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Title: A comparison of Similar Units of Dairy and Dairy Alternatives Products available in Trinidad

Student Name: Ayana Aisha Small

Project Supervisor: Dr. Patricia Dyett

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Department of Agricultural Economics & Extension
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The sun shines not on us, but in us. The rivers flow not past but through us. Nature was made not just for us, but for itself and its own happiness, and is the smile of the Devine"

by John Muir

First and fore most I would like to thanks my creator, without whom none of this would be possible.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Background. Diets based on nutrient content profiles such as, calories from fat, saturated fat, cholesterol, sugars and sodium, directly influence the development of Heart Disease, Diabetes Mellitus, and Cancer, the top three leading causes of death in Trinidad and Tobago. Dairy product are known to be a rich source of these nutrient, as such, manufacturers have sought to manufacture products with more "healthful" nutrient options from regular and alternative sources.

Problem Statement. Based on nutrient profiles of food nutrition fact labels, are alternative dairy products providing more "healthful" options than regular dairy products?

Methods. One-way ANOVA contrast of the nutrient profiles was carried out on similar units of regular and alternative milks; the Null Hypothesis was rejected at 5%. Additionally, mean nutrient content test were carried out between and among the regular and alternative milks, by base, type and composition.

Results. The nutrient content differences observed between regular and alternative liquid milk bases were significant for most of the nutrients ($p<0.05$), except for, saturated fat, sodium, calcium total carbohydrate and vitamin A content. For the powdered regular and alternative milk bases significance was shown for the nutrients; calories from fat, total fat, sodium, protein and calcium content.

Conclusion. Liquid alternative milks reflect the more healthful options having lower caloric, cholesterol and sugar content, and higher dietary fiber content, normally associated with reduced risk of heart disease and developing diabetes. Due to the many controversial claims on health implications of protein, vitamin C, vitamin D, calcium and iron, no conclusions can be made on whether the nutrient profiles of alternative milks reflect a more "healthful" option.

INTRODUCTION

"Many Imitations, Still No Equal", is the recent advertising campaign launch by the creator of 'GOT MILK?'. Mr. Steve James, executive director of the California Milk Processor Board (CMPB), in an October 2011 interview at this launch said, "We believe that people should have a choice and welcome the fact that there are alternatives for consumers. However, lately dairy milk has been under attack by some manufacturers of alternative milks that have made it their mission to make the dairy milk obsolete. We don't think its right to let customers be confused by imitation milks pretending to be the same as the original" (Wam 2011).

Statement of Problem

For decades, dairy products have been an integral part of the diet in many regions of the world, including the Caribbean. Dairy products are generally defined as foods obtained from cow's milk and includes, milk, butter, cheese, cream, custard, ice cream and yogurt. On average, a typical person may consume 2-3 servings of dairy a day; that is, some form of dairy product per meal (USDA 2005). The food group, "Foods from Animals" of the Caribbean Food Group Guidelines, suggest similar servings of dairy as the Food Pyramid Nutritional Guidelines (CFNI n.d.). Among all the various types of dairy products available in Trinidad, milk, and cheese are the two most commonly used by consumers.

Dairy has been promoted as a rich food source of many important nutrients such as High Biological value protein, calcium, riboflavin, vitamin D, vitamin A, and phosphorus. Many of these

nutrients are crucial to the integrity of skeletal health and other physiological benefits. However, there are health-related issues associated with dairy, one of which is that proteins cause allergic reactions in sensitive individuals; and the lactose found in milk poses problems to individuals who are lactose intolerant. Additionally, many dairy products also provide some less desirable nutrient elements such as high caloric density, calories from fat, saturated fat, cholesterol, and high sugar content. High consumption of foods providing the latter has influenced the increase in chronic disease development in many societies.

In recent decades, therefore, manufacturers , in an effort to meet the demands of consumers who pursue options that are considered more "healthful", have sought to provide dairy products with nutrient content claims such as; low fat, 1% fat, 2% fat, or non-fat (skim), and lactose-free. Other manufacturers make available dairy product alternatives made from plant sources, which may also be intended to join the list of more "healthful" options.

Health conscious persons in society have been making diligent efforts to read nutrition fact labels found on various dairy and alternative products in order to make the best possible decisions when choosing products for consumption. The critical question therefore is: Based on the nutrient content profiles found on food labels, are alternative dairy products that are available in Trinidad really providing more "healthful" options than regular dairy products?

Background

In recent years, there has been, an increase in the development of chronic diseases in many societies, including Trinidad and Tobago. The Annual Statistical Report 2004- 2005 of the top ten leading causes by rank and percentage of total deaths in Trinidad and Tobago lists: Disease of the Heart, Diabetes Mellitus and Malignant Neoplasm (Cancer), as the top three leading causes of deaths in that order (GovTT 2004-2005). All of these diseases are impacted by diet due to particular nutrient content profiles involving calories from fat, saturated fat, cholesterol, sugars, and sodium. The main food group that typically provides rich sources of many of these elements includes foods from animal sources such as meat, poultry, fish, eggs, and dairy.

Various ethnic, religious, and health cultures comprise the island; and some of these cultures adhere to specific diet-related practices, particularly involving food from animal sources. Nevertheless, it has been observed that even among the members of the population who may not use meat products for religious and other reasons, many still use some form of dairy, usually milk, and cheese. Because of possible nutrient-related chronic disease health implications as well as the significant number of persons in society who experience health issues such as lactose intolerance and milk allergies, a look at commonly used dairy products and alternatives is timely.

Rationale

The island of Trinidad is experiencing an increase in chronic disease development. Diet-related attributes of many chronic diseases include use of foods with calorie dense, high total fat, saturated fat, high cholesterol, and high sodium content. Foods from animal sources are known to provide a rich source of many of these elements. Various animal food products, particularly dairy products, can be found as an integral part of the diet and menu items of many of the cultural groups found in Trinidad. Apart from the chronic disease health implications, dairy products are also known to have adverse effect on persons who are lactose intolerant and have milk allergies.

Health conscious consumers therefore need to be certain that when compared to regular dairy products, the dairy alternatives intended for options that are more "healthful" are indeed providing nutrient profiles that are more conducive to health and less contributory to diet-related chronic disease risk.

Purpose of the Project

This research on one of the most commonly used dairy products in Trinidad will seek to compare the nutrient content of similar units of regular and alternative milk, through statistical analysis of the nutrients found on the nutrition fact labels of products available in Trinidad. The analyses will serve to compare regular milk and alternative milk in terms of calories and nutrients such as fats, cholesterol, sodium, carbohydrates, protein, and vitamins.

Based on the observed nutrient profiles from the research analysis, it can then be determined whether the health implications of regular dairy products are significantly different from alternative dairy products.

Hypotheses

- Based on nutrient fact labels, milk alternatives contain nutrient profiles that reflect options that are more “healthful”.
- Health implications associated with regular milk products are not associated with alternative milk products.

Methods

Both a directory and internet survey of the general food stores and health food stores in Trinidad was conducted. Thereafter, both the general food stores and health food stores with ≥2 branch locations in very populated and major city areas were then visited. A short, written questionnaire with both closed and open-ended questions was given to store managers. Questions pertained to availability of regular and alternative milk products in stores; the different brands available; the most common or popular brands and customer demands for alternative dairy products in the recent 5years.

Based on reports of the more common brands of dairy and dairy alternative products available, an observational study was then conducted to obtain the nutrient profiles from the nutrition fact labels

of each product. A comparison analysis was thereafter conducted on the mean nutrient profiles of regular and alternative milk products

Limitations

- Inability to obtain product nutrient profiles files from store managers.
- Common or popular product brands available that do not contain detailed nutrient label information.
- Biochemical analysis of nutrient loss from manufacture to shelf life not determined.

LITERATURE REVIEW

Dairy products are defined as foods obtained from cow's milk and include milk, butter, cheese, cream, custard, ice cream, and yogurt (Wikipedia n.d.). Consumption of dairy products is associated with overall diet quality and adequate intake of nutrients, including calcium, phosphorus, potassium, magnesium, zinc, iron, vitamin B_{12}, protein, vitamin B_2 and vitamins A and D (USDA 2005).

Adequate intakes of calcium rich foods such as milk and other dairy products help reduce the risk of osteoporosis, which affects adults over the age of 50 (Huth PJ. 2008). Osteoporosis can affect both women and men and occurs in all races (Surgeon General 2004). Calcium and vitamin D are known to be beneficial to bone health. Ninety-nine percent of the body's calcium is stored in the bones and vitamin D increases calcium absorption (Cashman KD 2002). In addition to calcium and vitamin D, other nutrients in dairy such as protein, phosphorus, magnesium, potassium, zinc, and vitamins A, C and K support bone health (Heaney RP 2001). Based on studies demonstrating the constructive balance and amounts of protein and calcium in dairy foods, dairy products appear to be ideal for skeletal health (Heaney RP 2001).

