

Dairy Products and Nutritional Performance in the Diets of People with HIV / AIDS¹

An Informational Monograph from
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The purpose of this monograph is to provide an introductory background on the effectiveness of dairy products in providing nutrition for people with HIV / AIDS.

- First, in Section I. we will review the attributes of HIV disease and AIDS, with associated nutrition requirements.
- Next, in Section II. we will review the nutritionally complete components of bovine milk in the human diet.
- Lastly, in Section III. – including the attached matrix - we will show the functional properties of dairy products in the nutrition of people with HIV/AIDS.

For an overview summary of this topic, read only the headings, text boxes and bold face type. Read time = 3 minutes. Monograph read-through time = 20 minutes.

I. The Phases of HIV / AIDS

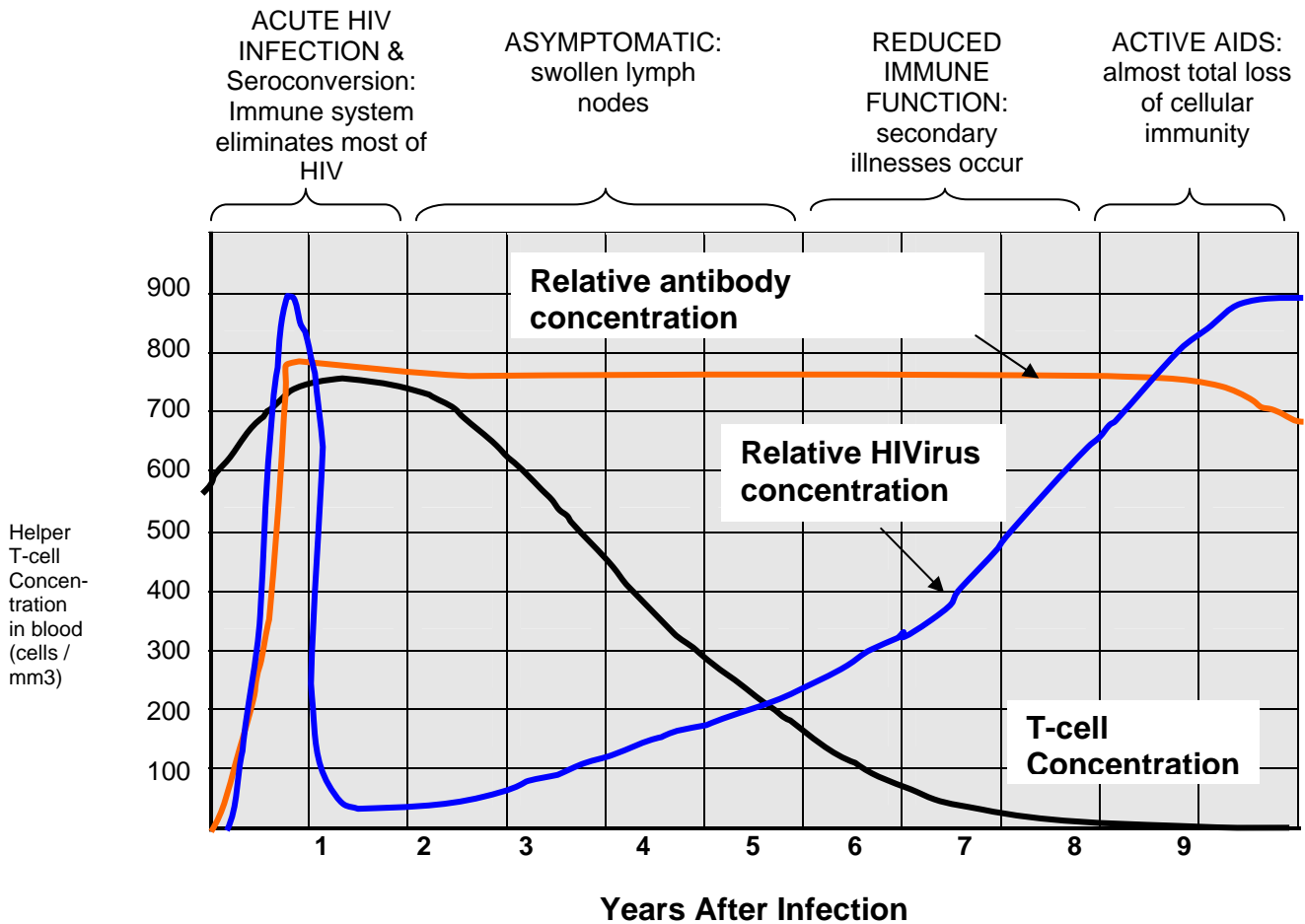
Human Immunodeficiency Virus (“HIV”) and Acquired Immunodeficiency Syndrome (“AIDS”) are extremely complex. It is a progressive disease beginning at initial “acute HIV infection” with the virus, progressing slowly at first – often with few symptoms - on to HIV disease with reduced immune function, and then to active AIDS (called “Advanced HIV Disease”) and ultimately death of the host. This progression of phases is shown in the table on the following page. During each phase there are stresses on the body that have crucial implications for the quality of nutrition needed and the body’s capacity to ingest, absorb, and utilize nutrients effectively. The age and general health of the infected person can also have an important effect on progression, nutrition needs, and survivability.

