acids	0.1
Fat source	19.0
Vitamins	0.2
Minerals	3.9
Total	**100.00**

Source: Landell Mills based on trade sources
Note: In China, the infant formula milk national standard (GB10767-1997) includes the following parameters (% by volume):

Table 7.2c Chinese infant formula composition, volume share

Attribute	Starter formula, %	Follow-on formula, %
Protein	10.0-20.0%	15.0-25.0%
Fat	>20.0%	15.0-25.0%
Energy	470-620 Kcal/100g 1966-2594 KJ/100g	>445 Kcal/100g <1862 KJ/100g

Source: Landell Mills based on trade sources

7.3 Usage of Dairy Protein and Dairy Carbohydrate in Asian Infant Formula

Based on the foregoing, usage of dairy proteins and lactose in selected Asian markets is estimated in the following table (note: these are broad estimates to reflect a likely situation. In more mature markets such as Japan, the percentage split of the key market sectors will be more likely: Starter formula, 58.5%; Follow-on formula, 34.5%; Special formula, 7.0%.).

Table 7.3 Dairy protein and carbohydrate usage in infant formula—selected Asian markets (mt)

Market	2006 (est.)	WPC	Casein	Non-fat milk powder	Lactose
Starter formula:	***Total Starter Formula***	***2.9%***	***11.6%***	***2.3%***	***53.6%***
China	158,501	4,956	18,386	3,646	84,956
India	39,308	1,140	4,560	904	21,069
Japan	20,922	606	2,427	481	11,214
Thailand	20,288	588	2,353	467	10,874
Indonesia	19,654	570	2,280	452	10,535
Philippines	18,703	542	2,170	430	10,025
Malaysia	13,631	395	1,580	314	7,306
Taiwan	12,363	358	1,434	284	6,627
South Korea	11,412	331	1,324	262	6,117

Market	2006 (est.)	WPC	Casein	Non-fat milk powder	Lactose
Pakistan	9,510	275	1,103	219	5,097
Vietnam	3,170	92	368	73	1,700
Hong Kong	238	7	28	5	128
Total (selected markets)	***327,700***	***9,500***	***38,013***	***7,537***	***175,648***
Follow-on formula:	***Total Follow-on Formula***	***3.7%***	***14.6%***	***2.2%***	***47.9%***
China	83,747	3,099	12,227	1,842	40,115
India	20,770	768	3,032	457	9,949
Japan	11,055	409	1,614	243	5,296
Thailand	10,720	397	1,565	236	5,135
Indonesia	10,385	384	1,516	228	4,974
Philippines	9,883	366	1,443	217	4,734
Malaysia	7,202	266	1,051	158	3,450
Taiwan	6,532	242	954	144	3,129
South Korea	6,030	223	880	133	2,888
Pakistan	5,025	186	734	111	2,407
Vietnam	1,675	62	245	37	802
Hong Kong	126	5	18	3	60
Total (selected markets)	***173,150***	***6,407***	***25,279***	***3,809***	***82,939***

Source: Landell Mills, based on trade interviews

7.4 Extrapolating to a Global Position

Notwithstanding the dangers of doing so, and purely for illustrative purposes, extrapolating the Asian data to a global basis, the structure and composition of the world infant formula market can be estimated as follows (mt, estimate for 2006):

Table 7.4a World infant formula market volume estimate

Region	Total, mt	Starter, mt	Follow-on, mt	Special, mt
Asia	516,875	327,700	173,150	16,025
Americas	244,840	151,845	83,200	9,795
Europe	104,285	52,145	35,500	16,640
Africa/Middle East	36,270	24,700	10,845	725
Oceania	4,530	2,720	1,630	180
World total	**906,800**	**559,110**	**30,4325**	**43,365**

Source: Landell Mills, based on official statistics and trade sources

On the basis that up to 70.4% of Starter formula, and similarly 68.4% of Follow-on formula, could be comprised of dairy protein and dairy carbohydrate, the opportunity for the blend supply into the global infant formula market is estimated as follows (2006, mt):

Table 7.4b Blend supply opportunity in the world infant formula market

Region	Total blends, mt	Starter blends, mt	Follow-on blends, mt
Asia	349,132	230,698	118,434
Americas	163,808	106,900	56,908
Europe	60,992	36,710	24,282
Africa/Middle East	24,806	17,388	7,418
Oceania	24,806	17,388	7,418
World total	**601,768**	**393,611**	**208,157**

Source: Landell Mills analysis

7.5 Potential Blend Trade Servicing Infant Formula Market

Apart from exporters in the Americas (U.S., Canada, Argentina), Europe and Oceania, much of the preceding volume could be reflected in global trade volume. It will be shown in one of two fashions:

- As discrete ingredients shipped to markets for primary blending closer to point of consumption
- As blends that are shipped in primary format to the market for addition of specific ingredients (vitamins, minerals, fat source, etc.)

Based on this understanding, the share of the global infant formula market that is comprised of dairy proteins and dairy carbohydrates that are traded internationally is reflected by the following data:

Table 7.5 Global traded infant formula market estimate, mt

Region	Volume, tones
Asia	350,000
Americas (excludes exporters)	134,500
Africa/M. East	24,800
Total volume internationally traded	**509,300**

Source: Landell Mills estimate

8.0 PROPRIETARY PROTEIN BLENDS

- The key focus for proprietary protein blends is the nutritional market
- The essential driver is to deliver "protein performance" off a credible health & wellness platform, with targeted results including:
  - Balanced diets—delivering meal replacement offerings
  - Athletes and similar seeking protein to help improve energy
  - High protein for post-exercise recovery
- Proprietary protein blends include those with dairy, non-dairy, and hybrid dairy/non-dairy constituents
- There is a wide range of proprietary protein blends, with a major application being nutritional bars
- Dairy protein inclusion is quite wide-ranging, and includes:
  - WPI
  - WPC
  - MPI
  - MPC
  - Calcium caseinate
  - Sodium caseinate
  - Hydrolyzed whey proteins
  - Bioactive whey derivatives (e.g. beta-lac, alpha-lac, IgG)
- Non-dairy proteins are chosen for their amino acid profiles, and include:
  - Wheat protein isolate
  - Soy protein isolate
  - Egg white
  - Hydrolyzed collagen

8.1 Background

Proprietary blends are becoming an important aspect of the nutritionals market. Indeed, in the U.S. they could be considered a cornerstone of the burgeoning nutritional food and supplements market—and are an objective attempt to deliver "protein performance" off a credible health and wellness platform.

Proprietary blends have been very much a part of the dairy industry and global dairy trade over the second half of the 20th century—so much so that they became embroiled in trade issues. A handful of these were highlighted in the preceding chapter. These came to the stage of being recognized in global trade terms, with tariff classification systems clearly identifying them. They included:

- Tru-Pro 224—a specialized dairy blend made in Australia and used by the baking industry for making breads, cakes and pies. It is a

mix of sodium caseinate, butterfat, whey solids and dried WMP. From 1985 to 1988, imports of Tru-Pro into the U.S. came under U.S. Customs Service recognition as a casein item under the TSUS provisions. However, with changes to HTS codes, there were issues over reclassification over which the Australian Government challenged the U.S., coming to a head during the early 1990s (refer Library of Congress Archives, Hon. Robert A. Bronski, House of Representatives)

- Junex—raised in the late 1970s as a product that came under the ambit of, "consultations held on requests addressed to the U.S.," by GATT. Junex was recognized at the time as being a dairy-based blend containing 5.5 to 45% butterfat. More contemporaneously, it has been classified as, "milk and cream, concentrated, in powder, granules or solid forms, containing added sugar, fat content 3-35%"

- RLAB—a dairy-based blend defined as, "milk and cream, concentrated in powder, granules or solid form, not containing added sugar, with a fat content > 35%"

There exists a range of proprietary protein blends used in the food industry. This chapter highlights the use of various proprietary protein blends used both in the U.S. and foreign markets. These include all-dairy blends, as well as those that have a less significant dairy content. The coverage is by no means exhaustive, as any quick reference to mail order websites for nutritional products and supplements, especially in the U.S., will demonstrate.

The following product examples which include proprietary dairy blends are given in Appendix III:

- Aussie Bodies – Wafer Bar
- Power Bar Foods – PowerBar Triple Threat 3 Bar Pack
- Met-Rx – Protein Bar
- Labrada Nutrition – Trail Mix Nut Bar
- PVL Nutrient – 2 Good Protein Bar
- Protica Nutritional Research – Profect Protein Beverage
- Solo GI Nutrition – Low Glycemic Nutrition Bar
- Biochem – all Natural Milled Flax Energy Snack

8.2 The Concept of Protein Blends

Protein bars are one of a range of new nutritional and dietetic products that are receiving strong support from a consumer market that is concerned about health, wellness and well-being, with a sector also concerned about convenient nutrition. Protein bars are typically comprised of the macro-nutrients (protein, carbohydrate and fats) along with vitamins, minerals and any of a range of specific ingredients with perceived or real functionality.

These protein bars are tailored for specific results and users. For example:

- High-protein meal replacement bars are one way of consuming a balanced diet in a convenient and tasty fashion
- High-protein bars with moderate to high carbohydrate content target athletes and those that undertake a high exercise regime, seeking the proteins and carbohydrates to improve energy
- High-protein bars for post-exercise recovery

The formulation of protein bars is typically based on a protein blend. In the manufacturing process, the main ingredients, including the protein (which may come as individual proteins or a protein blend), are mixed together with added water before going through the forming and enrobing process. Many of these protein blends are proprietary products made on behalf of a protein bar manufacturer. Alternatively, they may be proprietary protein blends that are produced by blending companies and available ”off-the-shelf.”

The proteins used in protein blends vary—again, dependent upon end use. For example:

- WPI/WPC—provides intact immunoglobulins, has a high concentration of BCAA, high biological value (which indicates ready absorption and utilization by human muscle)
- Casein—high natural glutamine content, supporting lean muscle mass
- SPI—enhancing thyroid hormone output, thus increasing metabolic rate to support fat loss. Moreover, isoflavones associated with soy protein have therapeutic effects related to cholesterol- and triglyceride-lowering properties. SPI is also a very good source of glutamine, arginine and BCAA

- Egg albumin—a very good amino acid profile
- Various hydrolyzed proteins that are available in a pre-digested form

8.3 Types of Proprietary Protein Blends

8.3.1 Introduction

Not surprisingly, there are numerous proprietary protein blends. Many of these are manufactured in the U.S., because this is where the protein bar market is most developed. Blenders are key players in the manufacture of protein blends. An opportunity exists for dairy companies to take a more proactive role in this market by formulating protein bars—both with and without dairy ingredients, depending on the needs of a specific user.

8.3.2 ProM3 Protein Blends

One typical protein blend is ProM3. This is said to include:

- Three unique proteins (WPC, calcium caseinate, egg albumen)
- A proprietary enzyme blend consisting of protease, lactase, & amylase
- No ingredients that are detrimental to muscle growth
- Pure muscle-building proteins for elite athletes

8.3.3 Protein blend in Enfamil Gentlease LIPIL – milk-based infant formula

Enfamil Gentlease LIPIL is positioned as a nutritionally balanced, milk-based infant formula. It was developed and is marketed as a first switch formula for babies who have fussiness or gas, combining partially pre-digested (hydrolyzed) proteins and reduced lactose. The milk protein blend is fashioned after breast milk, with whey and casein in a 60:40 ratio. Some further information related to the protein blend:

- The protein content represents 9% of the total calories in the formulation
- Partially hydrolyzed non-fat milk and WPC are the protein sources, based on a proportion of 60% whey and 40% casein
- The proteins are claimed to be easy to digest and are partially broken down
- The protein blend contains appropriate levels of essential and non-essential amino acids
- The protein blend is designed to promote good growth and development in infants

8.3.4 PowerBar Protein Plus

PowerBar ProteinPlus is a nutritional bar, marketed as a food supplement. The protein blend used in the formulation is TriSource. Key features of this blend include:

- It is an exclusive blend of high-quality whey, casein and soy proteins, incorporated into the product based on an ability to function to help repair, maintain and grow human tissues and muscles
- Each serving includes 5.0 grams of naturally occurring essential amino acids—leucine, valine and isoleucine—along with 4.4 grams of L-glutamine
- The protein sources are WPI, calcium caseinate and SPI

8.3.5 Musashi Nutrition

This Australian company markets its protein blend as containing four protein sources, carbohydrate free, low in fat and great tasting. Some features of this include:

- Protein blend consists of hydrolyzed lactalbumin, WPC, SPI, calcium caseinate, free-form amino acids and flavoring
- It is targeted at healthy snack or meal replacement products for athletes and others requiring an extra source of high-quality, easily digestible protein
- The protein content is 92%

8.3.6 ATW Optimum Protein Blend

This product is positioned as a versatile, multi-purpose protein blend, fortified with taurine. It claims to provide an optimum balance of carbohydrates and protein for peak performance, along with a complete amino acid profile. Key features include:

- 20 grams of protein per serving
- A combination of WPC and WPI
- Rich in BCCA and non-essential amino acids
- No aspartame, no artificial sweeteners, no MSG, no gluten
- Contains bioactive whey components, including:
  - Alpha-lactalbumin
  - Beta-lactoglobulin
  - Glycomacropeptide
  - Immunoglobulins
  - Lactoferrin
  - Lactoperoxidase
  - Various growth factors

9.0 NON-PROPRIETARY PROTEIN BLENDS

- Non-proprietary protein blends are more commonly known as “off the shelf” varieties
- These are more commonly traded than proprietary protein blends
- As with proprietary protein blends, these are targeting nutritional applications—nutritional bars in particular
- A wide range of dairy protein is used, and includes:
  - WPI
  - WPC
  - MPI
  - MPC
  - Dairy protein hydrolyzates
  - Caseinates
  - Caseins
- Proprietary protein blends that exclusively use dairy protein are very evident in the market
- Where non-dairy proteins are used, the most common are soy protein and hydrolyzed collagen

Along with the proprietary protein blends discussed in the preceding chapter, a large number of non-proprietary protein blends is also available in the U.S. market. A strong end user sector for these blends is nutritionals—especially nutritional bars and beverages.

Indeed, non-proprietary protein blends, also referred to as ”off-the-shelf” protein blends, appear to be more widely used than the proprietary products.

Some of the key characteristics of these products include:

- Use of a wide range of dairy protein—including WPI, WPC, MPI, MPC, hydrolyzed proteins, caseinates, casein and whey powder
- A number of products that use exclusively dairy proteins (casein, whey proteins) in the blend
- Soy ingredients as a co-blending ingredient—almost exclusively SPI
- Use of collagen—particularly hydrolyzed collagen

Appendix IV highlights the use of non-proprietary blends in a selection of finished products. Product examples given are:

- Bionic – Protein Bar
- Nutrilite – Protein Bar
- On – Gourmet Protein Bites
- Ultimate Nutrition – Chocolate Fudge Protein Drink
- Worldwide Sports Nutritional Supplement – High Protein Bar
- Balance Bar – Trail Mix Energy Bar
- Atkins Nutritionals – Caramel Bar
- EAS (Ross Abbott) – AdvantEdge RTD Beverage
- Premier Nutrition – Four Layer Protein Bar
- Worldwide Sports Nutrition Supplements – High Protein Double Layer Bar
- EAS (Ross Abbott) – Nutrition Bars
- Safeway – Vanilla Beverage Shake
- Trioplex – Cookies
- Sante Naturelle – Nutritional Supplement Bar

10.0 CHEESE BLENDS

- Cheese blends are a major area of growth opportunity
- This is largely based on growth in food service, consumers seeking greater choice, and the growth in exotic cheese options
- Usage in cheese blends is very strong in the U.S., providing a platform for U.S. manufacturers to enter the export market
- A key blend profile is Romano/Parmesan
- Future developments are likely based on:
  - Low-moisture cheeses
  - Low-fat varieties
  - Specialty applications (e.g. organic)
  - Widening the choice of cheeses
  - Developing more food system applications

With the growth in the food service market, consumers seeking tastier product choices, and with food service concepts such as pizza being introduced into household preparation, there has been a marked growth in demand for a growing range of products to satisfy entrenched and emerging food tastes. Cheese is one of the areas that has benefited from this market expansion.

Cheese is therefore being presented in a growing variety of ways to food formulators so that they can use them in cheese-based and cheese-flavored food preparations. Cheese blends have naturally arisen as a credible means of offering cheese solutions to menu and food product formulations.

This chapter looks at a range of cheese blends that are apparent in food products sold largely through retail outlets. Notwithstanding this sales channel, similar blended cheese products are being used for a variety of food service applications.

Some of the key issues arising from an analysis of this section include:

- Usage is particularly strong in the United States market
- All the cheese blends that were identified were non-proprietary blends
- Romano/Parmesan cheese blends have an extremely strong following in the market
- Some products incorporate two cheese blends (e.g. ConAgra Foods uses a separate cheese blend for its pizza topping and pizza sauce)

- Specialty products include organic cheese blends
- Cheese blends are not necessarily confined to two or more cheeses—formulations such as that used in Wegmans Wheat Crusted Cheese Pizza have a fully formulated cheese-based blend incorporating low-moisture wholemilk mozzarella cheese, provolone cheese, potato starch and cellulose
- While pizzas are a major area of application, cheese blends are used in other areas, such as:
  - Pasta side dishes
  - Soup
  - Savory biscuits
  - Spaghetti & meatballs
  - Cheese balls
  - Breadsticks
  - Dips

Product examples using cheese blends are given Appendix V, including:

- Wegmans Food Markets – Pork, Prosciutto and Parmesan Tortelloni
- ConAgra Foods – Pizza
- M&M Meat Shops – Italian Wedding Soup
- Omnibrands – Bite-Sized Cheese Crackers
- Wegmans Food Markets – Wheat Crusted Cheese Pizza
- ConAgra Foods – Spaghetti & Meatball Kit
- Safeway – Thin Crispy Crust Supreme Pizza
- Finest Quality – Cheese Balls
- Golden Crust Bakeries – Three Cheese Garlic Breadsticks
- Price Chopper – Mexican Style Cheese Dip

11.0 OTHER BLEND TYPES

- The use of blends in food applications is growing all the time
- This is based on food companies out-sourcing some of the functions they more traditionally may have done themselves, such as pre-blending
- With dairy being such an important constituent in many blends, out-sourcing blending also means out-sourcing dairy ingredient supply
- A range of examples is given in this chapter, including:
  - Flavor compounds—building on the initiatives outlined in chapter 3
  - The widening perception of GOS as a prebiotic, opening up opportunities for dairy to be involved in dietary fiber and related blends
  - Conventional dairy blends incorporating MSNF and milk fat with other food additives
  - The use of soluble blends for use in beverage formulations

The three preceding chapters have looked at proprietary and non-proprietary protein blends, and cheese blends. However, they are not the only blends in which dairy products are involved that have clear end-market applications.