Case-control studies in Greece found that consumption of dairy products or dairy food nutrients such as calcium, vitamin D and conjugated linoleic acid was associated with a significantly lower risk of acute coronary events, even after controlling for several confounding factors (Kontogianni MD 2006). Other recent studies suggest that these same dairy food nutrients may reduce cardiovascular disease risk by their beneficial effect on blood lipid levels (Major GC 2007). In 63 overweight or obese women with initially low calcium intakes (<800 mg/day), increased calcium and

vitamin D intake improved blood lipid and lipoprotein profiles during a 15-week weight loss intervention, with some of these changes being independent of changes in body composition (Major GC 2007).

Recent epidemiological studies such as the 10-year prospective study of more than 37,000 middle-aged women without diabetes found that women with the highest dairy intake (>2.9 servings/day) had a 21% lower risk for type 2 diabetes than those who consumed less than 0.85 servings/day after adjusting for potential confounding factors (Liu S 2006). Every extra daily serving of dairy foods was associated with a 4% lower risk of type 2 diabetes, this inverse association was mainly attributed to intake of low-fat dairy foods (Liu S 2006). Similar findings have been reported in men with each additional serving of dairy foods reducing men's risk of diabetes by 9% (Choi HK 2005). Although the mechanism(s) remains to be explained, dairy products contain a number of components that may support the inverse relationship between dairy consumption and type-2 diabetes (Nilsson M 2007).

Hypertension or uncontrolled high blood pressure increases the risk for cardiovascular disease and myocardial infractions (American Heart Association 2010). Recent observational studies indicate that dairy foods and dairy food nutrients such as calcium help maintain normal blood pressure (Djoussé L 2006). A cross-sectional study among 4,794 adults enrolled in the National Heart, Lung and Blood Institute, Family Heart study found that consuming three or more servings of dairy foods a day significantly lowered systolic blood pressure and prevalence of high blood pressure when compared to consuming less than one-half serving of dairy foods a day (Djoussé L 2006).

However, despite researched health benefits and constant encouragement through advertisement campaigns to drink more milk and consume more dairy products for the sake of our bones and other health benefits, further review of the subject provides contradictory reports and

recommendations (Lanou AJ 2004). In a research of postmenopausal women, women with a high dietary ratio of animal to vegetable protein intake had more rapid femoral neck bone loss and a greater risk of hip fracture than do those with a low ratio, this suggests that an increase in vegetable protein intake and a decrease in animal protein intake may decrease bone loss and the risk of hip fracture (Sellmeyer DE 2001). It has been suggested that this is as a result of the very acidic high levels of animal protein from dairy, thus the body tries to neutralize the acid by leaching calcium from its bones by flushing from the body in the urine (Lanou AJ 2004).

Cow's milk is also increasingly linked to certain cancers (Donaldson 2004). Hormones and other growth factors in milk seem to be implicated, and are unavoidable because dairy milk comes from pregnant cows and cows that have recently given birth (Danby 2005). Review of literature shows that milk and dairy products contain a cocktail of 35 different hormones such as estrogen, and 11 growth factors that can make cells grow out of control (Danby 2005). Insulin-like growth factor 1(IGF-1), controls different growth rates and development in both cows and humans (Wu Y 2002). IGF-1 is found in cow's milk; and it crosses the intestinal wall and enters the blood, because it survives pasteurization (Wu Y 2002). Even a small increase in human levels of IGF-1 raises the risk of several common cancers, including breast, prostate, lung, and colon (Wu Y 2002). Increasing cow's milk intake from 200 to 600ml a day produced a 30 per cent increase in IGF-1 in young boys (Hoppe C 2004).

Dairy products contain large amounts of saturated fats and are calorie dense (American Heart Association Nutrition Committee 2006). Diets high in saturated fat raise "bad cholesterol levels in the blood"; bad cholesterol is called Low Density Lipoprotein (LDL) cholesterol. High LDL cholesterol increases the risk of Coronary Heart Disease (CHD) (USDA 2005). Saturated fats increase cholesterol levels, which in turn increase the buildup of plaques. This buildup of fatty deposits (plaques) in the arteries block blood supply to the heart and lead to CHD and myocardial infractions. Research from

the 1980s by Frank M. Sacks, on “Plasma Lipoprotein Levels in Vegetarians” identified dairy products as a major source of saturated fat (Jenkins DJ 2006). A later 1990 research by M. L. Toohey, showed that African-American vegans had a healthier balance of fats in their blood than vegetarians who consumed milk and dairy products (Sarri KO 2003)

An escalation in chronic diseases has been observed recently in many societies, including Trinidad and Tobago. The Annual Statistical Report 2004- 2005 of the top ten leading causes by rank and percentage of total deaths in Trinidad and Tobago lists Disease of the Heart, Diabetes Mellitus and Malignant Neoplasm (Cancer), as the top three leading causes of deaths in that order (GovTT 2004-2005). Diet-related attributes include use of food products that are calorie dense and foods high in total fat, saturated fat, cholesterol, and sodium content. Dairy products are known to provide a rich source of many of these elements. Manufacturers have therefore sought to provide dairy products with lower calorie and fat content, in an effort to meet the demands of consumers who pursue options that are considered more “healthful”. Other manufacturers have carried their efforts a stage further by making available dairy product alternatives made from plant sources which will be void of cholesterol and which may join the list of more healthful options. It would therefore be useful for health conscious consumers to take a closer look at the nutrient profiles of regular dairy products, altered dairy options, and dairy alternatives, as they seek to make more informed food and diet choices. The nutrition fact labels on food products can provide very useful information in this regard.

A nutrient fact label, also known as the nutritional information panel, is a label required on most packaged food products in many countries, including Trinidad. These labels provide information on the amounts of specified nutrients contained in a serving of the food item (USDA 2005). The food labels can therefore also enable comparison of products based on key nutrients. Food label comparison can be made of nutrients such as calories, calories from fat, total fat, saturated fat, trans fat, cholesterol, sodium, carbohydrates, added sugars, and fiber; which are the macronutrients found

on food product labels (Poon P 2006). This information can assist persons trying to reduce the risk of chronic disease; persons looking for options that are more "healthful"; or those with particular lifestyle choices (Poon P 2006).

A typical nutrition fact label of any dairy or dairy alternative product available in Trinidad contains standard data (Figure 1). Using the nutrient profiles found on the nutrition fact labels of dairy and dairy alternative products available in Trinidad, can provide useful comparisons, in terms of calorie and nutrient content. This type of comparison can also be used to cognitively assess and weigh the health implications of regular dairy products versus alternative dairy products.

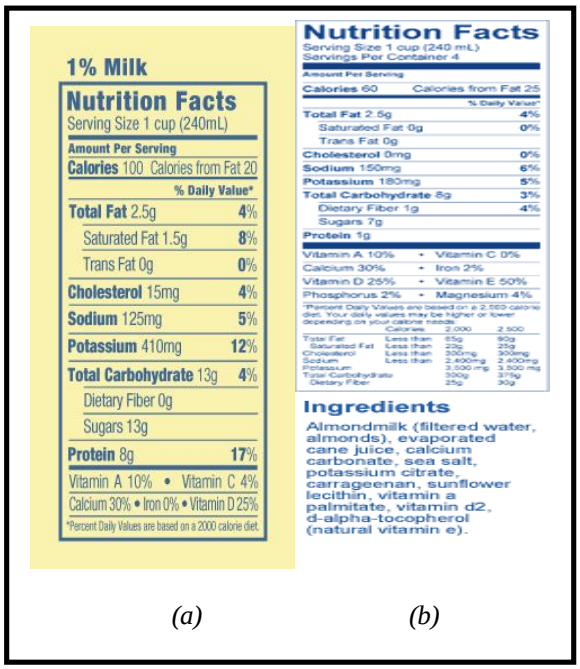


Figure 1. Comparison of Typical (a) Dairy and (b) Dairy Alternative Nutrition Fact Labels of Products Available in Trinidad

METHODOLOGY

Subjects

Using both the directory and internet, food stores with ≥2 branch locations were identified and surveyed within the very populated and major cities, with access for the general public of Trinidad, on brands of dairy and dairy alternative, milk products available. The subjects of this research were the nutrition fact labels of the regular and alternative milk products available at these participating food stores. These nutrition fact labels were obtained from direct observational studies of each product. Figure 2 shows the specific brands of milk and milk alternative product labels observed.