AIDS does not manifest itself as one disease at one time. From acute HIV infection to advanced HIV disease can be an indefinite period of often many years (or as little as a

¹ Land O' Lakes International Development has prepared this for informational purposes only and intends no recommendations or advice for individual dietary decisions or prevention or treatment of health conditions. HIV + individuals should immediately consult with a physician.

few). Thus after initial infection a person can live asymptotically (and productively) for a long time - if they have the proper nutrition, care (drug therapy being ideal), and living arrangements. The condition of the person afflicted varies greatly throughout this time as do the secondary illnesses experienced and their consequential nutrition needs.

THE STAGES OF HIV INFECTION



HIV (human immunodeficiency virus) concentration in the blood (blue) increases rapidly after the initial infection but falls due to the immune response. However, viruses continue to replicate within lymphatic tissues and cause damage there. The immune system (red) continues to combat the viruses during this period, which may last for years, but in time the virus concentration increases as helper T-cell concentration (black) gradually decreases. AIDS (acquired immune deficiency syndrome) is the last stage of the process as HIV (blue) overwhelms the body's defense system.

After Campbell et al; Biology, 5th edition, 1999

The above chart shows four generalized phases in the progression of HIV infection relating it to the condition of the person's immune response. Again, the nutritional issues may also be specific to these phases and malnutrition combined with a weakened immune system creates vulnerability to opportunistic infections and secondary illnesses that can cause premature death.

Active AIDS manifests itself in many often sub clinical secondary physical conditions as well as serious co-diseases that further weaken the body, deplete nutritional stores, and reduce nutrition uptake, collectively leading to death. Some of these include:

- Oral Thrush
- Diarrhea
- Nausea
- Skin lesions
- Compromised immune response
- TB, Malaria, Hepatitis, Cancers
- Respiratory infections
- Anorexia & Weight loss
- Constipation
- Chronic fatigue
- Depression
- Medications secondary effects

The important point is that HIV disease expresses itself on a continuum of increasingly debilitating symptoms over time. The food and nutrition needs which will vary accordingly can have measurable benefit for living better and longer. Some of these food and nutrition requirements will be covered under section 3 below.

II. Dairy Products and Human Nutrition

Dairy products, by the very nature of milk, are nutritionally dense – providing many critical nutrients per serving. They are well suited to the human diet in meeting our micronutrient and macronutrient needs: protein, fat, carbohydrates, vitamins, and minerals.

These basic components of milk will now be reviewed in turn.

Dairy Proteins

A person with HIV requires 50 – 100% more protein per day to meet the demands placed on their body (Woods 1999 in Oxfam 2002: 72). Dairy products are high in protein with the highest biological value among dietary proteins. In the USA, dairy products provide 19% of total dietary protein.

Proteins help maintain the body by contributing to growth, regulating body processes and providing energy. Proteins are the primary components of all living cells and body fluids with the exception of bile and urine. For this reason protein is essential for cell building and regeneration on an ongoing basis. During the period of rapid growth like

infancy and adolescence they are especially critical. Even enzymes, immune cells, and some hormones in the body are proteins. For example, Insulin, which regulates blood glucose, is a protein. Hemoglobin is an iron-bearing protein.

Milk is rich in high quality protein with high bioavailability in the body. There are two major types of proteins found in Milk. These are Casein and Whey Proteins. Casein is the protein present in cheeses for example. Whey is found concentrated in a by-product of cheese-making, in the form of a liquid that can be dried and consumed in many other foods. Each of these forms of protein contributes in specific ways to the nutritional value of dairy products for people with HIV disease.

Proteins contribute about 21% of the energy value in milk. One important measure of value to the human diet is “biological value” or “BV”. Biological value is a determinant of how effectively the protein can be metabolized and used for maintenance and growth. Milk proteins have a very high BV. The most significant constituents of dairy proteins are amino acids. These include 9 “essential” amino acids that are essential to survival and cannot be synthesized by humans; and 9 “non-essential” amino acids.

Amino Acids (composed of peptides and polypeptides) are the building blocks of proteins. Of the 20 amino acids, 18 are found in milk. Some of these amino acids are categorized as “essential” in the diet because the human body cannot synthesize them. All 8 (9 for infants) of the essential amino acids are present in milk in a useful balance. Amino acids are necessary in the human diet. For Example, diets high in grain typically are lacking in Lysine, which is an essential amino acid present in Milk. In this case, consuming milk in combination with grains makes the diet more complete.