This chapter looks at a range of further examples, including:

- A proprietary seasoning blend that uses butter and concentrated butter flavor in savory snack products
- Recognition by Mead Johnson that GOS is a plausible ingredient in prebiotic blends. There are two examples used by Mead Johnson, both under the Sustagen brand, targeting infants and school-aged children, where GOS is blended with inulin and FOS to provide a prebiotic blend
- More general dairy blends involving skim milk, butter, margarine, salt and emulsifiers, with similar applications:
  - Giant Eagle, U.S., in mashed potatoes
  - Orval Kent Foods, U.S., in sweet mashed potatoes
- U.K.-based Asda using milk protein in a starch blend (with wheat starch, glucose and food additives) for application in chocolate sponge pudding dessert
- Use of soluble blends in beverage and related formulations—low-fat milk solids blended with glucose syrups, hardened vegetable oil and potassium phosphate in a dry soluble Café Latte product

- A skim milk replacer comprising unspecified dairy ingredients in a Vietnamese formulation for baked cream cake

Product examples using other blend types are given in Appendix VI, including:

- World Finer Foods – Crisp Puff Pastry Bites
- Bristol-Myers Squibb – Vanilla Flavor Sustagen
- Mead Johnson – Children Nutritious Milk Powder
- Giant Eagle – White Cheddar Mashed Potatoes
- Orval Kent Food – Sweet Mashed Potatoes
- Lunds & Byerly's – Hash Browns
- Asda – Chocolate Sponge Pudding
- Kraft Foods – Café Latte
- Dae A Vina – Freshly Baked Cream Cake

12.0 BLENDS FROM OCEANIA – OVERVIEW

- The foregoing chapters identify the opportunity for blends in two spheres:
  - As tariff dodgers, with the example of the Canadian market given
  - The use of dairy components as food additives, with consideration given to: emulsifiers, compounded flavors & fat replacers
- However, the notion of blends is significantly more impressive than this, and this chapter on Oceania highlights the situation
- Dairy blends have long been acknowledged by NZFSA, for domestic and export applications, based on, "*what the dairy industry is actually doing*." Table 12.2 identifies a comprehensive list of blends that are evident in New Zealand, covering the whole sphere of dairy components, including liquid/concentrated/powdered formats, with various added components and fortifying agents ranging from other dairy to sugar, cocoa, vegetable oils, micro-nutrients, etc. in food and feed product offerings involving:
  - Milk
  - Cream
  - Lactose
  - Derivatives such as IgG
  - Buttermilk
  - Dried milks
  - Casein
  - MPC
  - Colostrum
  - Cheese
- A similar focus is provided for Australia, with wet and powdered blends, for food and feed applications, with dairy as a minor/major constituent, incorporated with a large variety of other components, including:
  - Chocolate flavoring
  - Vegetable fat
  - Sucrose & other sweetening agents
  - Flour
  - Non-dairy protein sources
- Indeed, the Australian blends trade is structured into descriptions by HS Classification, which allows (with judgment) for trade volumes to be estimated
- Thus, Australian exports of blends containing dairy is estimated to have grown from 150,000 mt in 2003, to over 170,000 mt by 2005
- Wholemilk powder blends at 37,000 mt is the most significant, with over 20% of total blend exports. Key destinations for this blend include:
  - Malaysia 13,500 mt
  - Indonesia 13,000 mt
  - Philippines 7,250 mt

12.1 Introduction

The foregoing chapters have touched on two aspects where dairy can be incorporated in blends:

- On the one hand, there is the very real issue of butteroil/sugar blends, with these being formulated as tariff dodgers for entry into the Canadian market
- On the other hand, the concept of using dairy and dairy components as food additives has been discussed. This addressed three somewhat overlapping market sectors:
  - Emulsifiers
  - Compounded dairy flavors
  - Fat replacers

However, as the earlier blends studies have quite explicitly inferred, these are only the tip of the iceberg. A wide range of different blends that are available for various applications in the market, and the experiences of the Australian producers (in New Zealand and Australia) are very clearly illustrated in the rest of this chapter.

12.2 The New Zealand Experience

In the case of New Zealand, NZFSA highlights the following definitions for dairy companies and other manufacturers involved in milk and dairy product processing that produce blends and mixes that have some dairy content. Note, these definitions are not exacting, and there is a degree of overlap.

That aside, it demonstrates the complexity that is involved in definitions and classifications. The wide coverage has been undertaken out of necessity, and reflects what is happening in the real world in terms of blend supply from New Zealand dairy and related companies for both the domestic and export markets.

Table 12.2 NZFSA approach to classifying blends with dairy components

Type of blend	Description of blend
Milk blend	A blend of milk products in liquid form
Milk-based blend	A blend of milk and non-milk products, in liquid form, with milk being the major component
Dairy-based sauce	Sauce, using dairy products as its base
Dairy-based blend	A blend of milk and non-milk products, in liquid form, with milk being the major component
Cream-based blend	Cream with addition of other dairy products or non-dairy products
Milk/sugar-based blend	A blend of sugar and milk, in liquid form, with other non-sugar components, but with milk being the major component
Sugar/milk blend	A blend of sugar and milk, in liquid form, with sugar being the major component
Milk/sugar blend	A blend of milk and sugar, in liquid form, with milk being the major component
Sugar/milk-based blend	A blend of sugar and milk, in liquid form, with other non-sugar components, but with sugar being the major component
Sugar/milk product-based blend	A blend of sugar and milk product(s), in liquid form, with other sugar-milk product components, but with sugar being the major component
High-IgG milk powder	Milk powder with enhanced IgG content
Nutritional milk powder	Special purpose, nutritionally fortified milk powder
Infant formula powder	Special purpose, nutritionally fortified milk powder
Follow-on formula	Special purpose nutritionally fortified milk powder
Nutritional milk powder	Special purpose, nutritionally fortified dry blended mix of milk products (e.g. milk powders, caseinates, whey powders, etc.)
Dairy-based nutritional powder	Special purpose, nutritionally fortified dry or wet blended mix of milk products and non-dairy ingredients

Type of blend	Description of blend
Milk-based tablet	A solid form milk-based product, usually produced by the very high compression of a powder blend. May also have added vitamins & minerals
Milk-based biscuit	A solid form milk-based product, usually produced by the high compression of a powder blend. May also have added vitamins & minerals
Blended milk powder	Two or more dry or wet blended milk powders blended (no non-dairy raw materials or ingredients). May include wholemilk powder, skim milk powder, and partly skimmed milk powder. May have been standardized with lactose or permeate
Formulated milk powder	Two or more dry or wet blended milk powders blended (no non-dairy raw materials or ingredients). May include wholemilk powder, skim milk powder, and partly skimmed milk powder. May have been standardized with lactose or permeate
Dried blended milk product	Two or more dried milk products, wet or dry blended, e.g., milk powders, cheese permeate, lactose, caseinate, whey powder, etc. May also have added vitamins, minerals
Dried formulated milk product	Two or more dried milk products, wet or dry blended, e.g. milk powders, cheese permeate, lactose, caseinate, whey powder, etc. May also have added vitamins, minerals
Formulated powdered milk product	Two or more dried milk products, wet or dry blended, e.g. milk powders, cheese permeate, lactose, caseinate, whey powder, etc. May also have added vitamins, minerals
Dried milk product blend	Two or more dried milk products, wet or dry blended, e.g. milk powders, cheese permeate, lactose, caseinate, whey powder, etc. May also have added vitamins, minerals
Dairy-based powder	One or more dried milk product(s) wet or dry blended with non-dairy ingredients, e.g. sweeteners, cocoa, corn oil, etc. May also have added vitamins, minerals
Buttermilk-based powder	Butter milk powder, wet or dry blended with non-dairy ingredients, e.g. sweeteners, cocoa, corn oil, etc. May also have added vitamins, minerals. May also have lesser quantities of other milk powders
Dairy-based powder blend	A dry blend of dairy and non-dairy powders, or dairy-based powders
Powdered milk product	Generally a product intended to be a “milk powder”, but has failed to comply with the specific CODEX Standard

Type of blend	Description of blend
Non-dairy and dairy product blend	A dried product, normally classed as a foodstuff, but manufactured in an NZFSA-Registered premise under an approved PSP, which has a component other than dairy forming the base (other than dairy being the major component)
Casein-based blend	A blend of dairy & non-dairy components, with casein as the base
Milk protein blend	Dry or wet blend of two or more milk protein powders (may include whey protein powders)
Milk protein-based blend	Dry blend of two or more milk protein powders, with other dairy or non-dairy ingredients
Milk protein concentrate and whey protein concentrate blend	Dry or wet blend of two or more milk protein powders (may include whey protein powders)
Whey powder blend	Dry or wet blend of whey powders
Whey-based blend	Whey product, wet or dry blended with non-dairy ingredients, (e.g. sweeteners, cocoa, corn oil, etc.) or lesser quantities of other milk powders. May also have added vitamins, minerals
Lactose-based liquid blend	Blend of lactose and non-dairy ingredients (with lactose being the base) and water, resulting in a liquid concentrate
Colostrum-based blend	Blend with colostrum as the major component base
Milk product/ colostrum blend	Blend of milk product and colostrum, with milk product as the major component base
Colostrum/milk product blend	Blend of colostrum and other dairy product, with colostrum as the major component base
Non-dairy, dairy and colostrum product blend	A dried product, normally classified as a foodstuff, but manufactured in an NZFSA-Registered premise under an approved PSP, which has a component other than dairy forming the base (other than dairy being the major component), and includes dairy and colostrum product
Dairy, non-dairy and colostrum blend	A dried product, with dairy as the base, and includes non-dairy and colostrum product
Dairy-based animal foodstuff	Animal stockfood, which includes dairy & non-dairy components with dairy as the base component

Type of blend	Description of blend
Non-dairy and dairy produce blend animal feedstuff	Animal stockfood, which includes non-dairy & dairy components with non-dairy as the base component

Source: NZFSA, personal communication

12.3 The Australian Experience

One of the difficulties with understanding flows between countries in terms of blends is the lack of transparency in terms of trade data. The Australians have the following AHECC by dairy product type which helps to lead to some understanding of volumes of blends traded.

As with the earlier table highlighted in the preceding section, this provides a definitive view on what sort of blends and mixes are being produced by the Australian dairy and related industries – and by virtue of the AHECC codes, ostensibly highlights the products that are destined for export markets.

Table 12.3 Australian Harmonized Export Commodity Classification – dairy blends

AHECC Code	Product description
04029900*	Sweetened chocolate-flavored reduced-fat milk
02106903	Soft serve dairy mix
04013050	Unsweetened frozen chocolate cream (> 6% fat)
04013050	Modified cream mixture
04021010	Sweetened skim milk powder
04021010	Sweetened bulk instant skim milk powder
04021010	Sweetened instant skim milk powder
04021010	Sweetened bulk skim milk powder
04021010	Sweetened modified skim milk powder
04021010	Calcium-enriched skim milk powder

AHECC Code	Product description
04021010	Skim milk powder blend
04021090	Sweetened milk powder blend
04021090	Sweetened milk powder blend, SMP mixture
04021090	Coffee creamer (sweetened milk solids blend, minor component dairy)
04022110	Unsweetened infant powder
04022130	Skim milk powder blend (chocolate flavor)
04022190	Unsweetened milk powder blend
04022190	Mixed milk powder products, other
04022190	Milk powder mixture, TruPro
04022190	Skim milk powder mixture
04022190	Milk powder mixture, Pro Sans S
04022190	Milk powder mixture, Rlab
04022190	Vegetable fat filled milk powder
04022910	Infant milk powder
04022920	Sweetened wholemilk powder 26% fat, small packs
04022920	Sweetened instant milk powder, tinned
04022920	Sweetened instant milk powder, other packs
04022920	Sweetened wholemilk powder 28% fat, small packs
04022920	Sweetened bulk wholemilk powder
04022920	Sweetened instant milk powder, tinned
04022920	Sweetened instant milk powder, other packs
04022920	Sweetened milk powder, tinned
04022990	Cream powder blend

AHECC Code	Product description
04022990	Milk powder blend/mixture
04022990	Whole milk powder blend/mixture
04022990	Milk beverage powder
04022990	Special dietary foods (dried milk powder blend)
04022990	Milk powder mixture, other
04022990	Milk powder mixture, Junex
04022990	Sour cream powder blend
04029150	Modified cream mixture (cream and skim milk concentrate)
04029900	Butter blend
04029900	Sweetened frozen chocolate cream
04029900	Sweetened milk
04029900	Sweetened reduced-fat chocolate milk
04029900	Sweetened modified reduced-fat milk
04029900	Sweetened modified milk
04029900	Sweetened chocolate-flavored milk
04029900	Sweetened coffee-flavored skim milk
04039090	Buttermilk powder mixture
04039090	Cultured soft serve ice cream mix (liquid)
04041000	Whey powder/dried milk powder blend
04041000	Whey protein isolate blend (chocolate flavor)
04041000	Whey protein isolate/skim milk powder blend (chocolate flavor)
04041000	Whey protein concentrate blend (chocolate flavor)
04049001	Cream whey blend
04061000	Cheesecake mix (fresh or cream cheese component)

AHECC Code	Product description
04062000	Cheese sauce mix (dried milk powder blend)
04062000	Cheese powder for sauce (minor components cheddar cheese and dairy powders)
04063029	Cheese bites (major component dairy)
15171010	Dairy spread—butter/vegetable oil blend
15171010	Margarine (minor component dairy)—to the EU
17049000	Sugar confectionery (minor component dairy)
18069091	Skim milk powder/cocoa preparation
18069091	Cocoa preparation (dried milk blend)
18069091	Chocolate crumb dried milk powder (minor component dairy)
19011000	Infant formula
19012001	Butter/sugar mix
19012001	Vanilla dairy pastry base (major component cream)
19012001	Flour/milk powder blend (minor component dairy)—to the EU
19012001	Dried milk preparation for bakery products
19012001	Dried milk preparation for cakes
19012001	Dried milk preparation for confectionery
19012001	Flour/milk powder blend (minor component dairy)
19012001	Flour/butter blend (minor component dairy)
19019096	Flour/SMP/sugar blend
19019096	Custard powder (minor component dairy)
19023000	Vegetable gratin (minor component dairy)—to the EU
19023000	Seafood lasagna (dairy-based sauce)
21021000	Milk powder blend culture medium pre-mix

AHECC Code	Product description
21039010	Dessert sauce (minor component dairy)—to the EU
21039010	Béchamel sauce
21039010	Carbonara sauce (milk, onion, cream, margarine, flour, etc.)
21039010	White sauce
21039010	Alfredo sauce (milk, cream, parmesan and margarine)
21061000	Skim milk powder/calcium blend
21069012	Ice cream mix, product based, dried milk blend
21069012	Ice cream mix, milk based, dried milk blend
21069012	Ice cream mix, dried milk blend
21069012	Dried frozen yogurt mix, milk based
21069012	Ice cream mix, non dried milk blend
21069093	Butteroil/caseinate blend (liquid)
21069093	Condensed milk (major ingredient)/ vegetable oil blend
21069093	Butter/sugar blend (minor component dairy)
21069093	Vegetable oil (major ingredient)/condensed milk blend
21069102	Ice cream mix, product based, non-dried milk blend
21099012	Ice cream mix, milk based, non-dried milk blend
23099020	Stockfeed, Denkavit
23099020	Provilac Gold (medicated premium CMR)
35011010	Casein mixture
35040000	Milk protein concentrate (non powder)
35040000	Sweetened milk protein concentrate 75
35040000	Sweetened milk powder blend, sweetened milk protein concentrate 75

AHECC Code	Product description
35040000	Sweetened milk protein concentrate 50
35040000	Sweetened milk protein concentrate 42
35040000	Sweetened milk protein concentrate 35

Source: MFAA, personal communication
Note: * Also available under the same AHECC Code as coffee, banana, mocha, eggnog, chocolate & honeycomb, strawberry flavored

A couple of points relate to the previous table:

- Sweetened products are included, as these include sugar and other sweeteners; however, in many cases they will not be ”blends” in the context of the current report. They are included because in many cases it is difficult to definitively separate consumer products from ingredient products from a top-line analysis such as this
- A number of products share AHECC codes, as can be seen from the above table. It is important to note that a number of non-blends are also included under some of these AHECC codes, so this is not necessarily a fool-proof approach to tracking blends *per se*
- The AHECC codes have been given to specific products because they are currently, or have been, manufactured in Australia for export markets. A number of interesting initiatives are being undertaken, including:
  - Proprietary blends—e.g. TruPro, Pro Sans S, Rlab
  - WPI is represented in a number of novel formulations
  - Cheese blends per se do not appear to be included in the list
  - Butteroil/caseinate blends
  - Liquid blends are being exported
  - Various blends with a flour and/or sugar component

12.4 Estimated Volume of Australian Dairy Blends Exports

From the foregoing section, it is possible to estimate the plausible volume of Australian dairy blend exports by key category.

A summary of the Australian blend export volume is given by the following table. A much more detailed analysis of Australian dairy blend exports, by detailed product and by key destination, is shown in Appendix VII.

Table 12.4 Summary overview of estimated Australian dairy blend exports, 2003 – 2004

HS Description	Jan-Dec 2003, mt	Jan-Dec 2004, mt	Jan-Dec 2005, mt
04013050	1,000	1,000	1,000
04021010	10,000	10,000	10,000
04021090	10,100	8,300	7,450
04022110	6,300	5,400	5,250
04022130	2,600	3,600	1,300
04022190	2,000	6,800	2,100
04022910	26,100	6,700	6,400
04022920	550	3,000	5,300
04022990	4,550	31,100	37,000
04029150	15	10	5
04029900	14,600	14,100	13,800
04039090	650	550	400
04041000	1,000	1,000	1,000
04049001	1,500	2,200	3,300
04061000	50	50	50
04062000	50	50	50
15171010	3,000	3,000	3,000

HS Description	Jan-Dec 2003, mt	Jan-Dec 2004, mt	Jan-Dec 2005, mt
17049000	1,500	1,500	1,500
18069091	11,900	12,000	12,700
19011000	1,500	2,400	1,400
19012001	15,500	19,300	22,900
21021000	50	50	50
21039010	10,000	10,000	10,000
21061000	1,700	2,200	750
21069012	1,700	2,600	1,900
21069093	20,000	20,000	20,000
23099020	3,500	5,800	6,700
35011010	130	25	60
Total all categories [1]	**151,545**	**172,735**	**175,365**

Source: Landell Mills Consulting estimates based on Australian Bureau of Statistics data and discussions with Australian dairy exporters

Note: [1] Excludes HS Classification 35040000 because no volume data available from source

12.5 Australian Industry Sources' Views on Dairy Blend Exports

Through the course of collecting and estimating the preceding data, some key observations from industry were obtained. These include the following:

- Volume of dairy blends exported from Australia is widely estimated at > 100,000 mt p.a. (indeed, the preceding data shows a rise from 150,000 mt p.a. in 2003, to 170,000 mt by 2004/2005)
- Dairy blend activity typically escalates when global dairy commodity prices heighten; thus, blending is one way of attempting to decrease the cost of milk solids for end users, particularly by

incorporating lower-valued material (e.g. whey solids) into products

- There is a strong trend towards exporting bulk blended product that is re-packed in the country of destination into retail-ready formats. Infant formula is one conventional example; others include chocolate-flavored dairy-based beverage mixes, as well as a host of new pre-blended dietetic products, sports and performance enhancement products, protein-fortified products utilizing MPC/WPC/WPI/MPI in dairy and non-dairy bases, etc.

- Sweetened and sugar-based blends have long been important dairy blends exported from Australia. The development of the retail milk powder market in many Asian countries, especially China, has necessitated sweetened varieties in order to more closely match consumer expectations

- The ice cream and recombining industries are conventional outlets for various blends. There is a great variety of blended products going into this sector, with very little standardization between end user needs. In many cases, the Australian exporters are dealing with end users with quite specific blends

- The bakery and confectionery industries are becoming larger users of dairy blends exported from Australia. These include:

  - Various sauces, including cheese-flavored sauces (and most of these have at least a minor dairy component—caseinates, SMP, WMP, milk fat)
  - Butter/sugar blends tailored for bakery/confectionery applications
  - Flour/butter blends for bakery, along with dried milk/flour blends for specific bakery applications

13.0 EUROPEAN BLEND MANUFACTURERS

- Europe is the home of dairy blends
- The earlier blends studies gave a comprehensive review of the European market
- There have been some recent developments, including:
  - Kerry Ingredients—strong hold on innovative and conventional dairy blends with a range of cheese/dairy powder blends, sugar/chocolate crumb-based dairy blends, and specialty lipid/dairy blends
  - Euroserum—actively supplying a comprehensive range of fat-filled whey products, used as milk substitutes, which are particularly attractive during periods of high commodity prices
  - Molda—consolidating its position with a strong performance in high-fat dairy powders
  - Viv-vreeland—tailoring blends for end user applications based on various milk fat feedstock blended with one or more of cocoa powder, cocoa butter, sugar, dextrin, vegetable oils
  - BBA Lactalis—one of Europe's largest blenders, using a full range of dairy ingredients to present dairy and dairy/non-dairy blends
  - Confranlait—positioning itself as a partner for the food industry, marketing blends targeting: infant milk, nutritional supplements, therapeutic nutrition – as well as a comprehensive range of high-fat/filled powders
  - Kievit—a more conventional range of blends, including fat-filled powders (up to 80% fat content), creamers, topping powders and other similar products
  - Armor Proteines—positioning itself as a supplier of economical food and dairy preparations, utilizing palm oil, coconut oil and hydrogenated soy oil
  - Ingredia—A full range of dairy and filled dairy products, with protein content ranging from 15 to 42.5%, and for substituting anything from 50 to 100% of milk solids

Many of the European blend manufacturers have been covered in the earlier reports. This chapter highlights new developments in terms of companies and blends that have occurred over the ensuing period.