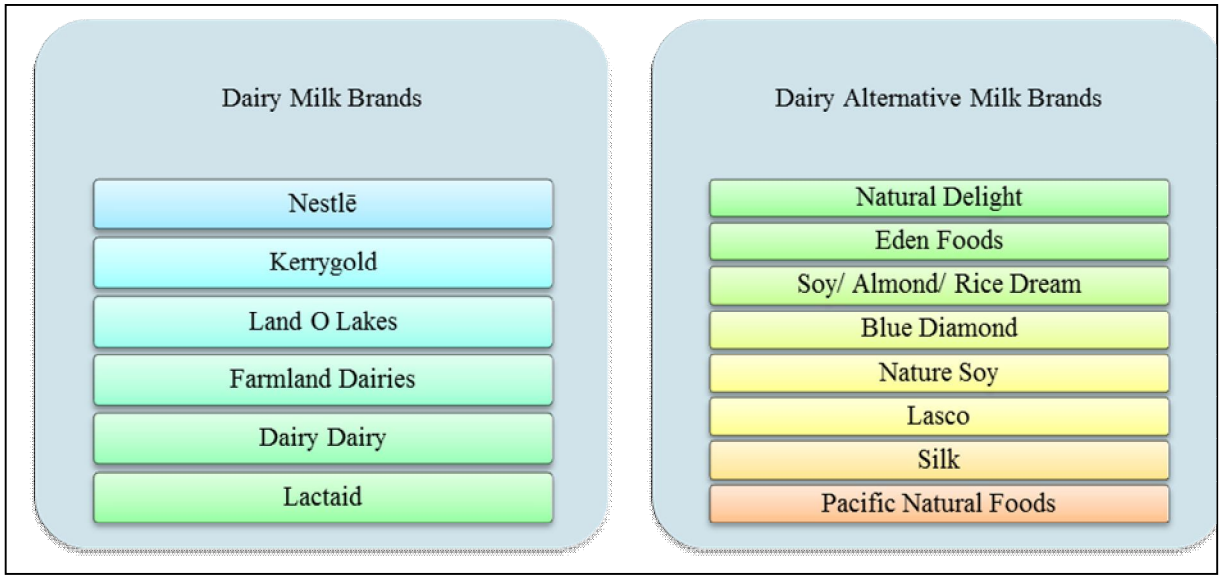


Figure 2. Dairy and Dairy Alternative Milk Product Brands, Available at Trinidad Food Stores

Design

Dairy and dairy alternative milk brands available in Trinidad served as the controlled variables of this research, with product base and composition as the independent variable and nutrient content from the nutrition fact labels as the dependent variable (see fig. 3). Dependent variables of the nutrient content included calories, fats, cholesterol, sodium, carbohydrates, proteins, and percentage daily value of vitamins A, C, D, calcium, and iron.

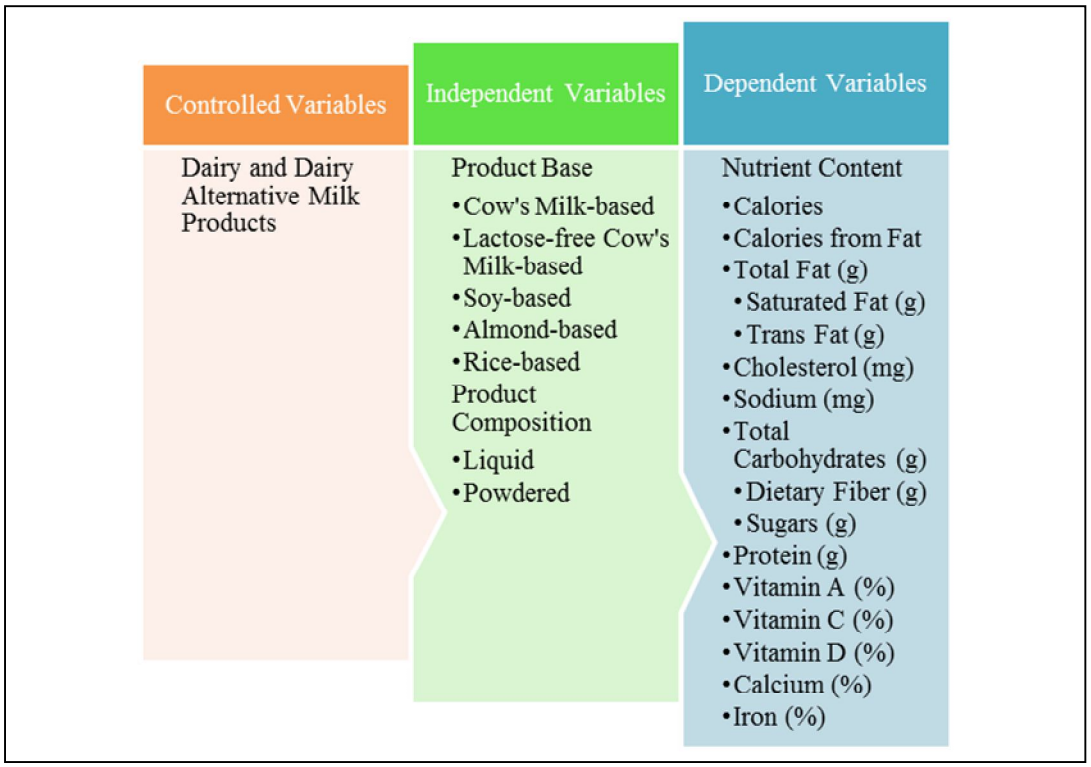


Figure 3. Controlled, Independent and Dependent Variables of the Dairy and Dairy Alternative Products Available in Trinidad

Procedure

An initial short, closed and opened-ended survey with questions pertaining to brands available of both dairy and dairy alternatives was asked of the food store managers of Trinidad food stores with ≥2 branch locations. Store managers responding to this survey were informed that they were only to identify their establishment and number of locations in Trinidad, and that no personal information for example, actual brand sales, be stated. Given the responses of brands available, products of both the liquid and powdered, dairy and dairy alternative milk options were grouped based on composition of their bases (Figure 4).

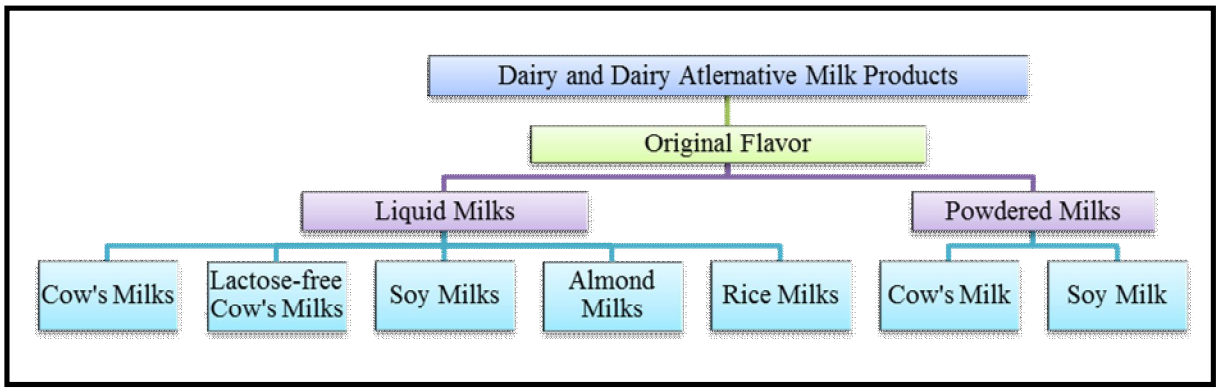


Figure 4. Groupings of Dairy and Dairy Alternative Milks by Composition of Product Bases

An observational study was then conducted on the products' nutrition fact labels. Where possible, sub-group information was separated for the milks in terms of butterfat content of the dairy products and normal and organic varieties of the dairy alternative product (Figure 5).

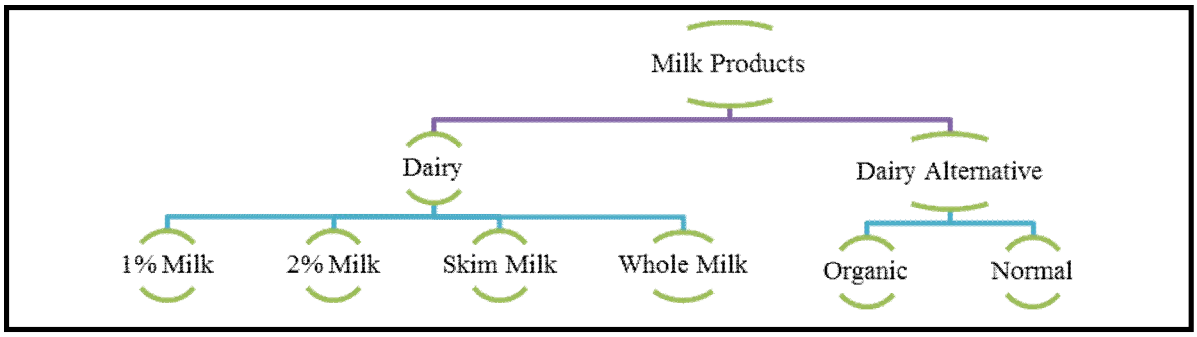


Figure 5. Butterfat and Organic Sub-grouping of Dairy and Dairy Alternative Milk Products

As in the sample label, each nutrient in the nutrition facts label has a corresponding value x_n (Figure 6). Information from the nutrition fact label of regular and alternative dairy brands available, were observed and collected. Along with this data collected included information on product and milk type for classifications purposes during the analytical process (Figure 7). Thus, with this information the milk nutrient profiles were created.