Amino Acid Profile of 34% Whey Protein Concentrate – Typical values

Amino Acid	gm. Amino Acid <u>per 100 gm.</u>		
		Lysine	3.2
Alanine	1.6	Methionine	0.7
Arginine	0.8	Phenylalanine	1.1
Aspartic acid	3.6	Proline	1.9
Cysteine	0.8	Serine	1.6
Glutamic acid	6.2	Threonine	2.3
Glycine	0.5	Tryptophan	0.6
Histidine	0.7	Tyrosine	1.0
Isoleucine	2.0	Valine	2.0
Leucine	3.6	<hr/>	
		Total A.A. gm./100 gm.	34.0

Casein

Thirty eight percent Solids-not-fat content of fluid milk is Casein protein. As a percent of skim milk protein, casein is 76% to 78%. It is the protein that is precipitated and concentrated in cheese. Research findings are showing that casein has anti-

carcinogenic properties and acts to protect against cancer of the colon. *It also acts on the immune system stimulating Phagocytic cell activities and increasing lymphocytes.*

Whey Proteins

Whey (or milk serum proteins) is a byproduct of making cheese and is separated from the curd as a milky liquid rich in water soluble vitamins, minerals, lactose (“milk sugar”), and proteins. Concentrations of Whey Proteins are especially exciting in the area of human nutrition. *In animal studies, these proteins have been shown to strengthen cell-mediated and humoral immune responses.* Milk proteins have been shown to confer many other advantages: antibacterial properties of lactoferrin; enhancing calcium absorption; improved immune function; reducing blood pressure; protection from tooth decay and increase bone strength; nutrient bioavailability and retention; regulation of cellular growth and maturation, toxin elimination and pathogenic virulence.

Milk Fat

Compared with an average adult, an individual with HIV requires 10-15% more energy each day (Woods 1999 in Oxfam 2002: 72). Whole milk has 150 kcal / 8 oz. cup. Fats and oils are the most concentrated form of energy in the diet. Many dairy products such as cheese and butter, concentrate fat and are a dense, delicious source of energy. A serious side effect of HIV disease can be fat malabsorption which may require special dietary changes to reduce fat intake. None-the-less, as described below, milk fat contains many highly effective nutritional components of benefit to people with HIV disease.

The energy provided by milk comes mainly from fat (49%) [then Lactose (30%), and protein (21%)], and is measured in thousands of calories per unit (“kcal”) For example in typical whole 3.2% milk fat milk there are 150 kcal/8oz. Cup; fat free skim milk provides 90 kcal/ 8 oz. Cup.

Milk fat (lipids) comprises approximately 3.25% of fluid milk. It contains milk’s fat-soluble vitamins: A, D, E, K. Cholesterol as a component of fluid milk occurs at about 0.5%. Dairy fat in moderation is an excellent source of fat-soluble vitamins, and concentrated, digestible energy utilized by the body. Some dairy foods are of course valued for their concentration of dairy fat and appeal: Butter, cream, confections, and many aged cheeses. Fatty acids present in dairy fats such as conjugated linoleic acid “CLA” are being researched for their anti-carcinogenic effect and reduction in the risk of coronary heart disease. Another element of milk fat, Sphingolipids (making up one third of milk phospholipids), are under research for their protective role in cancer and cardiovascular disease.

Butyric acid, another component of dairy fat, is being researched for its role in protecting against certain cancers. Myristic acid is a saturated fatty acid comprising 10% of milk fat. This fatty acid is being researched for its capacity to help the body fight infection. Fats or lipids provide the body with a thermal blanket of subcutaneous tissue insulating

the body from heat loss. Importantly, in times of famine or prolonged disease this store of body fat is convertible into usable energy. Lipids are also a component of cell membranes.

Lactose / Carbohydrate

Lactose, or milk sugar, is the main carbohydrate found in milk accounting for about 30% of the energy – calories. It is unique in being the only significant dietary carbohydrate of animal origin. In addition to its primary function as a source of energy, lactose contributes to the metabolism of protein and forming body lubricants. In milk products, such as cheeses, lactose is greatly reduced by the action of microorganisms that convert lactose to lactic acid. Lactose can also be divided into its component sugars: glucose and galactose, through the process of hydrolysis using an enzyme, lactase. Lactase hydrolyzed milk can be up to 99.9% lactose free.

During digestion in the body, the slow hydrolysis of lactose into glucose and galactose molecules generates a prolonged energy supply. Lactose also stimulates the growth of lactobacilli (“good bacteria”) that produce acid in the intestinal tract protecting against damaging bacteria. Lactose increases calcium absorption and retention. In combination with proteins, carbohydrates form substances that are essential to fighting infection, lubricating the joints and maintaining the health and growth of bones, skin, nails, cartilage and tendons. There is also research indicating an important role for lactose in the development of the infant’s intestinal tract.

Lactose Sensitivity: perspective

Lactose digestion occurs in the human gut with the assistance of an enzyme, lactase. As discussed earlier, lactase hydrolyzes lactose into its two simple sugars: glucose (our brain’s sole energy source) and galactose. A naturally occurring milk sugar, and the only carbohydrate of animal origin, lactose is supplied in the milk of mother animals to all nursing mammalian infants. It is our first carbohydrate. However, in humans, some individuals develop a sensitivity to lactose as they grow, due to the loss of lactase enzyme. It is quite rare for a person to have a complete “intolerance” to lactose. Typically, even adults with sensitivity tolerate moderate intake of dairy products and will reestablish the lactase enzyme function with ongoing milk consumption. In blind experiments, lactose sensitive or “intolerant” people have been successful consuming lactose equivalent to two 8 oz. glasses of milk during a day without adverse reaction. None-the-less lactose sensitivity remains a concern for many, preventing them from consuming dairy products. This is significant for a person with HIV forming perceptions about milk’s role in their diets. Because of many gastrointestinal problems, a person with HIV disease may choose to eliminate some dairy from their diet to see if this is a contributing factor. Lactase-deficient subjects absorbed lactose in yogurt better than lactose in milk resulting in fewer reports of symptoms. Lactobacillus acidophilus used in yogurt acts in the human gut to facilitate digestion of lactose. Fermented milk products and cheeses present an appealing dairy alternative for people with lactose sensitivity.