13.1 Kerry Ingredients

Kerry Ingredients UK
Bradley Road
Royal Portbury Dock
Bristol
BS20 7NZ
UK
Tel: +44 1275 378 500
Fax: +44 1275 378 555
E-mail: enquiries@kerry-ingredients.co.uk
Website: www.kerry-ingredients.co.uk

Kerry Ingredients' Specialty Dairy Ingredients business is responsible for developing, producing and marketing a wide range of specialized dairy ingredients for various applications. Within this offering is a specific range of products that could be construed as dairy blends. An overview of these is given as follows:

- Cheese-Treme™ Cheese and Dairy Powders—these products are produced by combining cheeses and other dairy ingredients in order to offer a range of shelf-stable cheese powders that deliver authentic flavor profiles. The range includes the full spectrum of flavors, from the distinctive milky fresh, acidic taste of Greek Feta to the sharp, sweet, nutty profiles of Swiss Gruyère. Complementing these are a range of traditional profiles such as cheddar, gouda, emmental, Romano, blue and mozzarella
- Cosana™—various blends, such as:
  - Chocolate crumb—utilizing a blend of fresh milk solids, sugar and cocoa to deliver a unique caramelized cocoa flavor
  - Milk crumb—milk solids and sugar
  - Sweet condensed milk—a blend of milk solids and sugar
  - Dulce de leche powder
- San-A-Creme™—a range of specialty lipid blends, including:
  - Nutritional lipid bases—a blend incorporating co-dried milk proteins, nutritional lipids (high in omega-3 & omega-6)
  - Beverage bases—spray dried emulsions used in powdered beverage systems

- Creamers—used as coffee whiteners, soups and beverage creamer bases, incorporating various milk components such as caseinates and non-fat milk solids

13.2 Euroserum

Euroserum
BP 17
70170 Port sur Saone
France
Website: www.euroserum.com

Euroserum markets a range of fat-filled whey products. These are milk substitute products that are used in a wide range of applications, including creamers, sweetened condensed milk and ice cream. They are particularly suitable for use in dry mix process applications.

Standard specifications for Euroserum fat-filled whey products are given in the following table.

Table 13.2 Euroserum fat-filled whey – standard specifications

Product description	Protein content (%)	Fat content (%)	Ash content (%)	Lactose content (%)
Sweet whey with 26% fat	8.5	26	6.0	56
Sweet whey with 50% fat	5.5	50	4.5	35
Demineralized whey with 26% fat	8.5	26	2.2	59

Source: Euroserum

13.3 Molda

Molda AG
Gartenstrasse 13
21368 Dahlenburg
Germany
Tel: +49 5851 88-0
Fax: +49 5851 7230
E-mail: info@molda.de
Website: www.molda-ag.de

Molda manufactures a range of dairy-based blends. Examples of these include:

- Butter powder—manufactured by spray drying a combination of non-fat milk solids and butter, with a resultant fat content of ~75%. Areas of application include: soup & sauce bases, croissant mixes, marinades, dressings and instant meals. Functional characteristics include:
  - Typical butter flavor
  - Good emulsifier
  - Long shelf life
  - Ready mixed in dry formulations

- Cream powder (75%)—manufactured by adding sugar to cultured skim milk and then spray drying. The resulting product has a characteristic soft curd cheese flavor and aroma for use in gateaux and dessert mixes. Functional attributes include:
  - Good solubility
  - Easy to add into dry mixes
  - Long storage life

- Cream powder (without phosphate)—with approximately 75% fat content, this is made from a blend of fresh cream and skimmed milk that is spray dried. The aroma and flavor are typical of cream. Used as a mixture for cream pastries, marinades, dressings, cream chocolate, instant food products, ice cream powder and praline/wafer fillings. Advantages include:
  - Typical cream flavor in convenient powder form
  - High fat content—efficient delivery
  - Slows down the formation of fat bloom in chocolate
  - Easily mixed and incorporated in most food systems
  - High level of purity
  - Strong whitening ability
  - Good emulsification properties
  - Can be used with a “without phosphate” declaration

13.4 Viv-vreeland

VIV Vreeland B.V.
Raadhuislaan 4
NL-3633 AR Vreeland
PO Box 5
NL-3633 ZT
Netherlands
Tel: +31 294 233 054
Fax: +31 294 231 747
E-mail: indo@viv-vreeland.nl
Website: www.viv-vreeland.nl

This company produces a range of tailored dairy blends to match the exacting requirements of all customers. The company uses as its basic ingredients AMF, butteroil, butter and fresh cream.

The company provides the following summary of typical products manufactured for its customers:

- AMF/cocoa powder
- Butter/cocoa powder
- AMF/cocoa butter
- Butter/cocoa butter
- AMF/sugar or dextrin
- Butter/sugar or dextrin
- Butteroil/vegetable fat
- Butter/vegetable fat
- Butter blends
- Butter spreads
- Cream/sugar or dextrin

13.5 BBA Lactalis

BBA Lactalis
France
Website: www.lactalis-industrie.com

Acknowledged as a leader in European milk powder manufacture, BBA manufactures a wide range of milk powder products, including:

- Spray dried or roller dried
- 0% to 42% fat content

In keeping with its leadership position, the company manufactures milk blends using its own dairy ingredients, including the use in blends of:

- Skim milk powder—spray or roller dried
- Full cream milk powder—spray or roller dried
- Caseins and caseinates—spray or roller dried
- Sweet whey and acid whey powders
- De-mineralized whey powder
- Lactose
- Cream
- Anhydrous milk fat
- Butter powders

In addition, the company manufactures a wide range of fat-filled dairy products using vegetable oils.

The company's blends are manufactured at two sites. One site only produces dry blend products, while the second site has spray drying and roller drying facilities.

13.6 Cofranlait

Cofranlait
110-114 rue Victor Hugo
92303 Levallois Perret Cedex
France
Tel: +33 1 47 15 37 00
Fax: +33 1 55 90 97 67
E-mail: info@cofranlait.fr
W3: www.cofranlait.fr

Confranlait positions itself as a partner for the food industry. The company offers formulation, development, manufacturing and packaging of semi-finished or finished powdered products. Specialty milk-based foods produced by Confranlait include:

- Infant milk and cereal formula
- Nutritional supplements
- Therapeutic nutrition

Some of the products produced by the company include:

- Powdered nutritional supplements for pregnant and lactating women
- Powdered infant formula for babies aged from birth until 6 months onward
- Powdered follow-up formula for babies from 6 months until 1 year onward
- Instant infant milk cereals, wheat-based, for infants from 4 months onward
- Powdered instant milk drinks for children from 3 to 7 years of age
- Powdered nutritional supplements for elderly people—these are low-fat, high-calcium formulations with added lecithin, fiber and beta-carotene
- A range of WMP and SMP products, with or without added vitamins, minerals, etc.

In addition:

- High-fat powders, including:
  - Vegetable origin—typically 26% fat content, used as a WMP replacer or alternative
  - Milk fat origin—known as cream powder or powdered cream in some countries, made from cream with skim milk adjusted to vary the fat level, and then spray dried. The fat content is typically 42%, 50% or 72%. Used for chocolate, confectionery, soups, sauces and baked goods

Specific high-fat powder blends include:

- Laixpa 652 21—an instant preparation made from full cream milk and selected milk components. Used for its emulsifying properties and binding attributes in biscuit, pastry, chocolate and confectionery products. Enhances aroma and color, and imparts excellent taste profile along with desired nutritional qualities
- Laixpa 570—made from skimmed milk and concentrated butter, then spray dried. Offers good emulsifying and binding properties, along with excellent flavor
- Laixpa 652 C—made from selected dairy fractions and vegetable fats. Used in the biscuit, pastry, and specialty bread-making business for its emulsifying and binding properties. Also has excellent flavor, and enhances product aroma and color
- Laixpa LS 26—consisting of selected milk components enriched with protein (22%) and vegetable fats. Used as a full cream milk replacer in drinks, ice cream, biscuits, pastries, sauces and pork products

13.7 Kievit (Friesland)

Friesland Foods Kievit
Oliemolenweg 4a
7944 HX MEppel
PO Box 189
7940 AD Meppel
The Netherlands
Tel: +31 522 238 138
Fax: +31 522 238 100
E-mail: info@kievit.com
W3: www.kievit.com

This company offers a full range of different dairy blends, including:

- Vana-Grasa—powdered formulations with different fat sources and fat content varying up to 80%. These products have a range of protein components and different carrier material. Typically used as a fat source in soups, sauces and bakery applications
- Vana-Lata—a range of fat-filled powders and cream powders, with varying fat content. Suited for soups, sauces and bakery applications
- Vana-Crema—a range of multi-functional creamers with various percentages of fat, fat types, fat/protein ratios, emulsifiers, carrier materials and additives. They are particularly suitable for dry instant and cooking soup mixes, and also have applications as pre-emulsified fat in wet soups and sauces. Various properties can be tailored to the requirements of food formulators, including:
  - Degree of whitening, color
  - Texture and mouthfeel
  - Taste and flavor profile
  - Creaminess
- Vana-Blanca/Vana-Domolat—dairy and non-dairy creamers/whitener range for use in coffee and tea or as an ingredient in instant chocolate drinks. Various properties can be tailored to end user requirements, including:
  - Solubility at different temperatures
  - Foaming properties
  - Stability in hard water/high temperature/different pH levels
- Vana-Dulce—caramelized, sweetened, condensed milk powders based on milk derivatives and sugar. Used in beverages and baked goods
- Vana-Choca—manufactured in an integrated agglomeration and spray drying process to produce instant chocolate drinks. Used in a variety of dry mixes as milk/chocolate flavoring
- Vana-Monte—a range of topping powders based on vegetable fats and emulsifiers for use in ice cream, pastry goods, mousse and whipped cream formulations

- Vana-Cerea—cereal-based creamers specially developed for use in 3-in-1 cereal mixes. Used ostensibly as instant milk powder alternatives

13.8 Armor Proteines

Armor Proteines
35460 Saint Brice en Cogles
France
Tel: +33 2 99 18 52 52
Fax: +33 2 99 97 79 91
E-mail: markcom@armor-proteines.com
W3: www.armor-proteines.com

In addition to offering a full range of dairy commodities and functional dairy derivatives, Armor Proteines is active in the manufacture and marketing of proprietary blends. This includes products made exclusively with dairy, as well as those with non-dairy components. The Lactarmor G range is positioned as an economical source of food and dairy preparations, completely or partially replacing milk powder or fat without unduly compromising the taste profile of the finished product.

A range of non-dairy vegetable are typically used in Lactarmor G products, including:

- Palm oil
- Coconut oil
- Hydrogenated soy oil

An overview of some of the main off-the-shelf blends marketed by Armor Proteines is provided in the following table.

Table 13.8 Armor Proteines dairy blend range

Brand	Description	Main attributes
Lactarmor G 26/10	A spray dried food preparation containing milk proteins, lactose and vegetable fat (coconut, soy, palm)	An economical milk powder substitute. Lactarmor G 26/120 BUTY is an alternative made exclusively from dairy material
Lactarmor G 26/12EB	A spray dried food preparation containing milk proteins, lactose and vegetable fat (coconut)	An economical substitute for milk powder
Lactarmor G 8/10	A spray dried dairy preparation containing milk proteins, lactose and cream	Exclusively dairy components. An economical substitute for milk powder
Lactarmor G 45/10	A spray dried food preparation containing milk proteins, lactose and vegetable fat (coconut, soy, palm)	An economical substitute for milk powder

Source: Armor Proteines

13.9 Ingredia

Ingredia S.A.
61-53 avenue Fernand Lobbedez
BP 946
62033 Arras Cedex
France
Tel: +33 3 21 23 80 00
Fax: +33 3 21 23 80 01
W3: www.ingredia.com

Ingredia has a range of functional dairy ingredients targeting various applications. Among these are a selection of blends with varying protein content. The following table provides an overview of those targeting the frozen dessert market.

Table 13.9 Ingredia Functional Powder Blends for Frozen Desserts

Product Name	Definition	Protein content	Replacement rate of milk solids	Texture rating	Taste rating
Procream 0.20A	Skimmed milk blend (20%)	20%	100%	**	**
Procream 0.20B	Sweet skimmed milk blend (30%)	20%	100%	***	***
Procream 0.24	Skimmed milk blend (20%)	24%	100%	**	**
Procream 0.25B	Skimmed milk blend (25%)	25%	100%0	**	**
Procream 151A	Sweet dairy blend	15%	50-100%	**	*
Procream 151AS	Sweet dairy blend	15%	50-100%	**	***
Procream 151B	Sweet dairy blend	15%	50-100%	***	***
Procream 151C	Dairy blend	15%	50-100%	**	**
Procream 151E	Dairy blend	15%	50-100%	*	*
Procream 151SC	Dairy blend	15%	50-100%	****	****
Procream 201	Dairy blend	20%	50-100%	*	*
Procream 251	Dairy blend	25%	50-100%	**	**
Procream 251V	Dairy blend	25%	50-100%	**	**
Procream LF	Food blend	42.5%	100%	****	***

Source: Ingredia

14.0 AUSTRALIAN BLEND MANUFACTURERS

- A full range of dairy blends is supplied by dairy companies in Australia
- These are servicing established end-user sectors, such as:
  - Infant formula/follow-on formula/growing-up milk
  - Other dietetic applications
  - Nutritional formulations
  - Ice cream mix/soft serve and related
  - Skim milk replacers
  - Protein blends
  - Whey-based blends
  - Milk replacers—for feed applications
- A profile is given of two companies that base their business on blends:
  - Frosty Boy—manufacturing a comprehensive range of soft serve and related blends for domestic and export markets. Ranging from 100 g to 25 kg, based on powder and liquid/UHT presentations
  - Intermix—a joint venture between MG, Mitsubishi Corporation and Erie Foods. Producing 36,000 mt of blends per year, with 26,000 mt p.a. destined for Japan. This company supplies a comprehensive range of dairy blends

14.1 Overview of Blending Companies

The following table provides a brief overview of some of the main dairy powder and related blenders in Australia. Following this table is more detail on two of the more significant blenders that have export business and are large volume contributors.

Table 14.1 Australian dairy blenders

Company details	Blends & mixes typically produced
Tatura Milk Industries Ltd 238-240 Hogan Street Tatura, Vic 3616 Australia Telephone +61-3-5824 6200 Facsimile +61-3-5824 2534 Website www.tatmilk.com.au	• Unsweetened infant formula • Proprietary dairy and dairy-based blends • Nutritional formulations

Company details	Blends & mixes typically produced
Meiji-MGC Dairy Co Pty Ltd Schubert Road Cobram, Vic 3644 Australia Telephone +61-3-5871 0400 Facsimile +61-3-5871 2323	• Infant formula • Growing-up milk • Follow-on milk
Snow Brand Australia Pty Ltd Level 10, IBM Tower 60 City Road Southbank, Vic 3006 Australia Telephone +61-3-9686 2411 Facsimile +61-3-9686 9039	• Infant formula • Growing-up milk • Follow-on milk
Nestle Australia Ltd 201 Sussex Street Sydney, NSW 2000 Australia Telephone +61-2-9931 2345 Facsimile +61-2-9932 2610 Website www.nestle.com.au	• Unsweetened infant formula • Various dairy-based dietetic blends • Ice cream mix
Murray Goulburn Co-operative Co Ltd 140 Dawson Street Brunswick, Vic 3056 Australia Telephone +61-3-9387 6211 Facsimile +61-8-9387 6544 Website www.mgc.com.au	• Ice cream mix • Nutritional blends • Protein blends • Skim milk replacers • Whey-based blends
Australian Dairy Products Pty Ltd Subsidiary of Warrnambool Cheese & Butter Factory Co Ltd 5331 Great Ocean Road Allansford, Vic 3277 Australia Telephone +61-3-5563 2100 Facsimile +61-3-5563 2156 Website www.wcbf.com.au	• Ice cream mix • Buttermilk/skim milk blends • Skim milk/whey blends

Company details	Blends & mixes typically produced
Probiotec (Australia) Pty Ltd 83 Cherry Lane Laverton North, Vic 3026 Australia Telephone +61-3-9278 7555 Facsimile +61-3-9369 6730 Website www.probiotec.com.au	• General-purpose milk replacers for feed applications • Milk replacers for lamb/kid applications • Milk replacers for swine applications
Biostarch Pty Ltd 147-153 Learmonth Street Ballarat, Vic 3350 AUSTRALIA Telephone +61-3-5339 3933 Facsimile +61-3-5334 2567 Website www.biostarch.com.au	• General-purpose milk replacers for feed applications • Milk replacers for lamb/kid applications
Simple Foods Pty Ltd 6 Jayne Court Dandenong South, Vic 3175 Australia Telephone +61-3-8787 5000 Facsimile +61-3-8787 5100 Website www.simplefoods.com.au	• Soft serve ice cream mix • Soft serve yogurt mix • Drinking chocolate mix • Coffee frappe mix • Pancake mix • Smoothie mix
Dairy Farmers Group Quad 1, 8 Parkview Drive Homebush Bay, NSW 2127 Australia Telephone +61-2-8732 1000 Facsimile +61-2-8732 5333 Website www.dairyfarmers.com.au	• Skim milk blends • Buttermilk blends • Whey-based blends

Source: Landell Mills analysis

14.2 Frosty Boy Pty Ltd

Frosty Boy Pty Ltd
70-82 Burchill Street
Loganholme, Qld 4129
Australia
Telephone: +61-7-3806 2888
Facsimile: +61-8-3806 2999
Website: www.frostyboy.com.au

This company manufactures a range of soft serve ice cream and related products for domestic and export markets. The company also provides contract packaging and co-development of products for specific customer needs.

In addition to its standard range, the company has the ability to develop further powder and UHT liquid blends based on:

- Non-savory, dairy-based or sugar-based powders for customers requiring sizes ranging from 100 g to 25 kg
- Single ingredient products—specifically instantized milk powder for domestic and food service clients
- Complete blends/mixes, —including:
  - Ice cream blends
  - Soft serve blends
  - Frozen yogurt blends
  - Instant pudding or custard blends
  - Granita crystal blends
  - Drinking chocolate
  - White drinking chocolate
  - Powdered condensed milk
  - Powdered yogurt drink
  - “Home-made” yogurt blends
- Parts of mixes, including:
  - UHT soft serve pre-mixes
  - Flavored UHT pre-mixes
  - Flavored milk pre-mixes
  - Ice cream pre-mixes

- Granita base pre-mixes
- Ice cream pre-blends

As an example of contract packing, Frosty Boy dry blends ingredients for the KFC ice cream mix. This blend is then shipped to the company's UHT facility where final mixing and packing is undertaken before shipping off to KFC receiver sites in Australia and throughout Asia.

Powder packing involves heat-seal, food-grade foil laminate bags, ranging from 100 grams to 3.5 kg. Alternatively, bulk product is packed in 25 kg bags with food grade plastic liners.

In the case of bags ranging from 1 to 3 kg, they are typically packed into boxes that do not exceed 12 kg.

Liquid UHT ice cream mix and soft serve is packed into 5- or 10-liter plastic bags, containing 10 or 15 liters per box. Alternatively, 12x1-liter Tetra Paks are supplied per shipping carton.