Nutrition Facts
Serving Size (ml) x_1
Servings Per Container
Amount Per Serving
Calories x_2 Calories from Fat x_3
% Daily Value*
Total Fat (g) x_4
Saturate Fat (g) x_5
Trans Fat (g) x_6
Cholesterol (mg) x_7
Sodium (mg) x_8
Total Carbohydrate (g) x_9
Dietary Fiber (g) x_{10}
Sugars (g) x_{11}
Protein (g) x_{12}
Vitamin A (%) x_{13}
Vitamin C (%) x_{14}
Vitamin D (%) x_{15}
Calcium (%) x_{17}
Iron (%) x_{16}
*Percentage Daily Values are based on a 2000 calorie diet Your daily values may be higher or lower depending on your calorie needs

Figure 6. Nutrient Content of a Nutrition Fact Label

Product Information{	Name Brand
Type of Product{	Dairy or Dairy Alternative
Type of Milk{	Cow's Milk-based Cow's Lactose-free Milk-based Soy-based Almond- based Rice-based
Nutrient Content{	Serving Size (ml) Calories Calories from Fat Total fat (g) Saturated Fat (g) Trans Fat (g) Cholesterol (mg) Sodium (mg) Total Carbohydrate (g) Dietary Fiber (g) Sugars (g) Protein (g) Vitamin A (%) Vitamin C (%) Vitamin D (%) Calcium (%) Iron (%)

Figure 7. Classification and Nutrient Profiling of Dairy and Dairy Alternative Products

Serving size of weights and measures from the nutrient labels was then calculated for conversion to a common unit, for the comparison analyses on nutrient content of products. Figure 8 provides the conversion factor and examples of the calculation formula used. Where nutrients contents were not available from nutrition facts label a note of 'Information Not Stated' (INS) was represented with a dash, "-", which signifies that only label data was collected, no new calculations or speculations were made of missing information.

$$\rightarrow \frac{U}{S\ \text{ml/oz/sl}} \times N_S = C_U$$

	Original Units				Units Needed			
	Serving Size (ml	Cal.	Total Fat (g)	Protein (g)	Serving Size (ml)	Cal.	Total Fat (g)	Protein (g)
a	250	180	2	4	240	180x240/250 =100.80	2x240/250 =1.92	4x240/250 =3.80
b	240	200	3	4	240	200x240/240 =200	3x240/240 =3.00	4x240/240 =4.00
c	265	195	1.5	3	240	195x240/265 =176.60	1.5x240/265 =1.40	3x240/265 =2.70

Figure 8. Examples of Serving Size Conversion Equations for Similar Units of Products

Analysis

Nutrient amounts for similar units of milk and milk alternative were compared via SPSS 20 analysis test for 'Means'. Thereafter the 'Contrast Coefficients' for the option of dairy and dairy alternative, and the 'Contrast Coefficients' for the bases were tested by 'One-way ANOVA'. The equal variance was not assumed and the 'Null Hypothesis' was rejected at 5%. Mean nutrient content was also carried out for milk base and type, based on the composition of the milk and milk alternative products available in Trinidad.

Products included 15 dairy and 10 dairy alternative liquid milks, a total of twenty-five nutrient profiles for the liquid milk products Using a test for homogeneity of variance, equal variance was not assume for the contrast test of "240 ml" servings of milk and milk alternative liquid milks. Powdered milk included a total of 11 nutrient profiles, 7 dairy and 4 dairy alternative milks. Test for homogeneity of variance was assumed equal for saturated fat, cholesterol, and vitamin C, while equal variance was not assumed for the remaining nutrients, for the contrast test of "30 gram" servings of the regular and alternative powdered milks.

RESULTS

Liquid Milks

The means test on nutrient content between overall regular liquid milks and liquid milk alternatives showed that regular milk had higher amounts of calories, calories from fat, total fat, saturated fat, cholesterol, sodium, sugars, protein, vitamin C, and calcium than alternative milks; But lower amounts of total carbohydrates, dietary fiber, vitamin A, vitamin D, and iron. Tans fat was not observed for any of the options (Figure 9 and Table 1)

Table 1. Mean Nutrient Contents of Milk and Milk Alternative Liquid Milks of Original Flavor

Option		Calories	Calories from Fat	Total Fat (g)	Sat. Fat (g)	Trans Fat (g)	Cholest. (mg)	Sodium (mg)	Total Carb. (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)	Vit. A (%)	Vit. C (%)	Vit. D (%)	Calcium (%)	Iron (%)
Dairy	**Mean**	**127.60**	**43.72**	**5.00**	**5.77**	**0.00**	**21.74**	**126.87**	**12.47**	**0.00**	**12.38**	**8.16**	**8.41**	**2.00**	**25.00**	**29.23**	**0.00**
	N	15	15	15	15	10	14	14	15	13	13	15	14	13	12	15	13
	Std. Deviation	23.62	27.06	3.04	9.72	0.00	9.88	14.75	1.39	0.00	1.19	0.79	1.96	1.63	0.00	4.81	0.00
Dairy Alternative	**Mean**	**101.00**	**29.50**	**3.30**	**0.25**	**0.00**	**0.00**	**119.50**	**13.00**	**0.75**	**7.90**	**4.70**	**8.89**	**0.00**	**25.83**	**22.60**	**4.80**
	N	10	10	10	10	10	10	10	10	8	10	10	9	9	6	10	10
	Std. Deviation	33.15	7.25	1.01	0.26	0.00	0.00	29.29	7.30	0.71	2.77	4.11	6.01	0.00	2.04	17.83	3.43
Total	**Mean**	**116.96**	**38.03**	**4.32**	**3.56**	**0.00**	**12.68**	**123.80**	**12.68**	**0.29**	**10.43**	**6.77**	**8.59**	**1.18**	**25.28**	**26.58**	**2.09**
	N	25	25	25	25	20	24	24	25	21	23	25	23	22	18	25	23
	Std. Deviation	30.24	22.30	2.55	7.92	0.00	13.23	21.74	4.60	0.56	3.01	3.11	3.93	1.59	1.18	11.99	3.27