Milk Minerals

Minerals are essential for adequate nutrition. The balance of minerals, their forms of intake, and associated food intake, can have a marked impact on their overall effectiveness in the diet. "Milk minerals" are available in this harmonized form for optimum utilization by the human body. This is not surprising, given the fact that it is the only form of nutrition provided to infants by their mothers for many months. Minerals present in milk such as calcium, selenium, and iron are critical in the diets of people with HIV disease.

Calcium

The most nutritionally significant mineral in milk, calcium is required for strong bones throughout life. During growth, inadequate calcium leads to porous, thin bones even if the length of the bone is not noticeably affected. Calcium is necessary in the diet for healthy colon mucosa and smooth artery muscle, it is believed by many researchers to reduce the risk of hypertension and colon cancer. In women, calcium is especially critical to prevent osteoporosis a thinning of the bones. While both health conditions such as osteoporosis and hypertension have multiple factors in their cause and treatment, calcium has been shown to be of significant benefit in their prevention and treatment.

Minerals contained in milk are balanced for optimal bioavailability and absorption

Minerals in Whole Milk	Quantity per liter
Calcium (mg)	1227.3
Chlorine (mg)	1031.35
Copper (mg)	0.1
Iodine (mcg)	237.21
Iron (mg)	0.52
Magnesium (mg)	138.2
Manganese (mg)	0.04
Molybdenum (mcg)	20.63
Phosphorus (mg)	963.28
Potassium (mg)	1567.65
Selenium (mcg)	15.47
Sodium (mg)	505.36
Zinc (mg)	3.92

ESHA Research, 1998.

Because protein and sodium increase urinary calcium loss these elements must be consumed in an appropriate ratio. The recommended ratio for calcium to protein is 20mg of calcium to 1 gm of protein (20:1) or higher. The calcium to protein ratio of cow's milk is approximately 36:1.

Current Dietary Recommendations for Calcium for Different Age Groups²

1 – 3 years	500 mg / day
4 – 8 years	800 mg / day
9 – 18 years (Incl. Pregnant, lactating females)	1,300 mg / day
19 – 50 years (Incl. Pregnant, lactating females)	1,000 mg / day
>50 years	1,200 mg / day

² Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine, National Academy of Sciences

Calcium-Rich Choices (For Adults 25 and older, 800 mg of calcium is recommended.)³

	Calcium Mg	Calories	Fat Grams
Yogurt, plain, lowfat (1 cup)	415	144	4
Milk, skim (1 cup)	302	86	0
Milk, 1% lowfat (1 cup)	300	102	3
Milk, whole (1 cup)	291	150	8
Buttermilk (1 cup)	285	99	2
Cheese, Swiss (1 oz)	272	107	8
Cheese, Cheddar (1 oz)	204	114	9
Cheese, Mozzarella pt-skim (1 oz)	183	72	5
Ice Cream hd, 10% fat (1/2 cup)	88	135	7
Cheese, cottage 2% lowfat (1/2 cup)	77	102	2

Milk Vitamins

Vitamins are divided into two groupings: fat soluble (more readily stored in body tissue) or water-soluble. Milk and dairy products contain both in a balanced abundance. Vitamins A, D, E, and K are fat-soluble and vitamin C and all the B vitamins are water soluble. Importantly, water-soluble vitamins are not well retained by the body and so require daily replenishment. Often, vitamin functions are more recognized for the symptoms of their deficiencies than their natural regulatory functions (e.g. vitamin C deficiency can result in scurvy). People with HIV disease are at particular risk of micronutrient (vitamins & minerals) deficiencies for a number of reasons: reduced food intake, poorly balanced diet due to anorexia, inadequate nutrient absorption in the gut because of diarrhea, and increased demands on body systems as it fights infection. (see p. 6 of the attachment under “secondary disease”)

The most important **fat-soluble vitamins** abundant in milk are A, D, and K. A is critical to eyesight (prevention of blindness) and maintenance of epithelial tissue such as the cornea, and mucous membranes that protect the body from infection: linings of the gastrointestinal tract, lungs, vagina, and skin. Without vitamin A these tissues function improperly and expose the body to infection. D facilitates calcium absorption from the intestine and deposition into the bone. It also functions to utilize calcium and phosphorus from bones. Rickets, characterized by deformity in the legs, is caused by vitamin D deficiency. Vitamin K is important for its role in blood clotting. While abundant in most diets and available from microbial synthesis in the gut, severe intestinal conditions combined with a poor diet will lead to a deficiency.