Powder vs. liquid is an important consideration for buyers. Some of the key features that impact the decision-making process in any objective comparison include:

- Economy—powdered soft serve mix is generally cheaper on a per liter basis than liquid product
- Taste—liquid soft serve blends typically contain emulsifiers, which can be detrimental to taste when compared with powdered versions that have no emulsifiers
- Shelf life:
  - Powdered mixes: up to 2 years
  - UHT liquid mixes: 6 to 9 months
  - Fresh mixes: 5 to 7 days
  - Frozen mixes: up to two years, but there may be quality deterioration depending on process, ingredients, etc.
- Space utilization—powdered mixes take up 65% less storage area
- Transportation—as powdered mix is roughly a quarter the weight of its liquid equivalent, there is significant cost savings. No refrigeration is required as is needed for fresh and frozen product. Similarly, storage can be undertaken at ambient temperatures, reducing overall storage costs

- Reconstitution of powdered mixes, based on formulation with instantized ingredients, is comparable to liquid product

There is a distinct difference between soft serve and gelato bases. Gelato bases have higher solids content, and up to 10% or more fat content.

Details on a selection of the company's products are provided in the following table.

Table 14.2 Frosty Boy product range – dairy blends

Product	Broad description	Features	Packaging	Yields
Frosty Boy full cream vanilla	Claims to be industry standard in powder soft serve blends	Contains 4.4% milk fat (per 100 ml serve @ 45% overrun)	Packed in 4x3 kg sachets per carton; 8x1.5 kg sachets per carton	37.6 liters liquid mix per 12 kg carton; 10 servings per liter liquid @ 40% overrun; 12.8 servings per liters liquid @ 80% overrun
Crème Freeze	A specialized blend with higher water to powder ratio, giving a more icy texture; contains 4.42% milk fat; can also be used as a thick shake or milk shake base	Suited for hot climates (slower meltdown), and its solid structure improves its chocolate dipping	4x2.5 kg sachets per carton	Yields 35 liters liquid mix per carton; 9.5 servings per liter mix @ 40% overrun; 11.75 servings per liter mix @ 80% overrun
Liquid Crème	Packed in 5 liter bottles – add water and shake	Shelf life is only 6 months due to large air pocket in bottle	Each carton consists of 2x5 liter bottles each containing 1.6 kg powdered soft serve base	10 liters of liquid mix per 12 kg carton; 10 servings per liter liquid at 40% overrun; 12.8 servings per liter liquid at 80% overrun
Yo-Frost low fat & low calorie	A low-fat frozen yogurt blend, 98% fat free and low in sodium (120 calories per 100 gram serving)	Used in yogurt smoothies, including beneficial yogurt cultures; typically marketed at 25% premium over standard soft serve alternatives	Packed in 8x1.5 kg sachets per carton; 4x3 kg sachets per carton	Reconstitute on basis of 1.5 kg powder to 3.5 liters water; 10 servings per liter liquid at 40% overrun; 12.8 servings per liter liquid at 80% overrun
Frosty Soft Serve Pre-mix	A special soft serve powder mix developed for countries with high dairy tariffs but with low cost milk (e.g. China)	Based on removal of a large share of milk solids, then adding full cream milk at point of application	Packed in 1.1 kg sachet bags	Add 3.5 liters full cream milk to 1.1 kg powder; 10 servings per liter @ 40% overrun; 12.8 servings per liter @ 80% overrun
UHT Crème Freeze	6% fat content, UHT liquid soft serve base	Based on formulating with gums and emulsifiers, resulting in a creamy but firm soft serve with slow meltdown qualities and excellent chocolate dipping features	Presented in a ready-to-use format, 12x1 liter	10 servings per liter @ 40% overrun; 12.8 servings per liter @ 80% overrun

Source: Frosty Boy Pty Ltd

14.3 Intermix Australia Pty Ltd

Intermix Australia Pty Ltd
92-96 Harburg Drive
Beenleigh, Qld 4207
Australia
Telephone: +61-7-3807 0744
Facsimile: +61-7-3807 0746
Website: www.intermix.com.au

Intermix is a high technology production facility based in Queensland, manufacturing a diverse range of dry-mix finished ingredients, blends, and pre-mix additives for end use applications in the beverage, dairy, bakery, confectionery, nutritional and snack sectors of the food and beverage industry.

Initially formed in the early 1990s, the company has developed a strong export market into the Asian theatre. The company currently has three equal shareholders, each providing specialized roles in the company:

- Erie Foods International, Inc—one of the largest milk protein suppliers in the U.S., and a custom processor for the dairy, health, bakery, confectionery, pet food, meat, poultry and seafood industries
- Mitsubishi Corporation—one of Japan's largest trading and investment companies, providing the organization with a core marketing channel into the Japanese market, as well as warehousing and distribution services in the market
- Murray Goulburn Co-operative Co Ltd—Australia's largest dairy co-operative, as well as a supplier of dairy ingredients in formulations

In addition to dairy ingredients, a range of grains (mainly wheat) and sugar derivatives are used in formulations. Total output is in excess of 36,000 mt per year, although capacity outweighs the current throughput, so there is room to expand. Around 26,000 mt of blends and pre-mixes are supplied into Japan each year from Intermix.

More recently, the company has developed a promising supply position into the China market, appointing Dah Chong Hong as its representative to establish a supply chain into China's food and beverage market.

Two key packaging formats are used:

- 25 to 30 kg multiwall, EVOH/90µM polythene-lined, heat-sealed paper bags
- 300 to 900 kg polypropylene woven IBC (bilk) bags with EVOH polythene liners

The company's range of products includes blends and pre-mixes, as well as intermediary stage products:

- Full cream milk powder-based blends & preparations
- Skim milk powder-based blends & preparations
- Milk protein blends and related products for nutritional, nutraceutical, functional food and food supplement applications
- Skim milk replacers
- Infant formula and related products (e.g. follow-on milk preparations, growing-up milk)
- Soy-based blends
- Blends of sugar, wheat flour and milk solids
- Cocoa liquor/milk solid blends
- Cocoa powder/milk solids blends
- Ice cream mix
- Milk shake/soft serve blends

15.0 BLENDS FROM OTHER SOURCES

- Blending in market is an important aspect of the blending industry, and dairy companies must target working with such in-market blenders
- Examples are given in this chapter, including:
  - Dairy Powders Thailand—Producing a range of fat-filled whey, skim milk replacers, milk replacer and whey replacer for feed applications
  - Phn & Itc Brazil—A blend trader, sourcing product for marketing to the local food industry. The example of Cream Milk Powder is given
  - Clover Products South Africa—Associated with Fonterra, this company is concentrating its efforts on low-cost filled creamers, fat content ranging from 50% to 20%. The product is wet mixed and spray dried for consistency in product delivery and performance, and is substituting for 100% dairy products

15.1 Dairy Powders Thailand

Dairy Powders Thailand blends various products, based on imported dairy and other raw materials. The company has a range of products based on dairy concentrates used for feeding young animals, as highlighted in the following table.

Table 15.1 Dairy Powders Thailand – product range

Product identity	Product description	Comment
Fat-filled whey	Topolac 50 L	Sweet whey powder blended with animal fat
	Topolac 50 P	Sweet whey powder blended with palm oil
	Topolac 50 PC	Sweet whey powder blended with palm oil and coconut oil
Skimmed milk replacer	Topolac 38	38% protein product
Milk replacer	DP Ecocalf	Milk replacer for rearing calves
	DP classiccalf	Milk replacer for rearing calves
Whey replacer	Topolac 11	

Source: Dairy Powders

In addition, the company has other dairy concentrate powders for the food and feed industries. Some of these products are as follows:

- DP 50 WL—a dairy concentrate with a high fat level, formulated as feed for young animals (especially suited for piglet feeding). Ingredients include lard and sweet whey powder. The product is available in 1,100 kg boxes, or 25 kg multiwall bags. Key characteristics include:

  - White powder, homogenous color, free flowing, nil scorched particles
  - Odor and taste – clean
  - Moisture – max. 3%
  - Crude protein – min. 5.4%
  - Crude ash – max. 4.7%
  - Free fat – max. 14%
  - Chloride – max. 1.5%
  - Sodium – max. 0.4%
  - Potassium – max. 1.4%
  - Crude fat – min. 48%

- DP 8 PA—used as a whole milk powder replacer. Can also be used in place of fat-filled skim milk powder. The product comprises a blend of dairy proteins, lactose and palm oil. Its use is targeted at ice cream, bakery, dairy beverages and chocolate industries, reconstituted by adding 0.9 liters of water to 130 g of DP 8 PA. Key attributes of the product include:

  - Economical to use versus SMP and WMP
  - Very high quality emulsion
  - Very smooth mouth feel
  - Consistent high quality
  - Excellent organoleptic properties
  - Moisture 3.5%
  - Lactose 69% (+/- 2.5%)
  - Protein 12% (11.0% min.)
  - Ash 7.5% (8.5% max.)
  - Fat 8.0% (+/- 1.0%)

15.2 PHN & ITC Brazil

This company produces a range of milk powder blends tailored for specific customer requirements. One example relates to Cream Milk Powder—a homogenous powder blend, free flowing, white/light cream colored, with a sweet dairy flavor. This product is a blend that is manufactured from sweet whey powder, buttermilk powder, maltodextrin, refined sugar, vegetable fat powder and full cream milk powder. Analytical data includes:

- Protein 27%
- Fat 27%
- Carbohydrates 64.5% (calculated by difference)
- Sugar 12.0% (calculated by composition)
- Moisture 2.6% max.
- Minerals 5.0%

15.3 Clover Products South Africa

Clover Products, in association with Fonterra Co-operative Group, has a range of blends available for the industrial market. An overview of these is as follows:

- Kremel—a spray dried blend of milk solids, corn syrup solids and vegetable oil. It contains 15% fat and 20% milk protein. Ingredients are: milk solids, corn syrup solids, vegetable fats, tri-calcium phosphate, di-potassium phosphate, and added vitamins A, D_3 & C. Chemical properties include:
  - Moisture max. 4.0%
  - Vegetable fat min. 15%
  - Protein (free fat dry matter) min. 20%
  - Reconstituted by adding 100 g of powder to 900 ml of water
- Superior Mix—a blend of whey powder and creamer, containing 13.5% vegetable fat and 6% milk protein. Ingredients are: whey solids, corn syrup solids, vegetable fat, di-potassium phosphate and an unspecified emulsifier. Chemical properties include:
  - Moisture max. 5%
  - Vegetable fat 11.5 to 15.5%

- Protein 4.0 to 8.0%
- Reconstituted by adding 100 g of powder to 900 ml of water

- Nu-Mel Dairy Powder—Nu-Mel medium-fat milk powder is a spray dried blend of bovine milk and other milk solids. It contains 28% protein, 11% butterfat and is fortified with vitamins A & D and iron. The ingredients are declared as: milk solids, moisture, vitamin A (added), vitamin D (added), ammonium iron citrate (added), anti-oxidant. The product is sold in retail packs, and is positioned as a nutritious family beverage and for use in cereal and coffee. The product is used as a standard milk substitute, and is reconstituted by adding 100 g of the product to 1 liter of water

- Non-dairy creamers & whiteners—these are packed in 25 kg bags, and are available in a range of fat levels:

  - ***Creamer with 50% fat***—a blend of corn syrup solids, vegetable fat, milk solids and casein presented in powder form, with added stabilizer, emulsifier, colorants and free-flow agents. It is used as a coffee or tea creamer, and also in the baking industry. Chemical specifications include: moisture 3.0% max., fat 47.0% min., protein (N x 6.38) ~2.0%, carbohydrate ~45%, minerals ~3.0%
  - ***Creamer with 34% fat***—a blend of corn syrup solids, vegetable fat, milk solids and casein presented in powder form, with added stabilizer, emulsifier, colorants and free-flow agents. It is used as a coffee or tea creamer, and also in the baking industry. Chemical specifications include: moisture 3.8% max., fat 33% min., protein (N x 6.38) ~2.0%, carbohydrate ~59%, minerals ~3.0%
  - ***Creamer with 30% fat***—a blend of corn syrup solids, vegetable fat, milk solids and casein presented in powder form, with added stabilizer, emulsifier, colorants and free-flow agents. It is used as a coffee or tea creamer, and also in the baking industry. Chemical specifications include: moisture 3.8% max., fat 29.0% min., protein (N x 6.38) ~2.0%, carbohydrate ~63%, minerals ~3.0%
  - ***Creamer with 24% fat***—a blend of corn syrup solids, vegetable fat, milk solids and casein presented in powder form, with added stabilizer, emulsifier, colorants and free-flow agents. It is used as a coffee or tea creamer, and also in the baking industry. Chemical specifications include: moisture 3.8% max., fat 23.0% min., protein (N x 6.38) ~2.0%, carbohydrate ~68%, minerals ~3.0%

- ***Creamer with 20% fat***—a blend of corn syrup solids, vegetable fat, milk solids and casein presented in powder form, with added stabilizer, emulsifier, colorants and free-flow agents. It is used as a coffee or tea creamer, and also in the baking industry. Chemical specifications include: moisture 3.8% max., fat 19.0% min., protein (N x 6.38) ~2.0%, carbohydrate ~72%, minerals ~3.0%

16.0 STRATEGIC ASSESSMENT

16.1 The International Traded Market for Dairy Blends

16.1.1 Korean imports

There is little doubt that the market for dairy blends is expanding. Anecdotal evidence gives support to this premise, with many industry participants and observers suggesting that this is happening in a number of key areas.

Indeed, the study of the Korean market for selected dairy blends shows an upward trend—particularly in the 0404 H.S. Code—despite some fluctuations between years. The trends are illustrated in the following table.

Table 16.1.1a Recent trends in South Korean dairy blend imports

HS Code	Brief description	2001, mt	2002, mt	2003, mt	2004, mt	2005, mt
1806.20.9010	Cocoa preparation containing 50% or more milk powder > 2 kg packs	6,587	7,968	6,174	7,941	7,889
1806.90.9010	Cocoa preparation containing 50% or more milk powder < 2 kg packs	346	483	269	740	57
0404.90.0000	Dairy blends, consisting of SMP/WMP & whey, whey permeate, MPC, milk permeate, etc.	11,450	13,946	6,312	21,643	22,331
1901.90.2000	Dairy constituents with added dextrin, fiber, coconut oils, flour, etc.)	6,765	7,766	6,401	7,968	6,377
Total		**25,148**	**30,163**	**19,156**	**38,292**	**36,654**

Source: Korea Customs

The reasons given for the strength in dairy blend imports into South Korea are summarized as follows:

- High import duties for standard dairy products

- The stable nature of the market, and acceptance of blends by industrial users
- A tight production quota system for domestic milk supply to combat the over supply of manufactured dairy products; thus, impact of local surpluses on dairy blend trade is expected to lessen in the foreseeable future
- The concentration of dairy blend business into the hands of a few manufacturers and end users

The prospects for U.S. trade in dairy blends into the South Korean market will be affected by the Free Trade Agreement currently under negotiation by these two countries.

16.1.2 Australian exports

In addition to the Korean situation, through the course of this report Landell Mills has traced trends in exports of dairy blends from Australia over the past three years, with volume indicated as follows:

- 2003 151,500 mt
- 2004 172,750 mt
- 2005 172,300 mt

As added credence to this Australian data, Intermix Australia Pty Ltd, a specialist dairy dry-mix, blending and pre-mix company, commenced operations in the early 1990s. Since then the company has built its business to reflect the following current business:

- Output 36,000+ mt total blends
- Sales to Japan 26,000 mt

On the basis that Australia represents 10% of total globally traded dairy products, an extrapolation of Australian trade data indicates that the volume of globally traded dairy blends is on the order of 1.7 million mt.

16.2 Whey as a Blending Component

One of the fundamental understandings of this study is that all whey could be used in blends. Use of whey in blends comes about by one of three means:

- As part of a primary mix
- As a secondary blend component, supplied in pre-blended fashion to users
- Supplied in its own right as an ingredient for pre-blending at the point of manufacture

Thus, with growth in whey output, there is growth in blends. While it is difficult to assess the exact nature and volume of whey used in blends, especially due to lack of trade data, the following indicators are understood:

- Global whey production is 94 million mt p.a.
- Up to 75% of this volume is used in feed applications, with much of the whey powder used in feed delivered pre-blended or blended in situ
- Value-added whey products are typically used in value-added dairy and non-dairy blends
- Key whey markets will roughly reflect the key whey blend markets. These are:
  - China
  - Canada
  - Mexico
  - Japan
  - South Korea
  - Thailand
- There is significant growth in value-added whey output. Much of this is used in blending applications, including:
  - Infant formula
  - Dry mixes
  - Dairy formulations
  - Bakery

- Enriching other products (e.g. WPC, WPI)
- Nutritional bars
- Oral care products
- Confectionery

Of key concern to all whey producers is the issue of whey permeate utilization.

16.3 Growth Areas for Dairy Blends

The report identifies some clear growth areas for dairy blends. These are summarized as follows:

- Continuing growth in conventional global food sectors:
  - Ice cream—potential for up to 88,750 mt p.a. of whey solids to be used in ice cream manufacture, delivered in blends. Of this, it is estimated that a maximum of 22,000 mt is currently pre-blended before delivery to the ice cream factory
  - Yogurt—potential for up to 80,000 mt p.a. of whey solids to be used in yogurt manufacture
  - Bakery industry—potential for up to 600,000 mt p.a. of dairy solids to be used as mixes and/or blends in the bakery industry
  - Infant formula—an estimated600,000+ p.a. mt of dairy ingredients could be used in the global infant formula market, and of this, internationally traded volume could be 500,000+ mt p.a.

- Products designed to circumvent trade barriers. This is happening in three key areas:
  - Blended proteins, such as Ingredia's PROMILK
  - Butteroil/sugar blends, such as what is occurring in Canada, and appears to be happening in Japan
  - In SMP/WMP replacers—particularly those that have a whey product constituent that delivers comparable milk solid attributes but does not attract the duty and/or quota situation for the products that they are replacing. While SMP replacers can include MPC, there are also skim/whey, skim/whey/buttermilk blends, and even products that have replaced part of the MSNF with non-dairy constituents

- Protein blends—particularly targeting the nutritional bar market, but with carry-over use in a range of nutritional and clinical applications. This is strong in the North American market, with further use in Europe and Japan. Other Asian markets are expected to follow, but are smaller and/or slower to develop. Blends that are used in this market which are of interest to dairy companies are dairy and dairy/non-dairy blends, both proprietary and non-proprietary

- Cheese blends—including cheese powder blends as well as cheese blends per se—are used in a growing range of mainstream applications, such as:

  - Pizzas (toppings, sauces)
  - Cheese sauces
  - Pasta side dishes
  - Soup
  - Spaghetti dishes
  - Cheese balls
  - Breadsticks
  - Dips
  - Savory biscuits
  - Savory snacks

- GOS-based blends—there is an emerging market for GOS blended with other dietary fibers (inulin, FOS) and used as a prebiotic in food products. While not yet a large market, a number of factors are important to consider at this early stage:

  - It signals evolving recognition of dairy carbohydrates in prebiotic applications
  - Potential may be greatest in the large prebiotic markets such as Japan and Western Europe
  - There may be carryover potential for other dairy carbohydrates (lactulose, lactosucrose, lactitol, lactose)
  - Symbiotic blends could be developed with specific probiotics for cultured functional foods (e.g. set yogurt, drinking yogurt, cheese)

- Dairy components used as food additives—three growth food additive markets are discussed in the report: emulsifiers, compounded flavors and fat replacers. A selection of discrete dairy ingredients has a role as food additives in food systems. Key considerations include:
  - There are a range of co-functionalities that dairy components can bring to a food system
  - Dairy ingredients allow food companies to maintain a natural, wholesome and GMO-free image in label declaration and product positioning terms

16.4 Changes in the Main User Sectors

A number of changes have taken place in the main user sectors that impact the opportunity for blends. These sectors, and the changes, are highlighted in the following table.