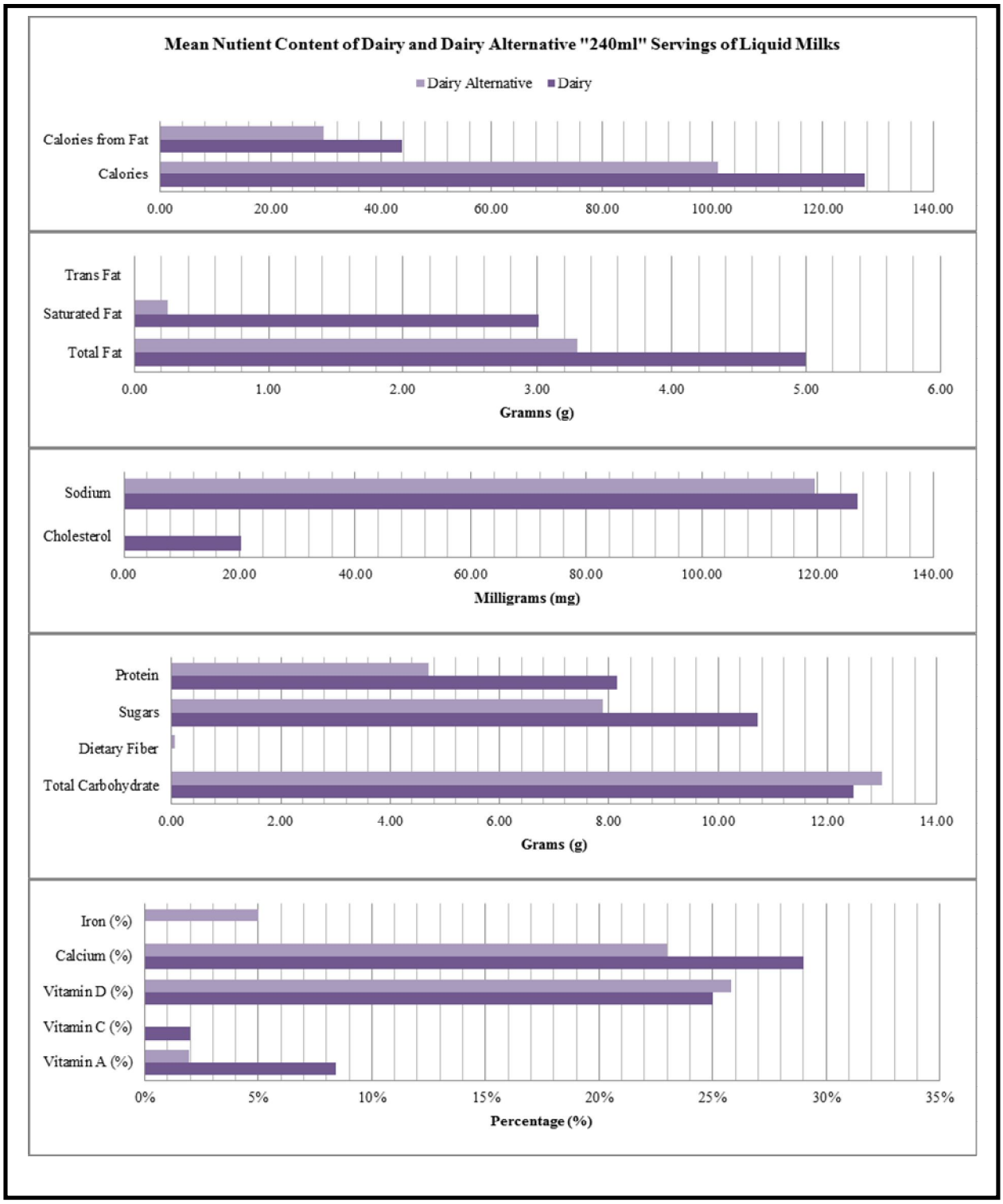


Figure 9. Overall Comparison of Mean Nutrient Content of Dairy and Dairy Alternative Liquid Milks Available in Trinidad

With the creation of ANOVA, contrast coefficients for “240 ml” servings of dairy and dairy alternative liquid milks, specific contrast test were carried out as shown in Table 3. These contrast test included comparison between and among the dairy and dairy alternative options to determine whether mean nutrient content differences observed were significant (Table 2).

Table 2. Contrast Coefficients for “240 ml” Servings of Dairy and Dairy Alternative Liquid Milks

	Contrast	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Contrast Test	Dairy and Dairy Alternative	Cow's Dairy and Lactose-free Cow's Dairy	1% Cow's Dairy and 1% Lactose-free Cow's Dairy	2% Cow's Dairy and 2% Lactose-free Cow's Dairy	Skim Cow's Dairy and Skim Lactose-free Cow's Dairy	Whole Cow's Dairy and Whole Lactose-free Cow's Dairy	Soy Dairy Alternative and Non-Soy (Almond and Rice) Dairy Alternative	Normal Soy Dairy Alternative and Organic Soy Dairy Alternative	Almond Dairy Alternative and Rice Dairy Alternative	Normal Almond Dairy Alternative and Organic Almond Dairy Alternative
Base and Type	1% Cow's Milk	-5	-1	-1	0	0	0	0	0	0	0
	2% Cow's Milk	-5	-1	0	-1	0	0	0	0	0	0
	Skim Cow's Milk	-5	-1	0	0	-1	0	0	0	0	0
	Whole Cow's Milk	-5	-1	0	0	0	-1	0	0	0	0
	1% Lactose-free Cow's Milk	-5	1	1	0	0	0	0	0	0	0
	2% Lactose-free Cow's Milk	-5	1	0	1	0	0	0	0	0	0
	Skim Lactose-free Cow's Milk	-5	1	0	0	1	0	0	0	0	0
	Whole Lactose-free Cow's Milk	-5	1	0	0	0	1	0	0	0	0
	Normal Soy Milk	8	0	0	0	0	0	-3	-1	0	0
	Organic Soy Milk	8	0	0	0	0	0	-3	1	0	0
	Normal Almond Milk	8	0	0	0	0	0	2	0	-1	-1
	Organic Almond Milk	8	0	0	0	0	0	2	0	-1	1
	Normal Rice Milk	8	0	0	0	0	0	2	0	2	0

Table 3 shows that the nutrient content differences observed between regular dairy and alternative milk bases were significant for most of the nutrients ($p<0.05$) except for saturated fat ($p=0.111$), sodium ($p=0.519$), calcium ($p=0.061$), total carbohydrates ($p=0.724$), and vitamin A ($p=0.802$).

Table 3. ANOVA Contrast Test "1" of Dairy and Dairy Alternative Liquid Milks *[a,b]

	Value of Contrast	Std. Error	T	df	Sig. (2-tailed)
Calories	-1051.667	187.239	-5.617	1.825	0.037
Calories from Fat	-244.667	34.833	-7.024	4.450	0.001
Total Fat (g)	-32.300	5.268	-6.131	2.685	0.012
Saturated Fat (g)	-156.167	59.331	-2.632	2.138	0.111
Cholesterol. (mg)	-673.933	32.186	-20.939	4.215	0.000
Sodium (mg)	207.167	280.347	0.739	2.697	0.519
Total Carbohydrates (g)	-13.067	33.773	-0.387	3.117	0.724
Dietary Fiber (g)	26.667	2.667	10.000	2.000	0.010
Sugars (g)	-196.500	16.817	-11.685	3.033	0.001
Protein (g)	-173.933	17.904	-9.715	1.521	0.024
Vitamin A (%)	17.200	62.658	0.275	2.869	0.802
Vitamin C (%)	-78.333	9.280	-8.441	3.829	0.001
Calcium (%)	-422.000	174.532	-2.418	4.882	0.061
Iron (%)	165.333	26.667	6.200	3.351	0.006

*Equal Variance Not Assumed

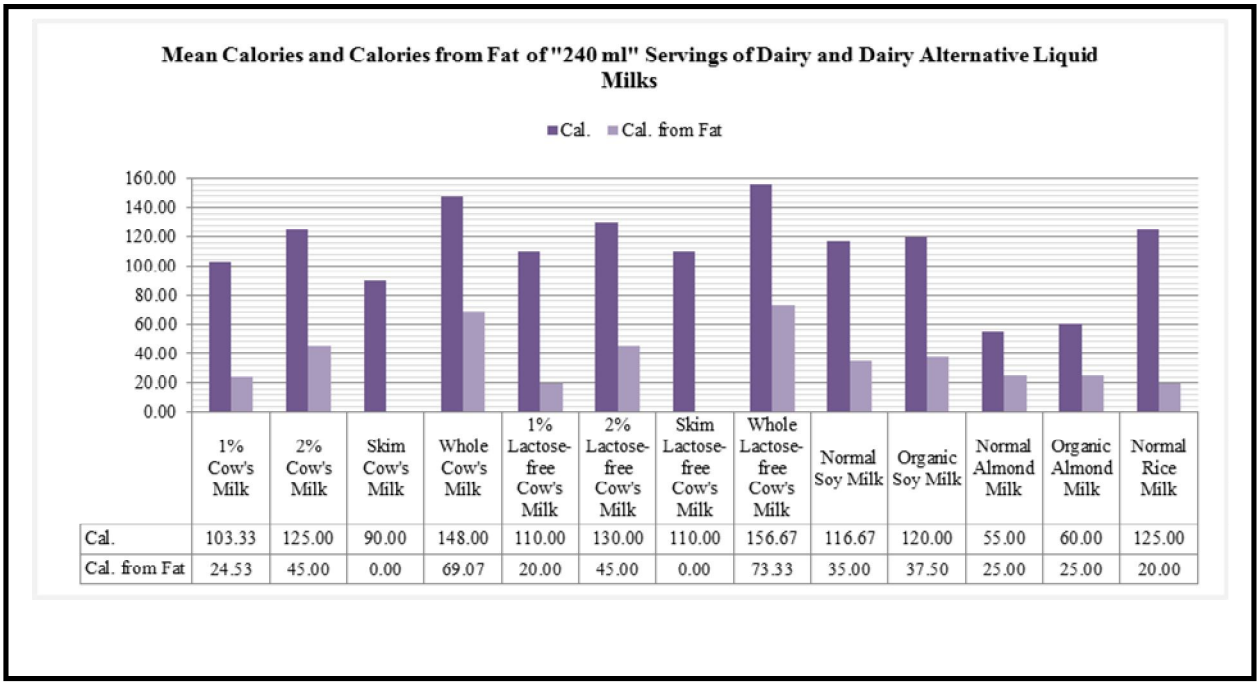
[a] Contrast cannot be evaluated for Trans Fat (g)

[b] Contrast cannot be evaluated for Vitamin d (%)

When the means test was done between regular milk with different fat and lactose content, and organic and regular milk alternatives, the results showed the following: Whole lactose-free milk had the highest calorie content. Whole cow's and lactose-free cow's milk had the highest mean total fat contents and regular skim and lactose-free skim milk had no calories from fat (Table 4 and Figure 10).