³ National Dairy Council 1992 by Permission

Vitamins contained in milk

Vitamins in Whole Milk	Quantity per liter
A (IU)	1299.5
B1 Thiamin (mg)	0.39
B2 Riboflavin (mg)	1.67
B3 (mg) Niacin	0.87
B6 (mg)	0.43
B12 (mcg)	3.68
Biotin (mcg)	19.6
Vit C (mg)	9.69
Vit. D (IU)	41.25
Vit. E (IU)	1.54
Folate (mcg)	51.57
Vit K (mcg)	41.25
Panhotenate (mg)	3.24

ESHA Research, 1998.

Significant water-soluble vitamins abundant in milk include B1, B2, B3. Vitamin B1 or Thiamin plays a critical regulatory metabolic role in the body's chemistry. It facilitates the conversion of carbohydrate to fat. Also important, is its role in the nervous system, cardiac, and circulatory function. Deficiency of B1 can lead to a condition known as beriberi, a breakdown of numerous bodily systems. B2 or Riboflavin is essential for fatty acid and amino acid synthesis. Cell growth does not occur without Riboflavin. B3 or Niacin plays a critical role in over fifty metabolic reactions. It is important in energy delivery and performance of all cells. A deficiency of Niacin results in the condition known as pellagra with skin conditions, diarrhea and nervous system disorders.

Average Nutrient Values for Some Dairy Products¹

Component	Non fat Dry Milk	Dry Whole Milk	Dry Buttermilk	Dry Whey (Sweet-type)	Whey Protein Concentrate			Lactose
					34%	50%	80%	
Calories (Kcal)	359	499	389	354	377	373	380	384
Calories from total fat	7	250	54	9	27	38	45	1
Total fat (g)	0.8	28	6	1	3	4	5	0.1
Saturated fat (g)	0.5	18	5	0.7	2.3	2.3	0.9	<0.01
Cholesterol (mg)	25	90	72	22	97	127	151	<1
Total carbohydrate g	52	37	49	73	51	36	4	98
Sugars (g)	51	36	48	72	49	35	3	98
Protein (g)	36	27	32	12	35	50	79	0.2
Sodium (mg)	494	372	497	876	551	472	183	11
Potassium (mg)	1,674	1,304	1,551	2,118	1,651	1,400	337	25
Vitamin A (IU)	30	1,265	254	64	72	50		<50
Vitamin C (mg)	8	8	5	3	1.5		1.4	<1
Calcium (mg)	1,248	921	1,094	594	536	498	637	28
Iron (mg)	0.4	0.4	0.6	0.6	0.6		1.2	0.2
Riboflavin (mg)	1.8	1.6	2.1	2.2	1.8		1	
Phosphorus (mg)	993	758	906	810	538	450	379	2.3
Ash (g)	8	6	8	8	6	7	4	0.1
Moisture (g)	3.4	2.7	3.5	4.5	4	4	3.5	2.4

¹Values expressed per 100 grams of product as is.

III. Dairy Product Nutrition in the Diets of People Living with HIV / AIDS

There is an extensive literature covering the special dietary requirements of people living with HIV/AIDS disease. Pertaining to dairy products specifically, there are three domains from which to evaluate nutrition.

1. **Organoleptic** (or gustatory) appeal – dairy products are delicious to eat, available and well accepted around the world. A person is enticed and motivated to eat healthy when they eat the large array of dairy based food.
2. **Dietary value** of dairy products, *reviewed above* – as a source of energy, protein, and basic nutrition dairy products are of high value and nutritionally dense so people get more of the nutrients their body needs even when eating less.
3. **Functional Food:** A rapidly emerging body of research showing that functional biological properties of milk components can confer unique benefit to people with HIV disease. This is surveyed in the *attached matrix*.

1. Gustatory Appeal of Dairy Products

People with HIV/AIDS experience food differently during their disease so the form of food can play a critical role in getting adequate nutrition. The need for a varied diet is essential. Dairy products exist in a remarkably broad range of forms and as such present a unique source of both diversity in the diet and pleasure in consuming them. As ingredients, dairy products add culinary appeal and nutrition. Consider the following list where they may be cold, hot, or room temperature; savory or sweet; bland or flavored; eaten alone, with other foods, or as ingredients to add appeal.

Sour cream	Butter
Cream cheese	Ghee
Fluid Milk	Powdered milk
Cream	Milk shakes
Candies	Smoothies
Ice Cream	Melted cheese, cheese sauce
Hard Cheeses	Frosting
Yogurt	Desserts
Kefir	Mouse
Other fermented milk products	Cream based soups and sauces

2. Dietary Value of Dairy Products for People with HIV Disease

In the early stages of HIV infection adequate nutrition can help to slow the progression to HIV/AIDS and diets rich in protein, energy and micronutrients are likely to help build immune resistance to opportunistic infections. This has led for calls for food relief rations to be revised to reflect the needs of people living with AIDS.⁴

Good Nutrition can change their life: reduces the cost of medical care, reduces complications and hospitalizations, shortens the duration of hospital stays, improves effectiveness and tolerance to medications and treatments, Increases productivity and independence, and Increases the ability to remain at home.⁵

For mother to child transmission of HIV/AIDS, *Combining nutritionally dense food with care for women who are pregnant or nursing and for their infants, helps turn the tide of HIV disease and death in four specific ways:*

1. Fully nourished mothers cope successfully with the physical demands of pregnancy, and if HIV positive, remain healthy care providing mothers, longer.
2. Higher birth weight, stronger infants from well nourished mothers can fend off disease and maintain health.
3. Mother's and child's bodies are in better condition for responding to HIV drug therapy when it is available.
4. Nursing Mothers have adequate energy and micronutrients themselves during breast milk production; or access to ready to use replacement milk for non-nursing mothers.