Table 16.4 Developments in the key dairy blend user sectors

User sector	Changes	Impact on blends	Likely future situation
Ice cream	Continuing growth, especially in Asia	Organic growth in blend demand	Expected to continue into the foreseeable future, particularly as per capita consumption of ice cream expands in high prospect developing markets such as China, Indonesia and South Asia
	Cost pressures due to increased dairy prices and stronger competition	More focus on driving cost out of the business	Increase in low-cost formula, possibly with growth in filled ice creams, more opportunity for whey-based SMP replacers
Yogurt	Continuing growth in all markets	Strengthening organic growth in blend demand	Expected to gain even more momentum into the foreseeable future—with opportunity for blends and pre-mixes to carry over into related areas (drinking yogurt, LAB drinks, other fermented dairy products such as labneh and laban)
	New knowledge about the use of blends in yogurt	Increased uptake of blends in yogurt formulations	Will gain greater traction in the future as whey and other low-cost ingredients are delivered with greater product consistency

User sector	Changes	Impact on blends	Likely future situation
	Cost pressures due to increased dairy prices and stronger competition	More focus on driving cost out of the business	Increase in low-cost formula, more opportunity for whey-based SMP replacers
Infant formula	Continuing growth, particularly in Asia, Latin America and Africa	As these are largely import-dependent regions, continuing opportunity for global trade	Expansion in volume opportunity
	Concerns in some quarters about efficacy and safety of soy formula	Vacuum will largely be picked up by dairy formulations	Further differentiation of product offerings (e.g. fortification with Igs, growth factors, nucleotides, etc. to more closely resemble breast milk)
Bakery products	Continuing growth in developing markets of Asia and South America	Dairy will not be an automatic choice for blends in all cases	Milk fat will not be competitive in these markets, so there's a real need to determine the preferred vegetable oil(s) to formulate for bakery sub-sectors when blended with SMP, whey powder, WPC, etc.
	Consumers are seeking greater taste experiences	Opportunities for cheese blends that deliver new taste profiles across a range of bakery, snacking and related items to secure a greater market foothold	Low-cost imitation flavors, soy-based cheeses could take a hold in this market
Nutritional formulations	Massive shift in awareness leading to growth	Protein blends are in high demand for this market	Most blenders are seeking a specific amino acid profile; therefore seeking a variety of protein sources to deliver this
	Demand for clear nutritional beverages and sports beverages is growing	Seeking hydrolyzed and bioactive proteins for this sector	Increased competition from lower-cost vegetable and collagen protein hydrolyzates

User sector	Changes	Impact on blends	Likely future situation
	Growth in meal replacement items (drinks, bars)	Very select specifications for any application. Variables will include heat stability, viscosifying effect, emulsifying capacity, solubility, nutritional credentials, bioactive attributes, delivery of sensory attributes, etc.	Impact on cost may make small volumes of any highly specified product prohibitively expensive. Niche manufacturers like New Zealand's Tatua Co-operative Dairy may find a role in supplying highly specified, low-volume blend ingredients

Source: Landell Mills analysis

16.5 Opportunities for U.S. Dairy Suppliers

16.5.1 Overview

From all the foregoing there is little doubt that the blends market is alive and well. The U.S. dairy industry has an intrinsic interest in developing its presence in the blends market from a number of perspectives:

- As the fourth largest global dairy commodity exporter, it must be performing on this basis in key markets with blends
- Many of the markets it services with whey, lactose and SMP in Asia and South America are large (and potentially larger) blends markets that could target current U.S. dairy trade
- As a major global whey producer, and recognizing the potential for almost all whey to be used in blends, the U.S. should be amongst the leaders in developing applications for whey – as blends as well as in other formats
- Whey permeate disposal is an ongoing issue for the U.S. (and other producers) – a blend-based solution would therefore be a strategic benefit
- Similarly, as a major global cheese producer, with a growing presence in strategic cheese markets, the U.S. could develop a strong presence in the cheese blend market

Opportunities for the U.S. as a dairy producing nation exist in a select range of areas. These are highlighted as follows, and it is highly recommended that specific studies are undertaken to look precisely at the opportunities for:

- Protein blends
- Cheese blends
- Filled milk powder products
- Whey-based SMP replacers
- Whey permeate-based whey replacers
- Dairy blend exports into the South Korean market under a widely anticipated new FTA regime between the two countries

16.5.2 Protein blends / cheese blends

Of greatest interest is the fact that the U.S. is a strong supplier into its domestic market of a range of protein blends and cheese blends. These are two high profile areas that are expected to grow further in terms of global blends trade, with likely market potential existing as follows (in a rough order of potential priority):

- Protein blends – Europe, Japan, Canada, other East Asia
- Cheese blends – Mexico, South America, East Asia, S.E. Asia, China

Given the excellent track record that the U.S. has in developing these products, and succeeding with them in the U.S. domestic market, it can piggy-back off this expertise by either exporting intact blends, or licensing offshore blenders to use the technology on the basis of sourcing ingredients from the U.S.

Thus an immediate competitive advantage is available by virtue of a successful track record, and this provides a platform for building these businesses.

16.5.3 Filled milk powder products / SMP replacers / whey replacers

The opportunity for filled milk powder/SMP replacers/whey replacer products has not been specifically assessed from a quantitative basis in this report. However, it is clear that:

- SMP replacers are the pioneering fundaments of the blend market
- Landell Mills is now seeing fat filled whey and whey replacers coming into play as companies seek novel and more cost effective ways of utilizing ingredients for performance and profit (cost) reasons
- The call for SMP replacers, fat filled dairy powders, and the recent advent of whey replacers are especially evident during this period of high dairy commodity prices
- Whey replacers offer an opportunity for a great variety of formulation offers, largely based on objective (cost) and target application
- Of major interest is the opportunity to use whey permeate as a basic carbohydrate source to be built upon – dairy and/or non-dairy proteins would be added for cost/functionality, along with the addition of selected (low cost) non-dairy fats, with possible micro-nutrient fortification, to provide:
  - A low cost nutritionally balanced formulation base for the food industry, and
  - A very low cost milk powder replacer for markets where wholemilk powder and traditional replacers are not gaining purchase for reasons such as availability, price, taste, etc
- Greater demand is also expected in the short- to medium-term in poorer nations (e.g. the African continent, Bangladesh) whereby conventional dairy commodities are prohibitively priced to a large sector of the community – whereas fat filled milk powder, whey replacers and the like could be effectively used in two presentation formats:
  - In formulated low cost, nutritionally balanced consumer presentations (powder, pre-mixes for RTD beverages, low-end market nutritionals, etc)
  - As dairy ingredients (SMP replacers, WMP replacers, whey replacers) for the food processing industries

Moreover, Landell Mills does know of new interest by a number of competitive dairy industry players in this and related areas, vis-à-vis:

- N.Z. and Australia – these manufacture fat-filled milk powders, although they have no natural advantage in cost of vegetable oil procurement. Indeed, Fonterra has associated with Clover Corporation in South Africa to market a range of fat filled milk powders with varying fat levels for African markets that have a natural inclination to the taste delivered by such formulations, along with a need for low cost food solutions
- Euroserum – advanced its product range to include a comprehensive range of fat-filled whey powders – thereby recognizing a role for whey as a carrier of non-dairy fat to provide SMP/whey powder replacers
- Confranlait – markets a comprehensive range of high fat/fat filled dairy powders
- Kievit – marketing fat filled powders (up to 80% lipid content)
- Armor Proteines marketing a range of fat filled powders – including product made from palm oil, coconut oil, and hydrogenated soy oil
- Ingredia – marketing a full range of filled dairy products, with individual products substituting for anything from 50-100% of conventional milk solids
- Kerry Ingredients has developed a range of specialty lipid/dairy blends – this is probably a second stage development

16.5.4 South Korea

The outcome of the current FTA negotiations between South Korea and the U.S. has the potential to affect the dairy blend market significantly. The U.S. is seeking an opening to this market through lower tariffs, and should prove an opportunity to usurp a share of imports from New Zealand, EU and Canada. The success of the FTA will position the U.S. to overcome the low ceilings related to the TRQs – particularly with regards to the two relevant HS Codes 0404.90.0000, 1901.90.2000.

16.6 A Strategic Perspective on Dairy Companies as Food Additive Companies

This final section of the report aims at re-orientating the thinking of dairy companies. Many have raised their profile from dairy commodity marketers to food ingredient marketers. However, Landell Mills believes it is time for innovative, far-sighted dairy companies to expand their horizons beyond the notion of food ingredients and to take on the mantle as food additive companies. And such a role will squarely position them in a function of tailoring solutions to the food industry by developing and supplying dairy blend-based food additives.

World trade in food additives is significant and quite diverse, covering a wide range of products and applications. The global market is currently estimated by Leatherhead to be in the order of US$ 25 billion p.a., with growth in almost all sectors. The key thrusts giving impetus to these trends include:

- A global trend towards increased consumption of prepared and processed foods and beverages, with volumes increasing in markets such as China, India and Latin America
- Growth in demand for convenience foods
- A rapid uptake in health and nutritional platforms
- Developing markets for natural and organic foods
- Continuing pressure by consumers on taste and quality in food consumption

The size and prospected for the food additives market is provided by the following table.

Table 16.6 Structure and growth prospects for food additives market

Category	Forecast market value (US$ millions, 2007)	Projected annual growth (% value change, p.a. 2004-07)
Flavors	6,550	3.0
Functional food ingredients	4,870	10.4
Hydrocolloids	3,500	2.4
Flavor enhancers	2,860	0.7

Category	Forecast market value (US$ millions, 2007)	Projected annual growth (% value change, p.a. 2004-07)
Acidulants	2,250	1.1
Sweeteners	1,800	0.9
Colors	1,155	2.1
Fat replacers	1,250	6.3
Enzymes	820	2.6
Emulsifiers	775	3.5
Preservatives	720	3.5
Vitamins & minerals	410	0.4
Antioxidants	325	3.9
Total	**27,285**	

Source: Landell Mills based on official statistics and trade sources

In this report it has been clearly stated that many dairy ingredients, dairy compounds and dairy derivatives have attributes that effectively position them as food additives. These may be available in their own right (e.g. D-tagatose as a sweetener), or by virtue of their natural role as a constituent in a recognized dairy product (e.g. the naturally high lecithin content of buttermilk powder, with its emulsifying characteristics).

However, the essence of this is that by virtue of these credentials, dairy ingredients, dairy compounds and dairy derivatives are unabashedly legitimate and primary candidates to be presented as food additive compounds in dairy and non-dairy blends that are used in food formulations. Furthermore, the notion of blends is in no small way about bringing such components together.

A range of examples are given in the report, ranging from cGMP, CPP, D-tagatose, fatty acids/esters, lactoperoxidase, lactose derivatives, milk mineral complex, caseinates, WPC, etc. The discussion centers on dairy being used as a food additive in three key areas, all of which from the preceding table show strong growth prospects:

- Emulsifiers
- Compounded dairy flavors
- Fat replacers

Indeed, the example of Simplesse WPC – both in its own and as a blend (WPC combined with an emulsifier blend) is given in the report. The notion of co-functionality whereby the use of dairy ingredients provides more than one physico-chemical property is delivered by such blend-based products as Simplesse by virtue of their role as emulsifiers and fat replacers.

Thus, it is recommended that U.S. dairy companies expand their vision and perspective on their market opportunities. Dairy commodity companies that have raised their view to consider their role as food ingredient companies can step up further and start taking on the role as food additive companies.

APPENDIX I: KOREAN HS CODES FOR DAIRY BLENDS AND COCOA PREPARATIONS

- **HS code: 0404**

0404:	Whey, whether or not concentrated or containing added sugar or other sweetening matter; products consisting of natural milk constituents, whether or not containing added sugar or other sweetening matter, not elsewhere specified or included
0404.10:	1. Whey and modified whey, whether or not concentrated or containing added sugar or other sweetening matter
0404.10.10:	A. Whey
0404.10.10.10:	Whey powder
0404.10.10.90:	Other
0404.10.2:	B. Modified whey
0404.10.21:	(1) Whey from which all or part of the lactose, proteins or minerals have been removed.
0404.10.2110:	(a) Lactose removed
0404.10.2120:	(b) Demineralized
0404.10.2130:	(c) Whey protein concentrates
0404.10.2900:	(d) Other
0404.10.2900:	(2) Other
0404.90.0000:	2. Other

- **HS code: 1806**

1806:	Chocolate and other food preparations containing cocoa
1806.10.0000:	1. Cocoa powder, containing added sugar or other sweetening matter
1806.20:	2. Other preparations in blocks, slabs or bars weighing more than 2kg or in liquid, paste, powder, granular or other bulk form in containers or immediate packagings, of a content exceeding 2kg
1806.20.1000:	A. Chocolate and chocolate confectionery
1806.20.90:	B. Other
1806.20.9010:	*Cocoa preparation containing 50% or more by weight of milk powder*
1806.20.9090:	Other

1806.90: 4. Other

1806.90.1000: A. Chocolate and chocolate confectionery

- **HS code: 1901**

Malt extract; food preparations of flour, meal, starch or malt extract, not containing cocoa powder or containing cocoa powder in a proportion by weight of less than 50%, not elsewhere specified or included; food preparations of goods of heading Nos. 0401 to 0404, not containing cocoa powder or containing cocoa powder in a proportion by weight of less than 10%, not elsewhere specified or included

1901.10: Preparations for infant use, put up for retail sale

1901.10.10. A. Food preparations of goods of headings 0401 to 0404

1901.10.1010: Prepared dry milk

1901.10.1090. Other

1901.10.90 B. Other

1901.10.9010 Of oatmeal

1901.901000 Malt extract

1901.90.90 C. Other

1901.90.9010 Oatmeal

1901 90.2000 Food preparations of goods of headings 0401 to 0404

APPENDIX II: PRODUCT EXAMPLES USING SIMPLESSE AS A FAT REPLACER

Starkist Seafood – Lunch-To-Go

Brand: Starkist

Market: Singapore

Product category: Prepared meals

Product description: Complete lunch pack with 3oz of Starkist tuna in a flavor fresh pouch, mayonnaise and relish packs with mixing spoon, six crackers and mint

Ingredients: Tuna: light meat tuna, water, vegetable broth (contains soy), salt; crackers: wheat flour, palm oil, sugar, coconut oil, contains 2% or less of leavening (sodium bicarbonate, sodium acid pyrophosphate, monocalcium phosphate), salt; reduced calorie mayonnaise: water, soybean oil, vinegar, modified food starch, high fructose corn syrup, egg whites, microcrystalline cellulose, salt, whey protein concentrate (all natural Simplesse brand), sodium benzoate and potassium sorbate (preservatives), xanthan gum, spices, natural flavor, onion powder, garlic powder, calcium disodium EDTA, oleoresin paprika, oleoresin turmeric; sweet relish: pickles (cucumbers, water, salt, vinegar), high fructose corn syrup, cabbage, corn syrup, distilled vinegar, salt, dextrose, natural flavoring, sodium benzoate and potassium sorbate (preservatives), xanthan gum, alum, locust bean and guar gums, dehydrated red peppers, oleoresin turmeric, FD&C yellow No. 5, blue No. 1, polysorbate 80; mint: sugar, glucose syrup, water, peppermint flavor, FD&C blue No. 1, FD&C yellow No. 5

Lacticinios Mexicanos – Cheese

Brand: Chen Light

Market: Mexico

Product category: Cheese

Product description: Reduced calorie Queso Cheese

Ingredients: Aged cheese, water, milk solids, sodium caseinate, Simplesse (milk protein), sodium citrate, salt, acidulates, preservatives, natural colorant

Hy-Vee Manufacturing – Vodka Sauce

Brand: Hy-Vee Grand Selections

Market: U.S.

Product category: Sauces & seasonings

Product description: A private label vodka sauce product

Ingredients: Imported Italian tomatoes, pure olive oil, fresh onions, imported Romano cheese (sheep milk, rennet, salt, enzyme), parmesan cheese (pasteurized part skim milk, cheese cultures, salt, enzymes, powder cellulose, potassium sorbate), Simplesse 100, vodka, fresh basil, fresh garlic, sea salt, sugar, citric acid, spices

Masily – Meal Replacement Beverage

Brand: Stop Calory

Market: Argentina

Product category: Weight control food

Product description: A low calorie, instant meal replacement drink mix. It is a source of proteins and fiber claimed to provide a diet rich in energy. It is available in chocolate, vanilla and banana flavors and is available in a 360g metal can, 4 x 30g sachets, 10 x 30g sachets or 24 x 30g sachets

Ingredients: Chocolate variety: soya protein concentrate, whey milk protein concentrate (Simplesse), crystalline fructose, polydextrose (dietary fiber), maltodextrin, powdered skimmed milk, powdered cocoa, chocolate essence, gum guar, carboxymethycellulose, vanilla essence, aspartame (150mg/100g)

APPENDIX III: PRODUCT EXAMPLES USING PROPRIETARY PROTEIN BLENDS

Aussie Bodies – Wafer Bar

Company: Aussie Bodies, 282 Normanby Road, Port Melbourne, VIC 3207, Australia

Brand: Protein Break

Product category: Confectionery

Product description: Protein Break Creamy Peppermint Protein Boost Wafer Bar is said to be deliciously crisp layers wafer and cream covered in chocolate, with an added protein boost for health, shape and vitality. It is claimed to contain fewer calories, less saturated fat and less carbohydrates then standard wafer bars, and is free from artificial colorings and flavors

Ingredients: Aussie Bodies protein blend 43% (whey protein concentrate, wheat protein isolate), milk compound chocolate 21% (sugar, vegetable fat, full cream milk powder, cocoa, milk solids non fat, cocoa liquor, emulsifier: 322, 492, flavor, salt), vegetable shortening, water, flour, sunflower oil, emulsifier: 322; 476, fructose, thickener: 1420, glucose syrup, salt, sweetener (splender sucralose), flavors, raising agent

Dairy blend: Aussie Bodies proprietary protein blend comprising WPC, wheat protein isolate

Power Bar Foods – PowerBar Triple Threat 3 Bar Pack

Company: Powerbar Foods, Box 112, 2325 Nurontario Street, Mississauga, Ontario L5A 4C7, Canada

Brand: Powerbar Triple Threat

Product category: Snack bar

Product description: Powerbar Triple Threat is available in a three bar pack. The pack of three units x 53 g includes two caramel peanut fusion flavor and one chocolate caramel fusion flavor bar. A unique game code is featured inside the pack, with the rules explained on the reverse of pack

Ingredients: Chocolate coating (sugar, fractioned palm kernel oil, cocoa powder, whey powder, soy lecithin, vanilla), caramel (corn syrup, sugar, cream, water, fructose, palm oil, soy lecithin, salt, sodium phosphate, flavor, carrageen), corn syrup, trisource protein blend (whey protein isolate, calcium caseinate, soy protein isolate), maltitol syrup, oat fiber, glycerin, (vegetable source), soy crisps (soy protein isolate, tapioca starch, salt), pyridoxine hydrochloride (vitamin B6), riboflavin (vitamin B2), thiamine monoitrate (vitamin B1), vitamin A palmitate, folic acid, biotin, cholécalciférol (vitamin D), cyanocobalmine (vitamin B12), potassium phosphate, calcium carbonate, calcium phosphate, magnesium oxide, ferrous, fumarate (iron), zinc oxide, manganese sulphate, copper gluconate, potassium iodide

Dairy blend: Trisource proprietary protein blend comprising WPI, calcium caseinate, SPI

Met-Rx – Protein Bar

Company: MET-Rx, Boca Raton, Florida 33487, United States

Brand: Met-Rx Protein Plus

Product category: Snack bar

Product description: Met-Rx Protein Plus is available in a Chocolate Chocolate Chunk flavor and contains 19g protein, 0g trans fat, 2g net carbohydrate and metamyosyn protein. The product has been reformulated and now contains 85% less sugar than the original bar

Ingredients: Chocolate flavored layer (maltitol) syrup, milk protein concentrate, unsweetened chocolate, fractionated palm kernel oil, cocoa (processed with alkali), glycerin, soy lecithin, salt, natural flavor), chocolate flavored coating (maltitol, fractionated palm kernel oil, milk protein concentrate, cocoa, calcium caseinate, soy lecithin, natural flavor), Metamyosyn VVP protein blend (milk protein concentrate, calcium sodium caseinate, whey protein isolate, hydrolyzed whey protein, whey protein concentrate, egg white, L-glutamine), hydrolyzed gelatin, glycerin, water, chocolate flavored chips (maltitol, unsweetened chocolate, cocoa butter, soy lecithin, natural flavor), maltitol syrup, natural and artificial flavor, coca (processed with alkali), salt, fructo-oligasaccharides, inulin, high oleic sunflower oil, vitamin and mineral blend (calcium phosphate, magnesium oxide, ascorbic acid, alpha tocopherol acetate, niacinamide, zinc oxide, copper gluconate, calcium D-pantothenate, ferric orthophosphate, vitamin A palmitate, pyridoxine hydrochloride, riboflavin, thiamin mononitrate, folic acid, biotin, potassium iodide, cyanocobalamin), caramel color, sucralose, maltodextrin

Dairy blend: Metamyosyn proprietary protein blend comprising MPC, calcium & sodium caseinate, WPI, hydrolyzed whey protein, WPC, egg white, L-glutamine

Labrada Nutrition – Trail Mix Nut Bar

Company: Labrada Nutrition, 403 Century Plaza Drive, Suite 440, Houston, TX 77073, United States

Brand: Labrada Rockin' Roll

Product category: Snacks

Product description: Labrada Rockin' Roll brand is Trail Mix Hi-Protein Nut Roll Bar. It contains caramel, nougat, peanuts, cranberries, raisins and almonds. It only contains nine insulin-impacting carbohydrates and is available in a 70g bar

Ingredients: Dry roasted peanuts, LeanPro nut roll protein blend (whey protein isolate, soy protein isolate, milk protein isolate, sodium caseinate) maltitol syrup, glycerin, raisins, dry roasted almonds, polydextrose, sweetened cranberries, hydrolyzed gelatin, fractioned palm kernel oil, gum arabic, natural and artificial flavors, soy lecithin, butter, sucrose

Dairy blend: LeanPro proprietary nut roll protein blend comprising WPI, SPI, MPI, sodium caseinate

PVL Nutrient – 2 Good Protein Bar

Company: PVL Nutrients, 101-1551 Broadway Street, Port Coquitlam, BC V3c 6N9, Canada

Brand: Whey Gourmet 2 Good!