Table 4. Base and Milk Type Mean Nutrient Content of “240 ml” Servings of Dairy and Dairy Alternative Original Flavor Liquid Milks

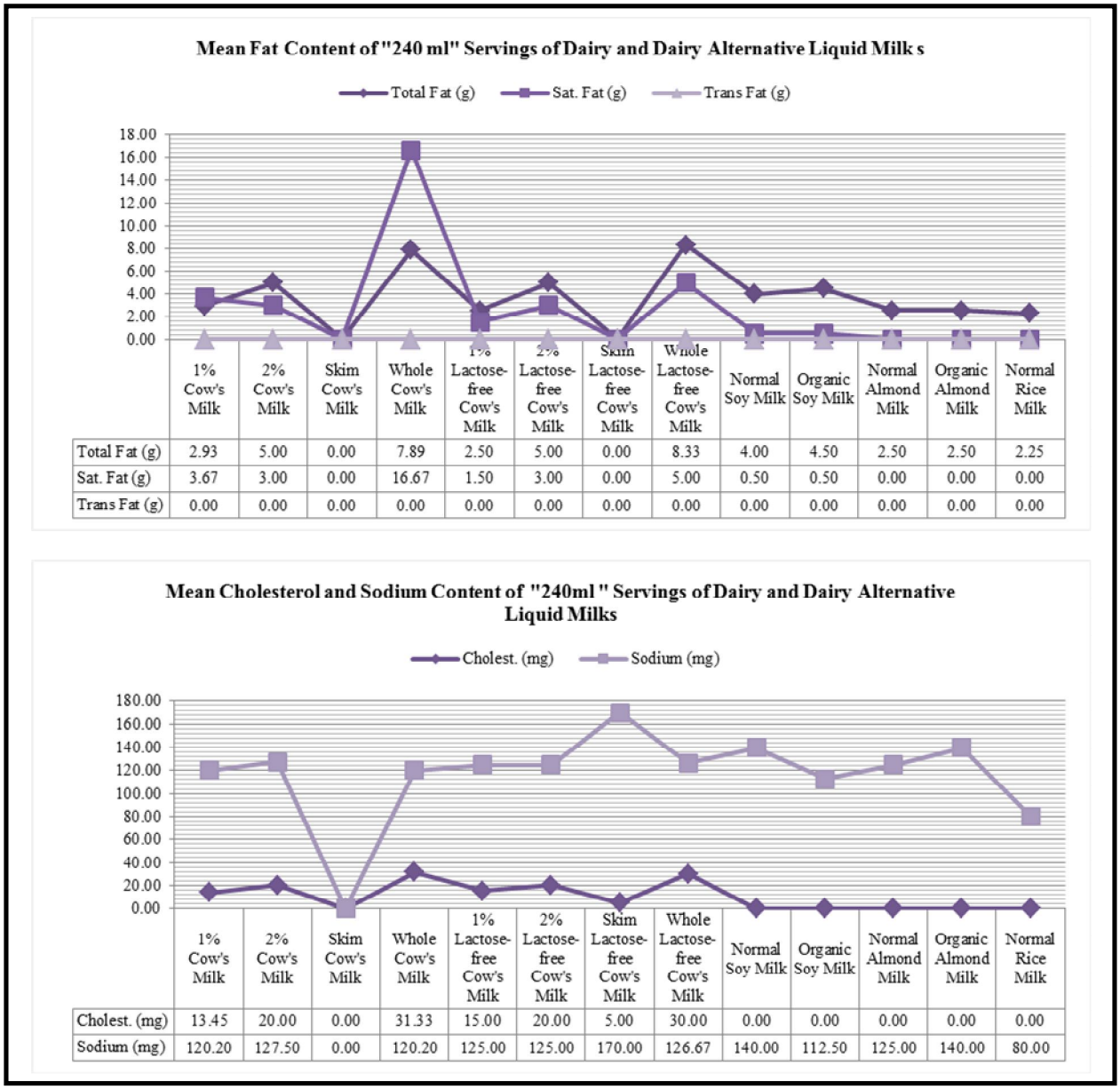
Base and Type		Calories	Calories from Fat	Total Fat (g)	Sat. Fat (g)	Trans Fat (g)	Cholest. (mg)	Sodium (mg)	Total Carb. (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)	Vit. A (%)	Vit. C (%)	Vit. D (%)	Calcium (%)	Iron (%)
1% Cow's Milk	Mean	103.33	24.53	2.93	3.67	0.00	13.45	120.20	12.17	0.00	12.50	7.89	9.23	3.00	25.00	26.40	0.00
	N	3	3	3	3	2	3	3	3	2	2	3	3	2	2	3	2
	Std. Deviation	5.77	7.85	0.75	3.75	0.00	3.00	12.89	0.76	0.00	0.71	0.18	1.34	1.41	0.00	6.24	0.00
2% Cow's Milk	Mean	125.00	45.00	5.00	3.00	0.00	20.00	127.50	12.00	0.00	12.00	8.00	10.00	3.00	25.00	30.00	0.00
	N	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2
	Std. Deviation	7.07	0.00	0.00	0.00		0.00	3.54	0.00	0.00	0.00	0.00	0.00	1.41	0.00	0.00	0.00
Skim Cow's Milk	Mean	90.00	0.00	0.00	0.00	0.00			13.00	0.00	13.00	8.00	10.00	4.00	25.00	30.00	0.00
	N	1	1	1	1	1			1	1	1	1	1	1	1	1	1
	Std. Deviation																
Whole Cow's Milk	Mean	148.00	69.07	7.89	16.67	0.00	31.33	120.20	11.84	0.00	12.00	7.89	6.00	3.00	25.00	26.40	0.00
	N	3	3	3	3	2	3	3	3	2	2	3	2	2	2	3	2
	Std. Deviation	3.46	1.62	0.18	20.21	0.00	6.35	12.89	0.28	0.00	0.00	0.18	0.00	1.41	0.00	6.24	0.00
1% Lactose-free Cow's Milk	Mean	110.00	20.00	2.50	1.50	0.00	15.00	125.00	13.00	0.00	12.00	8.00	10.00	0.00	25.00	30.00	0.00
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation																
2% Lactose-free Cow's Milk	Mean	130.00	45.00	5.00	3.00	0.00	20.00	125.00	13.00	0.00	12.00	8.00	10.00	0.00	25.00	30.00	0.00
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation																
Skim Lactose-free Cow's Milk	Mean	110.00	0.00	0.00	0.00		5.00	170.00	17.00	0.00	16.00	11.00	10.00	2.00	25.00	40.00	0.00
	N	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation																
Whole Lactose-free Cow's Milk	Mean	156.67	73.33	8.33	5.00	0.00	30.00	126.67	11.67	0.00	11.67	8.00	6.00	0.67	25.00	30.00	0.00
	N	3	3	3	3	2	3	3	3	3	3	3	3	3	2	3	3
	Std. Deviation	5.77	5.77	0.58	0.00	0.00	8.66	2.89	0.58	0.00	0.58	0.00	0.00	1.15	0.00	0.00	0.00
Normal Soy Milk	Mean	116.67	35.00	4.00	0.50	0.00	0.00	140.00	11.67	1.33	7.67	8.00	6.67	0.00	25.00	28.00	6.67
	N	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
	Std. Deviation	15.28	0.00	0.00	0.00	0.00	0.00	17.32	4.04	0.58	1.53	1.73	5.77	0.00	0.00	23.07	3.06
Organic Soy Milk	Mean	120.00	37.50	4.50	0.50	0.00	0.00	112.50	11.00	1.00	6.50	9.00	10.00	0.00	30.00	20.00	8.00
	N	2	2	2	2	2	2	2	2	1	2	2	1	1	1	2	2
	Std. Deviation	28.28	3.54	0.71	0.00	0.00	0.00	10.61	4.24		0.71	2.83				14.14	2.83
Normal Almond Milk	Mean	55.00	25.00	2.50	0.00	0.00	0.00	125.00	7.00	1.00	6.00	1.00	15.00	0.00	25.00	37.50	2.00
	N	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2
	Std. Deviation	7.07	0.00	0.00	0.00	0.00	0.00	35.36	1.41		1.41	0.00	7.07	0.00	0.00	10.61	0.00
Organic Almond Milk	Mean	60.00	25.00	2.50	0.00	0.00	0.00	140.00	8.00	0.00	6.00	1.00	10.00	0.00	25.00	0.00	0.00
	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Std. Deviation																
Normal Rice Milk	Mean	125.00	20.00	2.25	0.00	0.00	0.00	80.00	25.50	0.00	12.50	1.00	5.00	0.00		13.50	4.00
	N	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2
	Std. Deviation	7.07	0.00	0.35	0.00	0.00	0.00	28.28	2.12	0.00	2.12	0.00	7.07	0.00		16.26	2.83
Total	Mean	116.96	38.03	4.32	3.56	0.00	12.68	123.80	12.68	0.29	10.43	6.77	8.59	1.18	25.28	26.58	2.09
	N	25	25	25	25	20	24	24	25	21	23	25	23	22	18	25	23
	Std. Deviation	30.24	22.30	2.55	7.92	0.00	13.23	21.74	4.60	0.56	3.01	3.11	3.93	1.59	1.18	11.99	3.27



	1% Cow's Milk	2% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	1% Lactose-free Cow's Milk	2% Lactose-free Cow's Milk	Skim Lactose-free Cow's Milk	Whole Lactose-free Cow's Milk	Normal Soy Milk	Organic Soy Milk	Normal Almond Milk	Organic Almond Milk	Normal Rice Milk
Cal.	103.33	125.00	90.00	148.00	110.00	130.00	110.00	156.67	116.67	120.00	55.00	60.00	125.00
Cal. from Fat	24.53	45.00	0.00	69.07	20.00	45.00	0.00	73.33	35.00	37.50	25.00	25.00	20.00

Figure 10. Column Graph of Mean Calories and Calories from Fat Content

Regular whole milk had the highest amount of saturated fat; and along with lactose-free whole milk, the highest amount of cholesterol. Regular skim milk and milk alternatives had zero cholesterol content. Lactose-free skim milk had the highest sodium content while regular skim milk had the least (Table 4 and Figure 11).