Drug therapy imposes its own unique requirements for nutrition on people with HIV disease. There is evidence showing that consuming dairy products, as part of a balanced diet, contributes to a more effective response to, and tolerance, of drug therapy.

What is so pointedly suitable about dairy products for the nutrition of people with HIV disease is that they are available, affordable, palatable, familiar, and nutritionally dense forms of food. In food relief terms there is "availability, access, and utilization". All are attributes that address the exceptional stresses and needs of so many of these people.

⁴ HIV/AIDS: What are the implications for humanitarian action? A Literature Review ; July 2003; Paul Harvey

⁵ Ibid

Nutrient Contribution of Bovine Milk and Milk Products to the U.S. Diet

Calcium	73%	Magnesium	16%
Phosphorus	33%	Vitamin B 12	21%
Riboflavin	31%	Vitamin A	17%
Protein	19%	Vitamin B 6	10%

U.S. Government estimates

3. Functional Properties of Milk and Milk Products

Dairy Products are nutritionally dense and in the case of whole milk, nutritionally complete in the balance of nutrients. Components of milk and forms of dairy products additionally have biological properties of functional benefit to a person living asymptotically with HIV, or coping with active AIDS.

Milk component functions significant for people with HIV disease include:

- Anti-microbial – including control of gut microflora
- Anti-viral
- Binding of E coli and cholera enterotoxins
- Anti-cancer
- Immunomodulation
- Anti-oxidative
- Opioid effects
- Anti-thrombic (reduces clotting)
- Retard osteoporosis, loss of bone mass

These will be reviewed in the attached matrix: “HIV Related to Symptoms and the Functional Role of Dairy Nutrition”

Condition	Symptoms	Functional Role Dairy Products May Play
<p>I. Acute HIV Infection</p>	<p>Human Immunodeficiency Virus enters the body through a breach in primary defense (break in skin, mucous membranes, epithelial tissues) This includes blood transfusion with infected blood, or nursing from an HIV + mother where the infant has a surface lesion in its mouth or alimentary system. A brief period of flu like symptoms (experienced by about 70%) may or may not occur within days of infection. Sometimes few or no symptoms are present.</p>	<p>Dairy products offer a nutritionally dense and balanced form of food that helps build, maintain, and repair the body's defense systems. Overall physical health and nutritional status will influence the body's vulnerability to infection. For example, the presence of sexually transmitted disease such as gonorrhea will increase the chances of infection. This is due to the importance of an intact body defense system. Vitamin A, present in dairy, is essential for the health of epithelial cells, the body's first line in defense against HIV and other pathogens. (A. French et al; Association of Vitamin A (retinol) Deficiency with Cervical Squamous Intreepithelial Lesions in Human Immunodeficiency Virus-Infected Women; The Journal of Infectious Diseases 2000; 182:1084-9.) The production of mucous, an essential protection lining the mouth and urogenital tract is developed by proteins and components of lactose in milk.</p>
<p>II. Asymptomatic Phase (HIV Disease)</p>	<p>Studies have shown that decreased levels of the body's most powerful inter cellular antioxidant, glutathione, occur within weeks of HIV infection.</p> <p>The immune response requires mobilization – and loss - of millions of immune cells which are proteins. Replenishing these cells is an ongoing challenge to the body.</p>	<p>Dairy derived whey proteins have been shown to directly increase the body's synthesis of glutathione which is critical for someone with HIV disease.</p> <p>The amount of oxidative damage increases early in HIV disease worsening over time. The lower levels of glutathione lead to immune cell dysfunction in multiple ways, and allow body cells and tissues to become damaged from the oxidative stress. Researchers have shown that lowered levels of glutathione are strongly tied to an increased risk for disease progress. Insufficient glutathione also means that the liver is less able to properly break down drugs and other toxins, increasing the potential for liver damage from medications.</p> <p>Supplementation with whey proteins provided an increase in plasma glutathione, a critical antioxidant, in 30 patients with advance HIV infections, the treatment was well tolerated. During a two week trial, the commercial source of protein did influence the extent of increase in plasma glutathione levels. (Micke, P. et al., (2002) Effect of long term supplementation with whey proteins on plasma glutathione levels of HIV infected patients. European Journal of Nutrition 41:12-18.)</p>