Product category: Snack bar

Product description: Whey Gourmet 2 Good! Protein Bar, in a peanut butter chocolate flavor. It is available in a 98g bar

Ingredients: Gourmet protein pre-blend (whey proteins, milk protein isolate, calcium caseinate), caramel (fructose, condensed milk, butter, fractionated palm kernel oil, mono & di-glycerides, salt, soy lecithin, water, disodium phosphate), chocolate coating (sugar fractionated palm kernel oil, cocoa, milk powder, soy lecithin, natural flavor), high fructose corn syrup, roasted peanuts, peanut butter, glycerin, soy protein, isolate, MCT oil from fractionated coconut oil, canola oil, peanut flour, peanut extract, natural flavor, salt, soy lecithin, guar gum

Dairy blend: Gourmet proprietary protein pre-blend comprising whey proteins, MPI, calcium caseinate

Protica Nutritional Research – Profect Protein Beverage

Company: Protica Nutritional Research – PO Box 635, Lafayette Hill, PA 19444, United States

Brand: Protica

Product category: Beverages

Product description: The Protica brand has released Profect Protein Beverage, a hypoallergenic capsulized food. It is said to taste great and is free from fat, carbohydrates and preservatives. It is available in a range of flavors including this Blue Raspberry Swirl variety. It is available in a 86ml tube

Ingredients: Pure deionized water, Actinase (patent pending blend of enzymatically hydrolyzed (predigested) collagenic protein isolate, whey protein isolate, and casein protein isolate), less than 2% malic acid, vitamins (ascorbic acid (C), niacin (B3), pantothenic acid (B5), pyridoxine (B6), riboflavin (B2), thiamin (B1), folic acid, biotin and cobalamin (B12)), natural flavors, acesulfame-potassium, blue 1 and red 40

Dairy blend: Actinase proprietary blend comprising enzymatically hydrolyzed collagenic protein isolate, WPI, casein protein isolate

Solo GI Nutrition – Low Glycemic Nutrition Bar

Company: Solo GI Nutrition, 10250-176 St., Edmonton, Alberta T5S 1L2, Canada (www.solo-gi.com)

Brand: Solo GI

Product category: Snacks

Product description: Solo Gí Low Glycemic Nutrition Bar in Mint flavor is claimed to sustain energy and to be suitable for everyone. This product is certified kosher, contains 24 vitamins and minerals and 11g protein, and is a good source of fiber. It is available in a 1.76-oz pack. Also available in this range are Peanut Butter; Chocolate Charger; and Berry Blue varieties

Ingredients: Solo Gi™ protein blend (cocoa soy crisp (soy protein isolate, rice starch, cocoa), whey protein isolate, whey protein concentrate), chocolate coating (sugar, fractionated palm kernel oil, cocoa powder, whey powder, skim milk powder, soy lecithin, natural flavor), fructose, almond butter, fruit puree blend (dried plums, dried dates, white grape juice concentrate), chocolate cookies (wheat flour, cane juice crystals, canola oil, cocoa, salt, sodium bicarbonate), brown rice syrup, cocoa powder, water, Solo Gi™ fiber blend (inulin, oat bran concentrate), vitamin and mineral blend (dicalcium phosphate, magnesium oxide, ascorbic acid (vitamin C), vitamin E acetate, niacinamide (vitamin B3), zinc oxide, copper gluconate, D-calcium pantothenate, manganese sulfate, pyridoxine (vitamin B6), riboflavin (vitamin B2), thiamin mononitrate (vitamin B1), vitamin A palmitate, chromium chloride, folic acid, biotin, potassium iodide, sodium molybdate, sodium selenite, phytonadione (vitamin K1), cholecalciferol (vitamin D3), cyanocobalamin (vitamin B12)), natural flavor

Dairy blend: Solo Gi™ proprietary protein blend, comprising cocoa soy crisp, WPI, WPC

Biochem – All Natural Milled Flax Energy Snack

Company: Biochem, 180 Vanderbilt Motor Pky., Hauppauge, NY 11788, United States (www.biochem-fitness.com)

Brand: Sierra Bar

Product category: Snack bar

Product description: Sierra Bar All Natural Milled Flax Energy Snack is soft-baked, free from trans fat, and contains plenty of protein. This product uses certified organic milled flax. It is available in three flavors: Chocolate Chip; Peanut Butter Chip; and Cranberry

Ingredients: Proprietary protein blend (cross-flow micro filtered whey protein concentrate, wheat protein isolate), all natural corn syrup, whey crisp (whey protein isolate, whey protein concentrate, tapioca starch, calcium carbonate), chocolate chips (sugar, chocolate liquor, cocoa butter, dextrose, whey, soy lecithin), certified organic milled flax, sucrose, light brown sugar, liquid whole egg, palm oil, natural flavors, baking soda, konjac flour

Dairy blend: A proprietary protein blend comprising cross-flow micro-filtered WPC, wheat protein isolate

APPENDIX IV: PRODUCT EXAMPLES USING NON-PROPRIETARY PROTEIN BLENDS

Bionic – Protein Bar

Company: Bionic, 68 Reedbuck Crescent, Gauteng, South Africa

Brand: BioFuel

Product category: Snack bar

Product description: Biofuel Protein Bar with CLA has a chocolate flavor, is high in carbohydrates and protein and free from sugar. Also available is a lemon flavored energy bar

Ingredients: Protein Bar: protein blend (soya isolate, whey protein concentrate, milk protein isolate), sorbitol syrup, lactitol, milk chocolate coating (lactitol, vegetable fat, skimmed milk powder, whey, cocoa powder, lecithin, vanilla), fructose, sugar, glycerol syrup, lecithin, soya, vegetable fat, cocoa powder, glycerol, monostearate, CLA, vitamin blend, salt, nature identical flavoring

Dairy blend: A non-proprietary protein blend comprising SPI, WPC, MPI

Nutrilite – Protein Bar

Company: Amway, Nutrilite Division, United States

Brand: Nutrilite Positrim

Product category: Snack bar

Product description: Nutrilite Positrim Protein Bar is Fudgy Brownie Flavor with Almonds is claimed to be a great-tasting and convenient way to get the essential protein in the diet, without the extra carbohydrates and saturated fats. Two or three bars can be eaten a day, as a nutritious snack. Each bar provides 22 grams of high quality protein that provide all 9 essential amino acids; 3 grams of available carbohydrates and 18 grams of glycerin and maltitol, which may be valuable for those restricted/controlled carbohydrate diets. These ingredients have a minimal effect on blood sugar/glucose levels. It also contains 250 calories and is sugar free. There are no artificial additives or preservatives

Ingredients: Protein blend (whey protein isolate, soy protein isolate, whey protein concentrate, hydrolyzed whey isolate), glycerin, maltitol, sunflower oil, soy nuggets (soy protein isolate, rice flour, malt), cocoa (processed with alkali), gelatin, almonds, tricalcium phosphate, natural flavor, lecithin, salt, sucralose

Dairy blend: A non-proprietary protein blend comprising WPI, SPI, WPC, hydrolyzed WPI

On – Gourmet Protein Bites

Company: On, Sunrise, Florida 33325, United States (www.morsos.com)

Brand: Energex

Product category: Snacks

Product description: On Mor'sos are Gourmet Protein Bites with a Peanut Butter flavor. They are available in a 68g pack

Ingredients: Coating (palm kernel oil, maltitol, peanut flour, milk protein isolate, roasted peanuts, whey, salt, lecithin), protein blend (calcium caseinate, soy protein isolate, whey protein isolate, whey protein concentrate), high fructose corn syrup, corn syrup, glycerin, mini chocolate chips (maltitol, chocolate liquor, cocoa butter, lecithin, vanilla), soy crisps (soy protein isolate, rice flour malt extract), peanut flour, peanut butter (roasted peanuts, dextrose, vegetable mono glycerides, salt), natural flavors, lecithin, salt, vitamin blend (ascorbic acid, d-alpha tocopheryl succinate, maltodextrin, niacinamide, d-calcium pantothenate, vitamin A palmitate, pyridoxine hydrochloride, chromium polyisotinate, riboflavin, folic acid, biotin, cyanocobalamin), sucrose

Dairy blend: A non-proprietary protein blend comprising calcium caseinate, SPI, WPI, WPC

Ultimate Nutrition – Chocolate Fudge Protein Drink

Company: Ultimate Nutrition, Farmington, CT 06034, United States

Brand: Ultimate Sensation

Product category Beverages

Product description: Ultimate Sensation Chocolate Fudge RTD is a protein drink containing 30g protein. According to the manufacturer, it has an amazing taste. It is available in two varieties: Chocolate Fudge; and Creamy Vanilla. Each product is available in a 325ml can

Ingredients: Chocolate Fudge: purified water, protein blend (milk protein concentrate, whey protein isolate, whey protein concentrate), cocoa (processed with alkali), medium chain triglycerides, cellulose gel, natural flavors, sucralose, cellulose gum, acesulfame potassium, carrageenan

Dairy blend: A non-proprietary protein blend comprising MPC, WPI, WPC

Worldwide Sports Nutritional Supplement – High Protein Bar

Company: Worldwide Sport Nutritional Supplements, Bayport, NY 11705, United States (www.sportnutrition.com)

Brand: Pure Protein

Product category: Snacks

Product description: Pure Protein High Protein Bar Peanut Marshmallow Eclipse is said to contain 18g protein, 0g trans fat, and 2g net carbohydrates. It is naturally and artificially flavored. This product is available in a 1.76oz pack

Ingredients: Marshmallow filling (maltitol syrup, milk protein concentrate, lactitol, palm kernel oil, soy lecithin, titanium dioxide (color), vanilla extract, natural and artificial flavor), protein blend (whey protein hydrolysate, soy protein isolate, milk protein isolate), coating (fractioned palm kernel oil, maltitol milk protein isolate, partially defatted peanut flour, peanut butter (dry roasted peanuts), mono glycerides, soy lecithin, salt, sucralose), glycerin, water, hydrolyzed gelatin, peanut flour, marshmallow pieces (maltitol, rice flour, corn starch, wheat starch, soybean oil, natural and artificial flavor, soy lecithin, titanium dioxide (color), acesulfame potassium), soy crisps (soy protein isolate, tapioca starch, salt), natural and artificial flavor, inulin, salt, vitamin and mineral blend (ascorbic acid, ferrous fumarate, tricalcium phosphate, D-alpha tocopheryl acetate, niacinamide zinc oxide, copper gluconate, calcium D-pantothenate, vitamin A palmitate, pyridoxine hydrochloride, thiamin mononitrate, riboflavin, folic acid, biotin, potassium iodide, cyanocobalamin),dextrose, sugar, sucralose

Dairy blend: Non-proprietary protein blend comprising hydrolyzed whey protein, SPI, MPI

Balance Bar – Trail Mix Energy Bar

Company: Balance Bar, Kraft Foods, 1015 Mark Ave., Carpinteria, CA 93013, United States

Brand: Balance Bar

Product category: Snack bar

Product description: Balance Bar Trail Mix Energy Bar is now available in a 300g pack of six bars. This product is certified kosher and contains 15g of protein and 23 vitamins and minerals in each 50g bar. This product is available in three varieties: Fruit And Nut, Chocolate Chip, Cinnamon Oats & Honey

Ingredients: Fruit and Nut: protein blend [soy nuggets (soy protein isolate, tapioca starch, salt), soy protein isolate, calcium caseinate, casein, whey protein isolate], evaporated cane juice invert syrup, brown rice syrup, almonds, fractionated palm kernel oil, cranberries (dried cranberries, sugar), roasted soy nuts, nonfat milk, rolled oats, inulin (a natural extract of chicory root), contains less than 2% of natural flavor, blueberry puree concentrate, rice syrup, glycerin, salt, pectin, sunflower oil, soy lecithin, beta carotene, ascorbic acid (vitamin C), calcium phosphate, ferric orthophosphate (iron), vitamin E acetate, phytonadione (vitamin K1), thiamin mononitrate (vitamin B1), riboflavin (vitamin B2), niacinamide, vitamin B6, folic acid, vitamin B12, biotin, calcium pantothenate, potassium iodide, magnesium oxide, zinc

oxide, sodium selenite, copper gluconate, manganese sulfate, chromium chloride, sodium molybdate

Dairy blend: Non-proprietary protein blend comprising soy nuggets, SPI, calcium caseinate, casein, WPI

Atkins Nutritionals – Caramel Bar

Company: Atkins Nutritionals, Melville, NY 11747, United States

Brand: Atkins Advantage

Product category: Snack bar

Product description: Atkins Advantage Caramel Bar contain chocolate, peanut and nougat. It has high protein, 9g of fiber, 19 vitamin and minerals, and only 1g sugar and on sugar alcohols in each bar. According to the manufacturer, only 3g of carbohydrates impact blood sugar. This product is available in a 1.5oz bar

Ingredients: Protein blend (whey protein isolate, soy protein isolate, hydrolyzed collagen), polydextrose, glycerin, peanuts, palm kernel and palm oil, inulin, cocoa powder (processed with alkali), natural and artificial flavors, coconut oil, non fat dry milk, butter, soy lecithin, salt, citric acid, sucralose, acesulfame potassium. Vitamin and minerals blend: calcium (tricalcium phosphate, calcium carbonate), magnesium (magnesium oxide), vitamin A (vitamin A palmitate), vitamin C (ascorbic acid, sodium ascorbate), vitamin B1 (thiamine mononitrate), vitamin B2 (riboflavin), vitamin B6 (pyridoxine hydrochloride), vitamin B12 (cyanonobalamin), vitamin E (DL alpha tocopheryl acetate), vitamin B3 (niacinamide), biotin, pantothenic acid (D-calcium pantothenate), zinc (zinc oxide), folic acid, chromium (chromium chelate), vitamin K (phytonadione), selenium (sodium selenite). Contains: soy, peanuts, wheat, milk and sulfites

Dairy blend: A non-proprietary protein blend comprising WPI, SPI, hydrolyzed collagen

EAS (Ross Abbott) – AdvantEdge RTD Beverage

Company: EAS, 555 Corporate Circle, Golden, Colorado 80401, United States (www.eas.com)

Brand: Advantage Edge Essential Energy

Product category: Beverages

Product description: AdvantEdge Essential Energy Dietary Supplement Drink claims to be a unique formula that provides greater mental clarity, sustained energy and improved cellular response. It is available in two varieties: Creamy Chocolate; or Creamy Vanilla flavors, and comes in a pack of four 11floz cartons

Ingredients: Filtered water, crystalline fructose, protein blend (whey protein concentrate, milk protein concentrate), sunflower oil, essential energy blend (maltodextrin, soy lecithin, caffeine anhydrous, niacinamide, pyridoxine hydrochloride, riboflavin, thiamin mononitrate, folic acid, biotin, cyanocobalamin), cocoa powder processed with alkali, natural and artificial flavors, fructo-oligosaccharide (FOS), cottonseed fiber, potassium citrate, magnesium phosphate, sodium hexametaphosphate, xanthan gum, sucralose (Splenda™ brand), carrageenan, sodium ascorbate and acesulfame potassium

Dairy blend: A non-proprietary protein blend comprising WPC, MPC

Premier Nutrition – Four Layer Protein Bar

Company: Premier Nutrition, 6221 Yarrow Drive, Suite A, Carlsbad, CA 92009, United States (www.premiernutrition.com)

Brand: Twisted

Product category: Snack bar

Product description: Twisted Four Layer Protein Bar contains layers of pretzel, caramel, peanuts, and nougat, and comes in three varieties of coating: Vanilla; Chocolate; and Peanut Butter. This product comes in a 46g pack

Ingredients: Vanilla: Protein blend (whey protein isolate, soy protein isolate, milk protein isolate, hydrolyzed whey protein, whey protein concentrate, calcium caseinate), hydrolyzed gelatin, sugar, yogurt powder, vegetable glycerin, condensed milk (milk, sugar), corn syrup, pretzels (enriched wheat flour (flour, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid), salt, malt, partially hydrogenated soybean oil, yeast, sodium bicarbonate), water, peanuts, peanut flour, invert sugar, coconut oil, salt, lecithin (an emulsifier), vanilla. Contains soy, wheat, peanuts and milk

Dairy blend: A non-proprietary protein blend comprising WPI, SPI, MPI, hydrolyzed whey protein, WPC, calcium caseinate

Worldwide Sports Nutrition Supplements – High Protein Double Layer Bar

Company: Worldwide Sports Nutritional Supplements, Bayport, NY 11705, United States

Brand: Pure Protein

Product category: Snack bars

Product description: Pure Protein High Protein Double Layer Bar with Country Blueberry Pie flavor is naturally and artificially flavored. It is said to have a great new taste. Each bar contains no trans fat, 30g of protein, and 5g of net carbohydrates. This product is available in a 2.75oz bar. According to the manufacturer, it is America's protein bar. Also available in this range are Chocolate Peanut Butter; Peanut Marshmallow Eclipse; Chewy Chocolate Chip; and S'mores varieties