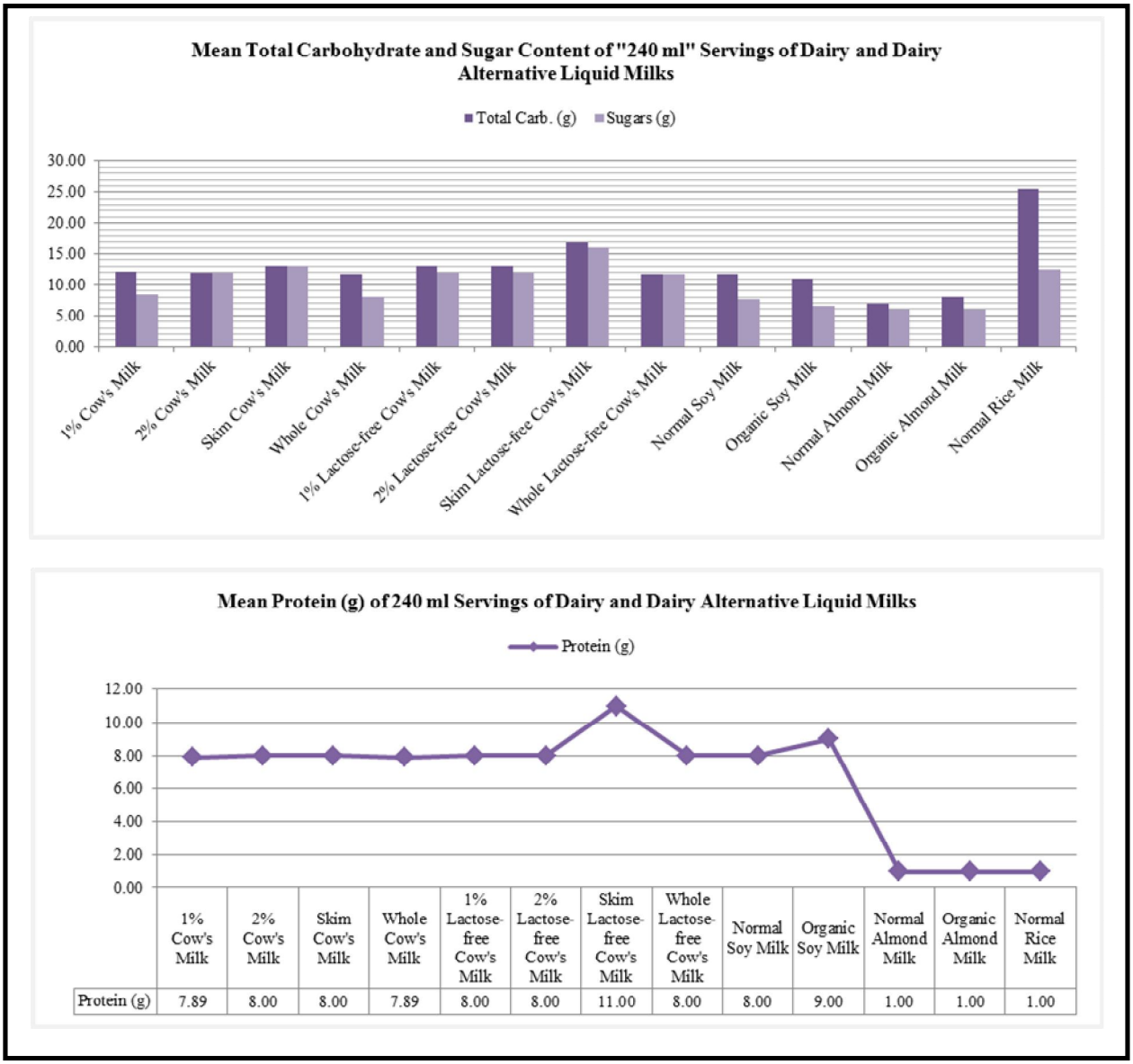


	1% Cow's Milk	2% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	1% Lactose-free Cow's Milk	2% Lactose-free Cow's Milk	Skim Lactose-free Cow's Milk	Whole Lactose-free Cow's Milk	Normal Soy Milk	Organic Soy Milk	Normal Almond Milk	Organic Almond Milk	Normal Rice Milk
Total Fat (g)	2.93	5.00	0.00	7.89	2.50	5.00	0.00	8.33	4.00	4.50	2.50	2.50	2.25
Sat. Fat (g)	3.67	3.00	0.00	16.67	1.50	3.00	0.00	5.00	0.50	0.50	0.00	0.00	0.00
Trans Fat (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	1% Cow's Milk	2% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	1% Lactose-free Cow's Milk	2% Lactose-free Cow's Milk	Skim Lactose-free Cow's Milk	Whole Lactose-free Cow's Milk	Normal Soy Milk	Organic Soy Milk	Normal Almond Milk	Organic Almond Milk	Normal Rice Milk
Cholest. (mg)	13.45	20.00	0.00	31.33	15.00	20.00	5.00	30.00	0.00	0.00	0.00	0.00	0.00
Sodium (mg)	120.20	127.50	0.00	120.20	125.00	125.00	170.00	126.67	140.00	112.50	125.00	140.00	80.00

Figure 11. Line Graphs of USDA Grouping "Limited these Nutrients", Mean Total Fat, Saturated Fat, Trans Fat, Cholesterol, and Sodium Content

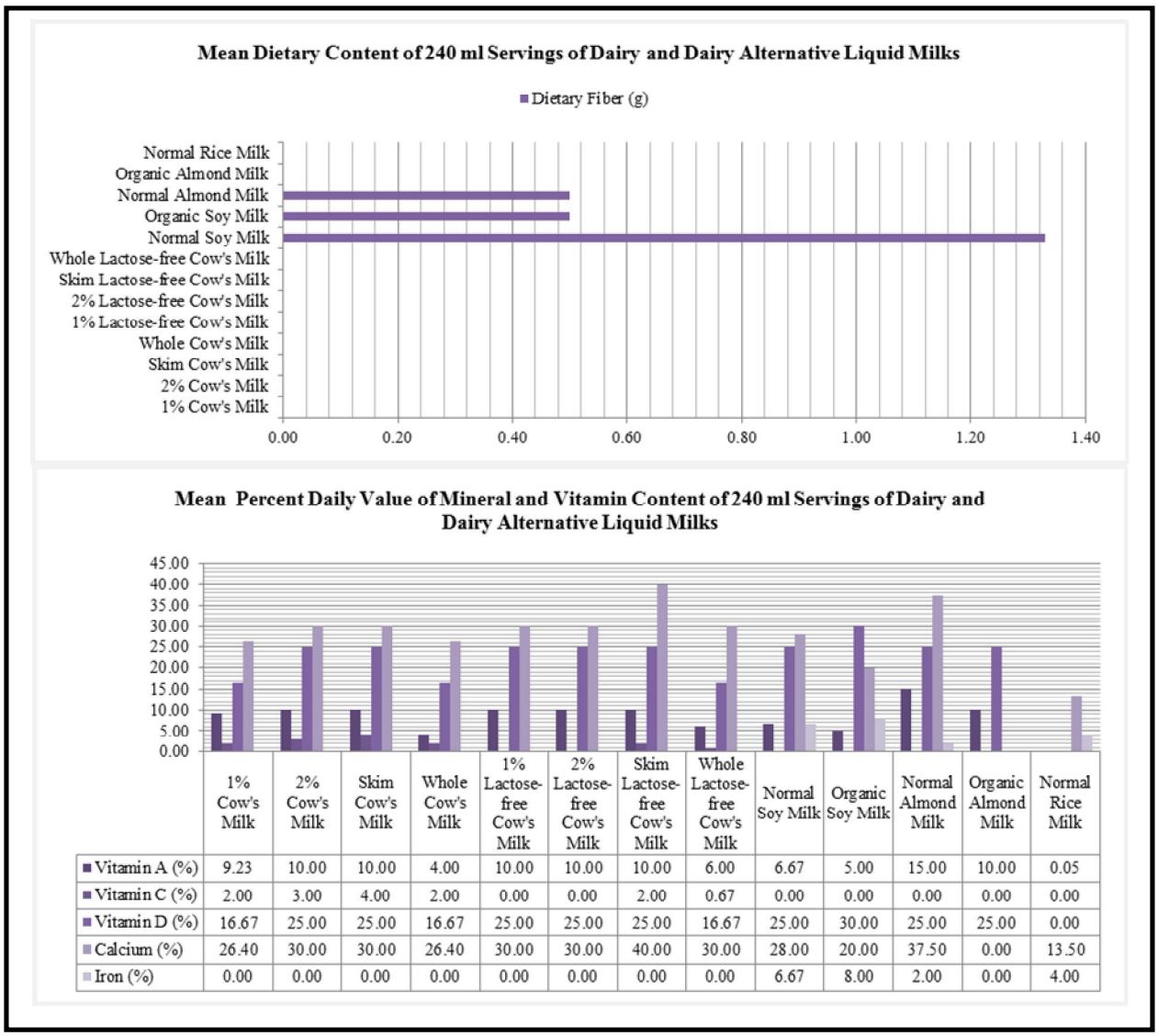
Figure 12 and Table 4 show that the rice milk had the highest mean total carbohydrate content among all dairy and dairy alternative liquid milk options. Lactose-free skim milk was observed to have the highest amount of sugar when compared to all the other regular and lactose-free milks and milk alternatives. The highest amount of protein content was observed for lactose-free skim milk and organic soy milk, while the lowest amount was observed for almond and rice milk.