Condition	Symptoms	Functional Role Dairy Products May Play
III. Reduced Immune Function Phase (HIV Disease)	<p>Secondary illnesses and co-infections begin. These may include serious forms such as Hepatitis B & C.</p>	<p>Micronutrients (Vitamins & Minerals) are abundant in dairy products. Researchers at the University of California at Berkeley showed that the <i>slowest HIV disease progression was seen in those with the highest intake of micronutrients</i>, a level that the researchers pointed out could not be achieved by diet alone but required nutrient supplementation. Those whose supplementation was in the highest level (based on daily intake), were only half as likely to progress to advanced HIV disease (AIDS) as those whose intake was in the middle or lowest levels.</p>
IV. Active AIDS (Advanced HIV Disease)	<p>The following are some of the symptoms experienced by people with HIV disease and advanced HIV disease; The presence, frequency, and severity of these symptoms will increase with the advance of the disease and the weakness of the immune system against infection.</p>	<p>Lactoferrin is a sub-fraction of whey protein and so is present in human breast milk and bovine milk. It has iron binding properties which improves absorption of iron by the body preventing anemia, deprives harmful bacteria of iron thus inhibiting their growth, and reduces the chances of the formation of free-radicals thereby preventing cell damage. It also has been shown to suppress tumor growth, and work against viral infections such as herpes.</p> <p>Maintaining a balanced nutritious diet is critical to fighting illness, supporting metabolic performance, and repairing damage. Dairy foods, with many functional properties, present one effective component of such a diet.</p>
Oral, Throat Thrush	<p>Sores form in the mouth and throat creating extreme discomfort and making abrasive and acidic foods difficult to consume.</p>	<p>Many forms of dairy products including yogurt and ice cream have been reported to be soothing as a source of food that is preferred by people during this condition. Also, beverage foods such as health-shakes, smoothies, milkshakes, milk, eggnog, drinking yogurt are an easier way of bypassing the sores with less harm and pain.</p>

Condition	Symptoms	Functional Role Dairy Products May Play
Hyper-metabolic response	This refers to the tendency of the body to accelerate metabolic processes as a response to advanced HIV disease. The immediate consequence is the use of more energy with the requirement for increased intake of food energy.	Dairy products are dense in energy: such as cheese, ice cream, butter, and dairy desserts (puddings and pies), butter fat, sugar, as well as protein. They are appealing to eat and provide concentrated energy – with good micronutrients, and lots of cell building protein – during periods of critical need.
Diarrhea	Chronic diarrhea is a persistent symptom of HIV infection as the immune system is weakened. It also is opportunistic as the patient becomes weakened by under-nutrition and secondary illnesses. Diarrhea is devastating on two fronts. First, it results in the rapid “shedding” of the contents of the intestines losing water and electrolytes leading to dehydration, shock and possibly death in extreme cases or in infants. Second, the parasites and pathogens damage the lining of the intestines reducing the absorption of nutrients resulting in further weakening of the person.	<p>Fermented milk products include: yogurt, kefir, nono (West Africa), and the numerous “sour milk” products consumed in Africa and throughout the world. Fermented milk products deliver live bacteria colonies such as <i>Lactobacillus Bulgaricus</i> and <i>L. Acidophilus</i>, <i>Bifidobacteria</i> (and yeasts such as <i>Candida Kefir</i>) into the human gastro-intestinal (“GI”) tract where they produce metabolites such as lactic acid contributing to a multitude of beneficial functions in protection and absorption. The presence of these beneficial bacteria has been clinically demonstrated to enhance nutrient absorption, maintain the integrity of the intestinal lining, protect against diarrhea, cancer of the colon and encourage more rapid recovery from pathogen or antibiotic diarrhea.</p> <p>Processed colostrum from cows specifically immunized against <i>Cryptosporidium parvum</i> was fed to AIDS patients with severe chronic diarrhea, a total of 40 grams of colostrum antibody product daily. This resulted in reduced diarrhea, reduced shedding of the organism and in some cases weight gain. These patients had uncontrollable infections that required substantial amounts of antibodies to combat the health condition. Less severe infections may have required lower quantity of antibodies. similar results have been demonstrated against other pathogens, such as <i>E. coli</i>, rotavirus, <i>Clostridium difficile</i>, <i>Candida albicans</i>, etc., with a range of doses. (Greenberg, Paul D. and Cello, John P. “Treatment of Severe Diarrhea</p>