Ingredients: Blueberry flavored filling (maltitol, hydrolyzed gelatin, sorbitol, fractioned palm kernel oil, pectin, soy lecithin, salt, natural and artificial flavor, citric acid, blue 1, red 3), yogurt coating (maltitol, palm kernel oil, milk protein isolate, nonfat yogurt (cultural nonfat milk), soy lecithin, natural flavor), protein blend (whey protein hydrolysate, whey protein isolate), hydrolyzed gelatin, soy crisps (soy protein isolate, tapioca starch, salt), glycerin, maltitol syrup, water, canola oil, blueberry flavored fruit pieces (sugar, blueberry juice solids (blueberry juice, blueberry extract), cranberries, sunflower oil, natural and artificial flavors, blueberry flavored paste (corn syrup, blueberries, dextrose, citric acid, cellulose gum, pectin, artificial flavor, sodium benzoate (preservative), red 40, blue 1), calcium carbonate, citric acid, peanut flour, titanium dioxide (color), vitamin and mineral blend (ascorbic acid, tricalcium phosphate, D-alpha tocopheryl acetate, niacinamide, zinc oxide, copper gluconate, calcium D-pantothenate, vitamin A palmitate, pyridoxine hydrochloride, thiamin mononitrate, folic acid, biotin, potassium iodide, cyanocobalamin), salt, potassium sorbate (preservative), sucralose

Dairy blend: Non-proprietary protein blend comprising whey protein hydrolyzate, WPI

EAS (Ross Abbott) – Nutrition Bars

Company: EAS, 555 Corporate Circle, Golden, Colorado 80401, United States (www.eas.com)

Brand: EAS Myoplex Carb Sense

Product category: Snack

Product description: EAS Myoplex Carb Sense Nutrition Bar in a chocolate peanut butter flavor is said to have an improved formula. The product claims to contain 3g impact carbs and 28g high quality protein

Ingredients: Protein blend (whey protein isolate, casein, soy protein isolate, calcium caseinate), maltitol syrup, glycerin, hydrolyzed gelatin, modified palm and palm kernel oils, water, maltitol, milk protein concentrate, peanut, ground peanuts), calcium carbonate, cream, caramel (color), natural and artificial flavors, vitamin and minerals blend (dicalcium phosphate, ferric orthophosphate sodium ascorbate, ascorbic acid, magnesium oxide, DL-alpha tocopheryl acetate, niacinamide, zinc oxide, copper gluconate, calcium pantotheryl acetate, manganese sulfate, thiamin mononitrate, pyridoxine hydrochloride, riboflavin, beta-carotene, vitamin A palmitate, folic acid, chromium chloride, biotin, potassium iodide, sodium molybdate, sodium selenite, phytonadione, cyanocobalamin), salt, soy lecithin, oligofructose, butter, mono and diglycerides, titanium dioxide (color), canola oil, disodium phosphate, carrageenan, soybean oil, sucralose, mixed tocopherols, maltodextrin

Dairy blend: A non-proprietary protein blend comprising WPI, casein, SPI, calcium caseinate

Safeway – Vanilla Beverage Shake

Company: Safeway, PO Box 99, Pleasanton, California 94566, United States (www.safeway.com)

Brand: Watch'n Carbs

Product category: Beverages

Product description: Watch'n Carbs presents Weight Control Shake, available in Vanilla; and Chocolate flavors. The product claims to be useful as part of a low-carb diet and is sweetened with Splenda. Each pack contains four 11-fl oz cans

Ingredients: Vanilla: water, milk protein blend (calcium caseinate, whey protein concentrate, whey powder). soybean oil, erythritol, contains 0.5% or less of the following: calcium phosphate, carrageenan, cellulose gel, cellulose gum, chromium chloride, copper sulfate, D-biotin, D-calcium pantothenate, ferrous sulfate, folic acid, soy lecithin, magnesium chloride, magnesium phosphate, maltodextrin, manganese sulfate, natural and artificial flavors, niacinamide, oat fiber, potassium chloride, potassium citrate, potassium iodide, potassium phosphate, pyridoxine hydrochloride, riboflavin, salt, sodium ascorbate, sodium citrate, sodium molybdate, sodium selenite, sucralose, thiamin mononitrate, tricalcium phosphate, vitamin B12, vitamin E acetate, vitamin K1, zinc sulfate, contains milk and soy ingredients

Dairy blend: A non-proprietary milk protein blend comprising calcium caseinate, WPC, whey powder

Trioplex – Cookies

Company: Trioplex, 2510 E.Sunset #5-83, Las Vegas, Nevada, United States (www.trioplex.com)

Brand: Tri-O-Plex

Product category: Biscuits

Product description: Tri-O-Plex Chocolate Chip Cookies are said to be soft and moist cookies, containing 20g protein. Each pack contains two cookies

Ingredients: Chocolate chips (sugar, unsweetened chocolate, cocoa butter, soybean lecithin, vanilla), sugar, unsalted butter, protein blend (soy protein isolate, whey protein isolate) whole liquid eggs, wheatflour, honey, brown sugar, water, vanilla extract, soybean lecithin, baking soda, salt

Dairy blend: Non-proprietary protein blend comprising SPI, WPI

Sante Naturelle – Nutritional Supplement Bar

Company: Sante Naturelle, 369 Charles-Peguy, LaPrairie, Quebec J5R 3E8, Canada

Brand: Energex

Product category: Snack bar

Product description: Energex Nutritional Supplement Bar is claimed to be enriched with 24 vitamins and minerals and is available in Oats and Chocolate Chips; Chocolate Crunch; and Fruity Delight variants

Ingredients: Oats and Chocolate Chips: granola (rolled oats, sugar, canola oil, molasses and honey), chocolate flavored coating (sugar, fractioned palm kernel oil, cocoa powdered processed with alkali, lactose and soy lecithin), soy nugget (isolated soy protein, rice flavor, malt and salt), chocolate chips (sugar, chocolate liquor, cocoa butter, soy lecithin and vanilla extract), corn syrup, protein blend (milk protein isolate, whey protein isolate and soy protein isolate), glycerin, raisin paste, sunflower oil, dextrose, fructose, rolled oats, brown rice crisp (brown rice flour, and rice flour), maltodextrin, natural and simulated flavors (modified corn starch), cellulose, guar gum, lecithin, salt; vitamins and minerals: dicalcium phosphate, tripotassium citrate, magnesium oxide, mixed tocopherol, niacinamide, zinc oxide ascorbic acid, ascorbate, manganese sulfate, d-calcium pantothenate, copper gluconate, reduced iron, d-l alpha tocopheryl acetate, pyridoxine hydrochloride, riboflavin, thiamin mononitrate, vitamin A palmitate, folic acid, chromium chloride, sodium molybdate, potassium iodide, biotin, sodium selenite, vitamin D3

Dairy blend: Non-proprietary blend of milk and soy-derived proteins, comprising MPI, WPI, SPI

APPENDIX V: PRODUCT EXAMPLES USING CHEESE BLENDS

Wegmans Food Markets – Pork, Prosciutto and Parmesan Tortelloni

Company: Wegmans Food Markets, Rochester, N.Y. 14603, United States

Brand: Wegmans Italian Classics

Product category: Pasta side dishes

Product description: Wegmans Italian Classics Pork, Prosciutto & Parmesan Tortelloni are stuffed durum semolina and egg pasta. This product is mildly spiced and is available in a 9-oz pack

Ingredients: Pasta: enriched durum semolina (semolina, niacin, ferrous sulfate, thiamine, mononitrate, riboflavin, folic acid), enriched wheatflour (niacin, iron, thiamin mononitrate, riboflavin, folic acid) whole pasteurized eggs, water, Filling: meat (pork, prosciutto), toasted wheat crumbs (wheatflour, glucose-fructose, vegetable oil, shortening [soya bean] salt, yeast vinegar, calcium propionate, flavoring, BHT) canola oil (canola oil, BHA, BHT, may contain beta carotene, citric acid) cheese (parmesan and Romano cheese blend [pasteurized cow milk, cheese cultures, bacterial culture, salt, rennet, calcium chloride, microbial enzyme, lipase, cellulose, citric acid]), salt, spices, crushed chili (spices, vegetable oil [canola])

Dairy blend: A non-proprietary blend of Romano and parmesan cheeses

ConAgra Foods – Pizza

Company: ConAgra Foods, PO Box 3768, Dept. B, Omaha, NE 68103-0768, United States

Brand: Healthy Choice

Product category: Prepared meals

Product description: Healthy Choice Café Selections brand are Gourmet Supreme Pizzas, with fire roasted bell peppers, onions, sausage and Italian style pepperoni. This product is microwaveable and contains 4g fat and 360 calories. It meets the American Heart Association food criteria for saturated fat and cholesterol. Also available in this range are: Italian Style Pepperoni; and Four Cheeses variants

Ingredients: Crust: Enriched unbleached flour (wheatflour, malted barley four, niacin, reduced iron thiamine mononitrate, riboflavin, folic acid), water, natural flavor, contains 2% or less of: soybean oil, enzymes, calcium stearoyl-2-lactylate, sugar, salt, yeast, acacia gum, soy lecithin), cheese topping blend: nonfat mozzarella cheese: pasteurized skim milk, cheese sausage crumbles: pork, seasoning (spices, salt, garlic powder, sugar, hydrolyzed soy protein, caramel color, natural flavors, disodium inosinate, disodium guanylate, extractive of paprika), water, sodium tripolyphosphate, reduced fat

pepperoni (pork, beef, partially hydrolyzed whey protein, dextrose, flavoring, lactic acid starter culture, natural smoke flavor, oleoresin paprika, potassium chloride, salt, sodium nitrite, spice, citric acid), sauce: water, tomato paste, corn syrup solids, seasoning blend (dehydrated garlic and onion, spices, sugar, salt, ascorbic acid, xanthan gum, disodium inosinate, disodium guanylate), parmesan cheese flavor: parmesan, cheddar and Romano cheese ((milk, cheese cultures, salt, enzymes), citric acid), sugar, modified corn starch, cellulose gum, herb blend (oregano, parsley, parmesan (part skim cow's milk, cheese cultures, salt, enzymes), water, caramel color, 4% low fat sausage, 4% reduced fat pepperoni used

Dairy blend: A non-proprietary cheese topping blend comprised of non-fat mozzarella cheese, pasteurized skim milk. Parmesan cheese flavor derived from a blend of parmesan, cheddar and Romano cheeses

M&M Meat Shops – Italian Wedding Soup

Company: M&M Meat Shops, Kitchener, Ontario N2H 6M3, Canada (www.mmmeatshops.com)

Brand: M&M Meat Shops

Product category: Soup

Product description: M&M Meat Shops has launched Italian Wedding Soup, a soup mix with vegetables mini meatballs and Italian pasta in a savory both topped with Swiss cheese and croutons. It is available in a 285g pack

Ingredients: Vegetable soup broth (water, cooked vegetables (carrots, onions, celery), sugar, corn oil, potato flour, salt, flavor, carrot powder), Swiss and Romano cheese blend, vegetables (onions, spinach, carrots, garlic), pork meatballs (contain soy proteins, eggs, milk ingredients), durum semolina wheat acini di pepe pasta, croutons (wheatflour, sugar, salt, sunflower oil, yeast), tomatoes (tomatoes, tomato juice, calcium chloride, citric acid, tomato paste), gelatin, corn starch, flavoring preparation (contains autolyzed yeast extract, salt, potassium chloride), olive oil, sugar, salt, spices, guar gum

Dairy blend: Non-proprietary cheese blend comprising Swiss and Romano cheeses

Omnibrands – Bite-Sized Cheese Crackers

Company – Omnibrands, PO Box 99, Pleasanton, California 94566-0009, United States

Brand: O-Organics

Product category: Savory biscuits

Product description: O Organics Bite-Sized Cheese Crackers are made with cheese from the Midwest, which has been carefully selected and aged for months before being blended with cracker dough. The result is a delicious, crispy cracker that carries real cheddar flavor in every bite. This product is available in a seven ounce pack

Ingredients: Organic wheat flour, Organic palm fruit oil, Organic sunflower oil and/or Organic high oleic safflower oil, Organic cheese blend ((Organic cultured pasteurized milk, salt, enzymes), Organic nonfat milk, Organic whey, salt, disodium phosphate), natural cheddar cheese flavor, sea salt, paprika, yeast, Organic malt extract, natural annatto, red pepper, natural vitamin E added to protect flavor

Dairy blend: A non-proprietary organic cheese blend (constituents unclear)

Wegmans Food Markets – Wheat Crusted Cheese Pizza

Company: Wegmans Food Markets, Rochester, NY 14603, United States (www.wegmans.com)

Brand: Wegmans

Product category Prepared meals:

Product description: New from Wegmans is Pizza Shop, Wheat Crusted Cheese Pizza. It is made with 100% whole wheat. Also available is a Pepperoni variety

Ingredients: Cheese: crust: 100% whole wheat flour, water, canola oil, yeast, dough conditioner (wheatflour, sugar, canola oil, emulsifier, ascorbic acid, enzymes), salt, spices, calcium propionate, potassium sorbate (preservatives), cheese blend (low moisture whole milk mozzarella cheese (pasteurized milk, cheese culture, salt, enzymes), provolone cheese (pasteurized milk, cheese culture, salt, enzymes), potato starch and cellulose; pizza sauce: vine ripened fresh tomatoes, extra virgin olive oil, basil, salt, sugar, dehydrated onions, oregano, garlic puree, roasted onions, citric acid

Dairy blend: A non-proprietary cheese blend comprising low moisture wholemilk mozzarella cheese, provolone cheese, potato starch, cellulose

ConAgra Foods – Spaghetti & Meatball Kit

Company: ConAgra Foods – PO Box 3768, Dept. B, Omaha, NE 68103-0768, United States (www.banquet.com)

Brand: Chef Boyardee

Product category: Prepared meals

Product description: Chef Boyardee Spaghetti And Meatballs Kit, with meat, spaghetti and grated cheese. This product claims to contain great tasting meatballs and is available in a 1.09kg pack

Ingredients: Sauce with meat: tomatoes (water, tomato puree), meatballs (beef, pork, water, crackermeal (wheatflour, niacin, iron, thiamine mononitrate (vitamin B1), riboflavin (vitamin B2, folic acid), textured vegetable protein (soy protein concentrate and caramel coloring, garlic powder and spices), water, beef, high fructose corn syrup, contains less than 2% of: soybean oil, modified corn starch, salt, onions, garlic, spices, autoluzed yeast extract, flavorings (including dairy flavors), citric acid; enriched spaghetti: semolina wheatflour, niacin, iron, thiamine mononitrate (vitamin B1), riboflavin (vitamin B2) and folic acid; grated cheeses: a blend of cheeses (parmesan and Romano cheese made from cow's milk (pasteurized par skim milk, cultures, salt, enzymes)), powdered cellulose added to prevent caking, potassium sorbate added as a preservative

Dairy blend: A non-proprietary cheese blend comprising Parmesan & Romano cheeses

Safeway – Thin Crispy Crust Supreme Pizza

Company: Safeway, PO Box 99, Pleasanton, California 94566, United States (www.safeway.com)

Brand: Safeway Select Verdi

Product category: Prepared meals

Product description: Safeway Select Verdi Thin Crispy Crust Supreme Pizza is made with Italian sausage, pepperoni, roasted peppers and onions, and rich mozzarella cheese. It is also said this pizza is of premium quality, should be oven cooked, and is available in a 24.8-oz pack. Also available in this range are Four Cheese; Four Meat; and Pepperoni varieties

Ingredients: Whole milk mozzarella cheese (pasteurized whole milk, cheese culture, salt, enzymes), water, Italian sausage (pork, water, spices, salt, corn syrup solids, paprika, natural flavorings, sugar), tomato paste, pepperoni (pork and beef, salt, spices, dextrose, lactic acid starter culture, oleorsin of paprika, flavoring, sodium nitrate, BHA, BHT, citric acid), contains 2% or less or roasted red pepper, roasted green pepper, roasted yellow pepper, onions, salt, sugar, spices, onion powder, garlic powder, Parmesan and Romano cheese blend (both made from pasteurized part-skim cow's milk, cheese culture, salt, rennet, calcium propionate), asiago cheese (pasteurized milk, cheese cultures, salt, enzymes), crust: enriched flour (wheat flour, malted barley flour, niacin, reduced iron, thiamin mononitrate, riboflavin, folic acid), water, contains 2% or

less of the following ingredients: canola oil, sugar, salt, yeast, and L-cysteine (dough conditioner) (12% sausage and pepperoni)

Dairy blend: Non-proprietary cheese blend comprising parmesan and Romano cheeses

Finest Quality – Cheese Balls

Company: Finest Quality, Indonesia

Brand: Fisher

Product category: Snacks

Product description: Cheese Balls with real cheese flavor

Ingredients: Soybean oil, corn grits, cheese seasoning (whey, maltodextrin, cheese blend [granular blue, Cheddar] {milk, cheese culture, salt, enzymes}, contains 2% or less of the following: salt, partially hydrogenated soy bean oil, sodium phosphate, citric acid, yellow 5, yellow 6, whey protein concentrate, lactose and natural and artificial flavors and mixed tocopherols) and MSG (flavor enhancer)

Dairy blend: A non-proprietary cheese blend comprising granular blue and cheddar cheeses

Golden Crust Bakeries – Three Cheese Garlic Breadsticks

Company: Golden Crust Bakeries, 25170 Anza Drive, Santa Clarita, CA 91355, United States

Brand: Golden Crust

Product category: Bakery

Product description: Golden Crust introduces Three Cheese Garlic Breadsticks, with no trans fat. They can be heated in a conventional oven for four to eight minutes, or alternatively can be microwaved in under a minute. The product can be served with salad, soup or dip and is available in a 2lb bag

Ingredients: Enriched flour (wheatflour, malted barley, flour, niacin, reduced iron, thiamin mononitrate, riboflavin, folic acid), water, cheddar cheese [cultured pasteurized milk, salt, enzymes, annatto as color, cellulose and/or potato starch (prevent caking), natamycin (mold inhibitor)], Romano and parmesan cheese blend (cultured milk, salt, whey), contains 2% or less of the following: salt, dextrose, soybean oil, garlic, yeast, spices (oregano, basil, rosemary), sugar, soy flour, dough conditioners (monoglycerides, calcium, stearoyl, lactylate, wheatflour, calcium sulfate, ascorbic acid, corn starch, azodicarbonamide (ADA), L--Cysteine, enzymes, potassium iodate), calcium propionate and potassium sorbate (preservatives)

Dairy blend: A cheese blend comprising parmesan & Romano cheeses

Price Chopper – Mexican Style Cheese Dip

Company: Price Chopper, Schenectady, NY, United States (www.pricechopper.com)

Brand: Central Market Classics Solutions

Product category: Spreads

Product description: Central Market Classics Solutions offers Mexican Style Cheese Dip. This creamy blend of four cheeses is mixed with green and red peppers, onions, and tomatoes. It microwaves in minutes and is available in Price Chopper stores

Ingredients: Vegetables (green peppers, onions, red peppers, tomatoes (tomatoes, tomato juice, calcium chloride, citric acid), water, mozzarella-Romano cheese blend (pasteurized milk, cheese culture, bacterial culture, salt, calcium chloride, microbial enzyme, lipase, cellulose), cultured half-and-half (pasteurized milk and cream, non-fat dry milk, bacterial culture, microbial enzyme), Swiss and yellow cheddar cheese blend (pasteurized milk, bacterial culture, cheese culture, salt, calcium chloride, microbial enzyme, color, cellulose), tomato paste, canola oil, enriched wheat flour (wheat flour, amylase, niacin, reduced iron, thiamine mononitrate, riboflavin, folic acid), butter [pasteurized cream, salt, may contain color (annatto), modified corn starch, spices, pepper sauce (vinegar, red peppers, salt), salt, garlic, locust bean gum, guar gum

Dairy blend: Two cheese blends, one comprising mozzarella and Romano cheeses; the other comprising Swiss & yellow cheddar cheeses

APPENDIX VI: PRODUCT EXAMPLES USING OTHER BLENDS

World Finer Foods – Crisp Puff Pastry Bites

Company: World Finer Foods, Bloomfield, NJ 07003, United States (www.worldfiner.com)

Brand: Reese Croissan Twists

Product category: Savory snacks

Product description: Reese Croissan Twists Crisp Puff Pastry Bites Asian Sesame flavored are claimed to be flavored with "Chef Paul Pruhomme's Magic Seasoning Blends". To prepare place the pastries in the oven for two to three minutes or for one minute in the microwave

Ingredients: Wheatflour, butter, sesame seeds, yeast, salt, skimmed milk powder, barley malt, Chef Paul Prudhomme's Magic Seasoning Blend™ (natural butter flavor, butter [cream, water, salt]); nonfat milk, tocopherols, ascorbyl palmitate and BHT, whey protein concentrate, wasabi powder (horseradish, mustard, mustard extract, citric acid, ascorbic acid), artificial coloring (yellow 5, blue 1), sesame seeds (white and black), sweet dairy whey, sugar, salt, granulated onion, granulated garlic and spices)

Dairy blend: Chef Paul Prudhomme's Magic Seasoning Blend™ comprising natural butter flavor, butter

Bristol Myers Squibb – Vanilla Flavour Sustagen

Company: Mead Johnson Philippines, a subsidiary of Bristol-Myers Squibb, Princeton, New Jersey, United States

Brand: Sustagen School

Product category: Beverage mix

Product description: Sustagen School has three pre-biotics, a dietary fibre combination of inulin, fructo-oligosaccharide and galacto-oligosaccharide, that helps promote the growth of good bacteria in the colon, to reduce bad bacteria. It contains zinc, vitamin A and vitamin B6 that are important to help maintain good body condition, help reduce the growth of bad bacteria and help maintain the digestive system. It is Vanilla flavored and Halal certified. This product is available in a 400g pack and is for children aged six years and up

Ingredients: Whole milk powder, sucrose, skim milk powder, powdered creamer, corn syrup solids, minerals such as calcium phosphate, cupric sulfate, ferrous sulfate, magnesium phosphate, manganese sulfate, potassium citrate, potassium iodide, sodium chloride, sodium citrate, sodium selenite, zinc sulfate, prebiotic blend such as inulin, fructo-oligosaccharide, galacto-oligosaccharide, natural and artificial flavours, vitamins such as alpha tocopheryl acetate, beta carotene, biotin, calcium pantothenate, cholecalciferol, cyanocobalamin, niacinamide, folic acid, phytonadione, pyridoxine hydrochloride, riboflavin, sodium ascorbate, thiamin hydrochloride, vitamin A palmitate

Dairy blend: A non-proprietary prebiotic blend comprising FOS, GOS, & inulin

Mead Johnson – Children Nutritious Milk Powder

Company: Mead Johnson, Middernkampweg 2, Nijmegen, The Netherlands

Brand: Sustagen

Product category: Baby food

Product description: Sustagen vanilla flavored growing up milk powder for children between the ages of three to six years old. It contains a new prebiotic blend (inulin, FOS, and GOS) formula. This product claims to help children's digestion and maintain a healthy body

Ingredients: Skimmed milk powder, whole milk powder, glucose polymer, milk fat, sucrose, prebiotic blend (inulin, FOS, and GOS), minerals (calcium carbonate, copper sulfate, ferric sulfate, magnesium phosphate, manganese sulphate, potassium citrate, sodium citrate, sodium selenium, zinc sulfate), vitamins(E, beta-carotene, biotin,calcium pantothenate, D, B12, folic acid, niacin, K1, B6, sodium ascorbate, B1, A), flavor

Dairy blend: A non-proprietary prebiotic blend comprising inulin, FOS & GOS

Giant Eagle – White Cheddar Mashed Potatoes

Company: Giant Eagle, 101 Kappa Drive, Pittsburgh, PA 15238-2809, United States (www.gianteagle.com)

Brand: Giant Eagle

Product category: Potato product

Product description: Giant Eagle White Cheddar Mashed Potatoes are claimed to be made with only the finest real potatoes, milk and real cream butter for the best in quality and taste. They are said to be quick and easy to prepare, and are microwaveable. This product is available in a 24 oz pack

Ingredients: Potatoes, dairy blend (skim milk, butter [cream, salt], margarine [liquid soybean oil, water, salt, whey, hydrogenated cottonseed oils, mono- and diglycerides, soy lecithin, sodium benzoate {preservative}, citric acid, artificial flavor, beta carotene {color}, vitamin A palmitate], salt, mono- and diglycerides), sour cream (cream, skim milk, food starch-modified, lactic and citric acid, gelatin, mono-and diglycerides, guar gum, potassium sorbate, carrageenan, natural and artificial flavor, sodium phosphate, lactic acid culture), cheddar cheese (cheddar cheese [milk, cheese culture, salt, enzymes], cream, salt, sodium phosphate, lactic acid) contains 2% or less: salt, potassium sorbate

Dairy blend: A non-proprietary dairy blend comprising skim milk, butter, margarine, salt, mono- & di-glycerides

Orval Kent Food – Sweet Mashed Potato

Company: Orval Kent Food, 1547 Abbott Drive, Wheeling, Illinois 60090, United States

Brand: Yoder's

Product category: Side dishes

Product description: Claims to be made with real butter and 100% real potatoes. The product is microwaveable and ready in just six minutes

Ingredients: Sweet potatoes, water, dairy blend (skim milk, butter [cream, salt], margarine [liquid soybean oil, water, salt, whey, hydrogenated cottonseed oils, mono and diglycerides, soy lecithin, sodium benzoate (preservative), citric acid, artificial flavor, beta carotene (color), vitamin A palmitate], salt, mono and diglycerides), contains 2% or less of sugar, salt, potassium sorbate (preservative), sodium acid pyrophosphate (protect color), spice. Contains: milk, soy

Dairy blend: A non-proprietary dairy blend comprising skim milk, butter, margarine, salt, mono- & di-glycerides

Lunds & Byerly's – Hash Browns

Company: Lunds & Byerly's, Edina, MN 55424, United States (www.lundsmarket.com; www.byerlys.com)

Brand: Lunds & Byerly's

Product category: Side dishes

Product description: Lunds & Byerly's Hash Browns are said to be made with 100% real cheddar cheese, contain no trans fat and are microwaveable

Ingredients: Hash brown potatoes (potatoes, dextrose, disodium dihydrogen pyrophosphate (added to maintain color)), cream of chicken soup (chicken stock, wheatflour, chicken fat, cooked chicken meat, cream (from milk), modified food starch, water, contains less than 2% of salt, cooked mechanically separated chicken, dried whey (from milk), soy protein concentrate, monosodium glutamate, dried dairy blend (whey (from milk), calcium caseinate), yeast extract, flavoring, beta carotene for color, soy protein isolate, sodium phosphates, chicken flavor (contains chicken stock, chicken powder, chicken fat), spice extract), sour cream (skim milk, cream, grade A whey, food starch-modified, guar gum, sodium phosphate, sodium citrate, potassium sorbate (a preservative), locust bean gum, enzymes), cheddar cheese (pasteurized milk, cheese cultures, salt, enzymes, annatto vegetable color), water, onions

Dairy blend: A non-proprietary dairy blend comprising whey, calcium caseinate

Asda – Chocolate Sponge Pudding

Company: Asda, ASDA House, Southbank, Great Wilson Street, Leeds LS11 5AD, United Kingdom (www.asda.co.uk)

Brand: Asda Good for you!

Product category: Dessert

Product description: Asda Good For You Chocolate Sponge Pudding is a moist chocolate sponge topped with a creamy chocolate flavor sauce. It has less than 5% fat, 178 calories per pack, and 1.7g saturated fat per pack. This product is suitable for vegetarians, is microwaveable and is available in a 100g tub. Also available is a Strawberry and Golden Syrup variety

Ingredients: Chocolate: water, sugar, wheatflour, breadcrumb (wheatflour, water, yeast, salt, soya flour, vegetable fat, glucose syrup, flour treatment agent (ascorbic acid)), cocoa (3.2%), starch blend (wheat starch, glucose syrup, milk protein, emulsifiers (lactic acid esters of mono and diglycerides of fatty acids, polyglycerol esters of fatty acids, xanthan gum), diphosphate), hydrogenated vegetable oil (hydrogenated palm oil, palm oil, water), modified maize starch, skimmed milk powder, golden syrup (invert sugar, sucrose, water), dried egg powder, salt, raising agents (sodium bicarbonate, sodium aluminum phosphate, acidic), vanilla essence (vanilla, water, color (ammonia caramel)), double cream (milk)

Dairy blend: A non-proprietary starch blend comprising wheat starch, glucose syrup, milk protein, emulsifiers, diphosphate

Kraft Foods – Café Latte

Company: Kraft Foods, 36 Gross Road, Elandsfontein 1406, South Africa

Brand: Jacobs

Product category: Beverages

Product description: Jacobs brand Café Latte - a white coffee drink with soluble milk powder blend and instant coffee. This product is available in a pack of ten, 14g sachets

Ingredients: Soluble milk powder blend (glucose syrup, hardened vegetable oil, low fat milk solids (8%), stabilizer, (potassium phosphate)), sugar (15%), instant coffee (15%), lactose, aromatic substances

Dairy blend: A non-proprietary soluble milk powder blend comprising glucose syrup, hardened vegetable oil, low fat milk solids, potassium phosphate

Dae A Vina – Freshly Baked Cream Cake

Company: Dae A Vina, D2/93 Cau Giay Road, Quan Hoa Guild, Hanoi, Vietnam

Brand: Delimanjoo

Product category: Bakery

Product description: Delimanjoo Freshly Baked Cream Cake, available in a 350g pack

Ingredients: Wheatflour, refined sugar, eggs, cooking oil, skimmed milk powder blend, dextrin, modified starch, shortening, baking power, vanilla flavor, salt, gum, natural color

Dairy blend: A skim milk replacer comprised of dairy ingredients

APPENDIX VII: DETAILED ANALYSIS OF AUSTRALIAN DAIRY BLEND EXPORT VOLUMES, 2003 – 2004

Recent volume trends – Australian dairy blend exports

HS Description	Jan-Dec 2003, mt	Jan-Dec 2004, mt	Jan-Dec 2005, mt	Commentary
04013050	13,780.7	19,128.8	16,399.5	The blend component of this category is likely to be frozen chocolate cream, and represents a small part of the total category (est. < 1,000 mt)
04021010	123,917.8	143,397.6	157,824.3	The overwhelming majority of this classification is SMP. However, blends incorporated within this category include sweetened SMP, calcium-fortified SMP, and SMP-based whey and/or buttermilk blends. Blends volume estimated < 10,000 mt
04021090	10,076.2	8,318.0	7,443.1	This category is likely to have dairy (esp. SMP) as a large though minor component. Involves mainly sweetened products, but also includes coffee creamers. Entire volume is likely to be classified as a blend
04022110	6,280.4	5,442.1	5,269.1	Wholemilk-based infant formula. Entire volume is likely to be classified as a blend
04022130	2,586.3	3,562.2	1,296.1	This is almost entirely chocolate-flavored skim milk powder. Entire volume is likely to be classified as a blend
04022190	2,073.0	6,829.3	2,104.2	An assortment of products is incorporated within this category. All are unsweetened, and include filled milk powders, milk powder/non-dairy bases, mixed dairy powders. Entire volume is likely to be classified as a blend
04022910	26,095.7	6,718.5	6,393.0	This is an infant formula classification. Entire volume is likely to be classified as a blend
04022920	547.8	3,064.0	5,325.2	This represents a range of retail ready and bulk packs of sweetened WMP. Entire volume is likely to be classified as a blend
04022990	4,551.8	31,124.9	37,079.4	This category represents a range of high-fat dairy powders (typically > 28%). Entire volume is likely to be classified as a blend
04029150	14.1	7.7	7.0	A small category describing modified cream mixtures (cream & skim milk concentrate). Entire volume is likely to be classified as a blend
04029900	14,591.9	14,127.7	13,768.4	This appears to be a “catch-all” category under the 0402 HS classification for all remaining products. It includes sweetened high-fat products, chocolate-

HS Description	Jan-Dec 2003, mt	Jan-Dec 2004, mt	Jan-Dec 2005, mt	Commentary
				flavored products, chocolate and/or sweetened modified (incl. reduced fat) milk and skim milk varieties. Entire volume is likely to be classified as a blend
04039090	686.3	536.2	420.3	This represents buttermilk powder-based blends and soft serve ice cream mix. Entire volume is likely to be classified as a blend
04041000	72,601.2	85,639.9	80,348.7	The overwhelming majority of this volume is standard whey powder products. However, within the category is a volume (est. < 1,000 mt) of whey-based blends (incl. whey/milk powder blends, chocolate-flavored WPI, chocolate-flavored WPC, chocolate-flavored WPI/SMP blends)
04049001	1,533.5	2,274.1	3,293.8	This represents cream and whey blends. Entire volume is likely to be classified as a blend
04061000	35,427.8	46,372.5	43,712.9	A small component (< 50 mt) comprises dairy-based cheesecake mix, with a fresh or cream cheese component
04062000	2,547.7	2,349.5	1,754.9	A small component (< 50 mt) comprises cheese flavored and cheese powder base mixes
15171010	14,146.2	14,170.4	13,122.7	A share of this (est. 3,000 mt) represents butter/vegetable oil blends, and margarine with a minor component being dairy (shipped to EU markets)
17049000	11,192.0	10,466.5	9,078.2	This entire volume is sugar confectionery products, comprised of blends. Most of these have nil dairy content, with an estimated < 1,500 mt, being sugar confections with a minor dairy component
18069091	11,895.6	12,043.2	12,687.8	This represents the traditional "chocolate crumb-style" commodity, being SMP/cocoa preparations, etc., with dairy often a minor component. Entire volume is likely to be classified as a blend
19011000	1,495.6	2,403.0	1,432.4	Another infant formula classification. Entire volume is likely to be classified as a blend
19012001	15,502.5	19,303.3	22,911.9	This category represents confectionery, ice cream, pastry and related bases. Includes a range of butter/sugar mix, flour/milk powder blends, flour/butter blends, and vanilla dairy pastry bases. Entire volume is likely to be classified as a blend
21021000	307.3	275.4	408.0	This represents culture mediums, some of which have a dairy component. An estimated 50 mt is considered to be dairy blends

HS Description	Jan-Dec 2003, mt	Jan-Dec 2004, mt	Jan-Dec 2005, mt	Commentary
21039010	13,740.4	12,947.7	16,310.9	Represents a range of sauce products for cooking and bakery applications. Many of these will have a dairy component (SMP, cheese, butter, etc.).– Estimated > 10,000 mt represents dairy blends
21061000	1,732.4	2,224.6	779.7	This product represents SMP/calcium blends. It includes product being shipped in bulk for re-packing, or for use as a food ingredient. The entire volume could reasonably construed to be a dairy blend
21069012	1,698.5	2,583.6	1,921.6	This category represents ice cream and yogurt pre-mixes for industrial applications. Entire volume is likely to be classified as a blend
21069093	39,628.5	49,044.9	49,129.8	This category represents various blends that have a dairy component, including butteroil/caseinate, filled condensed milk, and butter/sugar blends. Much of this volume could be construed as dairy blends (est. > 20,000 mt)
23099020	3,452.1	5,869.8	6,713.5	This volume is all dairy blends. It represents milk-based CMR and stockfeed formulations
35011010	131.2	25.2	59.7	This entire volume is dairy blends. It represents casein mixtures
35040000	6.0	9.3	24.0	Note: No volume data is available for this category. The data is provided in A$ (millions). This includes various products such as MPC blends, sweetened WPC style blends (varying protein levels). Entire volume is likely to be classified as blends

Source: Australian Bureau of Statistics; discussions with Australian dairy exporters

Exports of blends from Australia – key destinations

HS description	Product description	Estimated volume 2005, mt	Key destination 2005, mt	
			Market	**Mt**
04013050	Unsweetened frozen chocolate cream (>6% fat)	1,000	Philippines	226
			U.S.	177
			S. Korea	164
			Japan	139
			All others	294
04021010	Sweetened skim milk powder	10,000	Malaysia	1,635
			Singapore	1,420
			Thailand	1,331
			Indonesia	1,255
			Philippines	1,001
			All others	3,358
04021090	Sweetened milk powder blend	7,450	U.S.	2,001
			Mexico	1,905
			EU	1,601
			Japan	446
			All others	1,497
04022110	Unsweetened infant powder	5,250	Thailand	2,505
			Malaysia	1,705
			Hong Kong	412
			S. Korea	302
			Taiwan	219
			All others	107
04022130	Skim milk powder blend (chocolate flavor)	1,300	Taiwan	997
			Malaysia	200
			China	21
			All others	82
04022190	Unsweetened milk powder blend	2,100	Singapore	1,004
			Guatemala	208
			P. New Guinea	102
			Bangladesh	100
			All others	686

HS description	Product description	Estimated volume 2005, mt	Key destination 2005, mt	
			Market	**Mt**
04022910	Infant milk powder	6,400	Malaysia	1,945
			Taiwan	1,940
			China	1,456
			Philippines	843
			All others	216
04022920	Sweetened instant milk powder	5,300	Oman	2,107
			Fiji	1,005
			Jordan	743
			Vietnam	444
			All others	1,001
04022990	Wholemilk powder blend	37,000	Malaysia	13,448
			Indonesia	13,056
			Philippines	7,249
			Taiwan	1,741
			All others	1,506
04029150	Cream & skim milk concentrate	5	Fiji	2.60
			P. New Guinea	2.00
			Philippines	0.14
			China	0.10
			All others	0.16
04029900	Sweetened, modified milk	13,800	Japan	9,333
			N.Z.	3,443
			Singapore	443
			H. Kong	219
			All others	362
04039090	Buttermilk powder mixture	400	Singapore	64
			Taiwan	54
			U.S.	53
			Uzbekistan	52
			All others	177
04041000	WPI-based blend	1,000	Philippines	130
			China	128
			Singapore	125
			Indonesia	120
			All others	605

HS description	Product description	Estimated volume 2005, mt	Key destination 2005, mt	
			Market	Mt
04049001	Cream whey blend	3,300	EU	943
			U.S.	843
			S. Korea	434
			China	338
			All others	742
04061000	Cheesecake mix	50	Japan	21
			Taiwan	12
			S. Korea	10
			H. Kong	4
			All others	3
04062000	Cheese sauce mix	50	Singapore	33
			U.S.	12
			Philippines	2
			N.Z.	2
			All others	1
15171010	Butter/vegetable oil blend	3,000	N.Z.	1,877
			Singapore	312
			P. New Guinea	310
			Fiji	270
			All others	231
17049000	Sugar confectionery (minor dairy component)	1,500	N.Z.	887
			U.S.	229
			U.K.	215
			India	72
			All others	97
18069091	Chocolate crumb	12,700	Japan	10,100
			N.Z.	1,104
			Singapore	323
			Hong Kong	231
			All others	942
19011000	Infant formula	1,400	N.Z.	1,009
			Fiji	234
			P. New Guinea	152
			Singapore	4
			All others	1

HS description	Product description	Estimated volume 2005, mt	Key destination 2005, mt	
			Market	Mt
19012001	Butter/sugar mix	22,900	Japan	13,199
			N.Z.	3,898
			Hong Kong	1,056
			S. Arabia	856
			All others	3,891
21021000	Milk powder blend – culture medium	50	N.Z.	15
			U.S.	8
			EU	7
			Chile	5
			All others	15
21039010	Dessert sauce mix	10,000	N.Z.	5,401
			Japan	3,597
			Singapore	398
			Hong Kong	357
			All others	247
21061000	Skim milk powder/calcium blend	750	Singapore	222
			N.Z.	212
			S. Korea	149
			Indonesia	145
			All others	22
21069012	Ice cream mix/frozen yogurt mix	1,900	China	723
			Philippines	623
			N.Z.	321
			Malaysia	88
			All others	145
21069093	Butter/sugar mix	20,000	Japan	14,090
			N.Z.	4,087
			Indonesia	221
			S. Africa	200
			All others	1,402
23099020	Calf milk replacer	6,700	Japan	3,056
			Thailand	1,799
			Singapore	705
			Taiwan	545
			All others	595

HS description	Product description	Estimated volume 2005, mt	Key destination 2005, mt	
			Market	**Mt**
35011010	Casein-based blend	60	Mexico	59.9
			All others	0.1

Source: Adapted from Australian Bureau of Statistics