		<p>Caused by <i>Cryptosporidium parvum</i> with Oral Bovine Immunoglobulin Concentrate in Patients with AIDS, Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology, 13:348-354, 1996).</p> <p>Lactoferrin has been shown to bind with Rotovirus and inactivate, one of the most common diarrheal pathogens.</p> <p>Lactose is metabolized into compounds that protect the gastrointestinal tract.</p>
<p>Compromised immune response</p>	<p>HIV viruses continue to replicate within lymphatic tissues and cause damage there. The immune system continues to combat the HI viruses during this period, which may last for years, but in time the virus concentration increases as the body's helper T-cell concentration gradually decreases.</p>	<p>(refer also to "colostrum" discussed under diarrhea)</p> <p>Lactoferrin a fraction of whey protein, has been shown to be inhibitory to HIV virus (Berkhout, et al., 2003).</p> <p>Ng et al. 2001 evaluated a number of bovine milk proteins for activity against HIV-1 enzymes considered to be important to the life cycles of the HIV virus; These proteins have been assayed for inhibitory activity against human immunodeficiency virus type 1 (HIV-1) There is increasing suggestion that the Immunoregulatory action of the primary milk proteins is well balanced and that some components may serve to regulate the function of others (Wong, et al. 1997)</p> <p>Immunomodulating peptides: Components in dairy foods that may modulate immune response, either through specific or non-specific means, include: Whole casein, alpha s, beta and kappa casein; Casein glycomacropeptide Casein derived immunopeptides have been shown to stimulate the phagocytic activities of human macrophagesand the peptides may stimulate the proliferation and maturation of T cells and natural killer cells</p> <p>for the defense of the newborn against a large number of bacteria. (Nagendra, P. Shah; Effects of milk-derived bioactives: an overview; British Journal of Nutrition (2000), 84, Suppl. I, S3-S10</p> <p>Immunoglobulin of milk and whey, especially from colostrum, have been suggested to assist in the development of passive immunity; The number of specific immunoglobulins in the whey from commercial milk supplies is not known, but will reflect the exposure of the cows to antigens in their natural environment. Where a given milk supply represents milk from thousands of individual cows, it is to be</p>

		<p>expected that there will be a wide range of different immunoglobulins present -- the type and levels of which would be expected to vary widely. It is known that whey protein concentrates, treated to avoid denaturation., from mixed milk supplies generally contain sufficient antibody to <i>E. coli K-99</i> to meet the requirements of the USDA to serve as a colostrum supplement.</p>
<p>Depression</p>	<p>Hopelessness, isolation, loss of interests, loss of appetite, giving up, are all found in people challenged with this shattering disease.</p>	<p>Milk casein contains bioactive peptides with opioid properties. Opioid peptides are those having pharmacological similarities to opium (morphine) and are derived from milk casein called casomorphins. These are found in the blood plasma of pregnant and lactating women and are associated with mood enhancing properties. (Nagendra, P. Shah; Effects of milk-derived bioactives: an overview; British Journal of Nutrition (2000), 84, Suppl. I, S3-S10) Teschemacher (1987) and Paroli (1988) also reported analgesic and sedative effects of opioid peptides when injected in the bloodstream.</p> <p>Milk and dairy products contain the amino acid Tryptophan which is known to enhance mood and brain function. Studies with humans and animals conducted over the past 30 years show that serotonin nerve circuits promote feelings of well being, calm, personal security, relaxation, confidence and concentration. The "serotonin deficiency syndrome" is one of the most common and widespread disorders of human psychobiology in the modern world. Prozac allegedly increases the amount of serotonin in the synaptic gap that slightly separates nerve cells from each other.</p> <p>-See the published research of S.N. Young and H.M. Praag</p>
<p>Skin lesions</p>	<p>Sores on the skin that refuse to heal leading to breaches that admit other infections</p>	<p>Micronutrients such as vitamin A and iron as well as proteins, are critical to maintaining epithelial health and to healing lesions. As discussed elsewhere, the body's defense systems are strengthened generally by adequate nutrients which dairy is rich in supplying.</p>
<p>Anorexia; Weight loss</p>	<p>Loss of appetite is a common chronic problem. Weight loss results from reduced intake of food, increased metabolic demands, co-infections, nausea, and chronic diarrhea.</p>	<p>Because of dairy foods bland pleasing tastes they are an excellent carrier or ingredient in meals for someone with loss of appetite. Many report enjoying desserts such as pudding or cream based soups. Favorite foods such as traditional porridges can be made more nutritious through the addition of milk powder for example.</p>

Condition	Symptoms	Functional Role Dairy Products May Play
Constipation		The presence of adequate amounts and forms of gut flora (beneficial microorganisms that colonize the lower alimentary canal) contributes to effective bulking of chime and elimination.
Nausea	Nausea accompanies HIV and many of the secondary illnesses. This may also be a reaction to drug therapies. Loss of nutrients is a consequence	There are natural nausea suppressants. Some bland dairy products such as yogurt are reported to be accepted and retained by patients with nausea.
Medications and their secondary effects	Nausea, hunger and thirst, dry mouth – many and unpredictable	Drug therapy imposes its own unique requirements for nutrition on people with HIV disease. There is evidence showing that consuming dairy products specifically, as part of a balanced diet, contributes to a more effective response to, and tolerance, of HIV drug therapy. However, there are often strict dietary guidelines that accompany drug therapy and these must take precedence when present.
Secondary disease : TB, Malaria, Hepatitis; Respiratory infections	These are the diseases that will kill someone who is HIV+ because of the weakening effect of the disease.	Dairy products are nutritionally dense in micronutrients essential to a strong immune system and surviving chronic diseases. “The potential for micronutrient deficiencies to act as co-factors in HIV transmission and progression is most obvious in poor populations with inadequate dietary intake <i>and a high infectious disease burden</i>Micronutrient deficiencies could be co-factors in the progression of HIV infection to AIDS and death, in the sexual transmission of HIV, and in mother-to-child transmission of HIV.” ⁶

⁶ United Nations Sub-Committee on Nutrition (“ACC/SCN”), Dr. Henrik Friis, Research Dept. of Human Nutrition, The Royal University, Denmark