	1% Cow's Milk	2% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	1% Lactose-free Cow's Milk	2% Lactose-free Cow's Milk	Skim Lactose-free Cow's Milk	Whole Lactose-free Cow's Milk	Normal Soy Milk	Organic Soy Milk	Normal Almond Milk	Organic Almond Milk	Normal Rice Milk
Protein (g)	7.89	8.00	8.00	7.89	8.00	8.00	11.00	8.00	8.00	9.00	1.00	1.00	1.00

Figure 12. Column Graph of Mean and Line Graph of Mean Protein Content, Based on the USDA Grouping "Get Enough of these Nutrients

Normal almond milk and lactose-free skim milk had the highest amount of calcium. Organic soy milk had the highest iron content among milk alternatives, while none of the dairy milks contained iron. Almond milk demonstrated the highest vitamin D content among milk alternatives, while rice milk demonstrated zero vitamin D content. Neither the dairy nor the rice milks showed dietary fiber content. Normal almond milk had the highest vitamin A content among all the milk alternatives (Table 4 and Figure13).



	1% Cow's Milk	2% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	1% Lactose-free Cow's Milk	2% Lactose-free Cow's Milk	Skim Lactose-free Cow's Milk	Whole Lactose-free Cow's Milk	Normal Soy Milk	Organic Soy Milk	Normal Almond Milk	Organic Almond Milk	Normal Rice Milk
Vitamin A (%)	9.23	10.00	10.00	4.00	10.00	10.00	10.00	6.00	6.67	5.00	15.00	10.00	0.05
Vitamin C (%)	2.00	3.00	4.00	2.00	0.00	0.00	2.00	0.67	0.00	0.00	0.00	0.00	0.00
Vitamin D (%)	16.67	25.00	25.00	16.67	25.00	25.00	25.00	16.67	25.00	30.00	25.00	25.00	0.00
Calcium (%)	26.40	30.00	30.00	26.40	30.00	30.00	40.00	30.00	28.00	20.00	37.50	0.00	13.50
Iron (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.67	8.00	2.00	0.00	4.00

Figure 13. Mean Dietary Bar Graph and a Column Graph of Mean Vitamin Content, Based on the USDA Grouping "Get Enough of these Nutrients"

ANOVA contrast tests between overall regular dairy liquid milk and lactose-free liquid milk showed that lactose free dairy milk had significantly higher amounts of calories, sodium, total carbohydrates, protein, and calcium than regular dairy milk ($p<0.05$); and regular dairy milk had significantly higher content of vitamin C ($p<0.05$) (Table 5).

Table 5. ANOVA Contrast Test "2" of Cow's Dairy and Lactose-free Cow's Dairy Liquid Milks *[a,b,c,d]

	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Calories	40.333	7.157	5.636	3.468	0.007
Calories from Fat	-0.267	5.704	-0.047	3.873	0.965
Total Fat (g)	0.007	0.557	0.012	4.033	0.991
Saturated Fat (g)	-13.833	11.866	-1.166	2.138	0.357
Cholesterol. (mg)	5.213	6.437	0.810	4.215	0.461
Sodium (mg)	178.767	10.944	16.334	4.614	0.000
Total Carbohydrates (g)	5.653	0.572	9.890	4.347	0.000
Sugars (g)	2.167	0.601	3.606	1.899	0.075
Protein (g)	3.213	0.151	21.302	4.000	0.000
Vitamin A (%)	0.773	0.773	1.000	2.000	0.423
Vitamin C (%)	-10.333	1.856	-5.568	3.829	0.006
Calcium (%)	17.200	5.091	3.378	4.000	0.028

*Equal Variance Not Assumed

[a] Contrast cannot be evaluated for Trans Fat (g)

[b] Contrast cannot be evaluated for Dietary Fiber (g)

[c] Contrast cannot be evaluated for Vitamin D (%)

[d] Contrast cannot be evaluated for Iron (%)

When regular dairy milk and lactose-free milk with different fat content were compared, the ANOVA contrast test showed that there were no significant differences in content for any of the nutrients.

An ANOVA contrast test between soy liquid milk and non-soy alternative liquid milk was carried out (see Table 6). Non-soy alternative liquid milks included almond and rice milks. Evidence from this table shows soy milk having significantly higher amounts of dietary fiber, protein and iron than the non-soy dairy alternative liquid milks ($p<0.05$). No significant difference in nutrient content was observed for calories ($p=0.108$), calories from fat ($p=0.061$), total fat ($p=0.063$), sodium ($p=0.426$), total carbohydrates ($p=0.367$), sugars ($p=0.242$), vitamin A ($p=0.598$) and calcium (0.499)

Table 6. ANOVA Contrast Test "7" of Soy Dairy Alternative and Non-Soy (Almond and Rice) Dairy Alternative*[a,b,c,d,e]

	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Calories	-230.000	67.082	-3.429	1.531	0.108
Calories from Fat	-77.500	7.500	-10.333	1.000	0.061
Total Fat (g)	-11.000	1.581	-6.957	1.220	0.063
Sodium (mg)	-67.500	74.204	-0.910	3.201	0.426
Total Carbohydrates (g)	13.000	11.958	1.087	2.602	0.367
Dietary Fiber (g)	-5.000	1.000	-5.000	2.000	0.038
Sugars (g)	6.500	4.717	1.378	3.912	0.242
Protein (g)	-45.000	6.708	-6.708	1.515	0.042
Vitamin A (%)	10.000	17.321	0.577	3.600	0.598
Calcium (%)	-42.000	57.009	-0.737	4.375	0.499
Iron (%)	-32.000	8.944	-3.578	3.292	0.032

*Equal Variance Not Assumed

[a] Contrast cannot be evaluated for Saturated Fat (g)

[b] Contrast cannot be evaluated for Trans Fat (g)

[c] Contrast cannot be evaluated for Cholesterol (mg)

[d] Contrast cannot be evaluated for Vitamin C (%)

[e] Contrast cannot be evaluated for Vitamin D (%)

Between normal and organic soy milks, no significant differences in nutrient content was observed for any of the nutrients.

Contrast test analysis between liquid almond milk and liquid rice milk showed that the rice liquid milk had a significantly higher content of both calories ($p<0.05$) and total carbohydrates ($p<0.05$). However, no significant difference was observed for total fat ($p=0.500$), sodium ($p=0.180$), sugars ($p=0.117$), vitamin A ($p=0.350$), calcium ($p=0.729$) and iron ($p=0.374$); and no contrast could be evaluated for calories from fat and the remaining nutrients (Table 7).

Table 7. ANOVA Contrast Test "9" of Almond Dairy Alternative and Rice Dairy Alternative*[a,b,c,d,e,f,g,h]

	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Calories	135.000	11.180	12.075	1.471	0.019
Total Fat (g)	-0.500	0.500	-1.000	1.000	0.500
Sodium (mg)	-105.000	47.170	-2.226	1.678	0.180
Total Carbohydrates (g)	36.000	3.162	11.384	1.220	0.035
Sugars (g)	13.000	3.162	4.111	1.220	0.117
Vitamin A (%)	-15.000	11.180	-1.342	1.471	0.350
Calcium (%)	-10.500	24.192	-0.434	1.210	0.729
Iron (%)	6.000	4.000	1.500	1.000	0.374

*Equal Variance Not Assumed

[a] Contrast cannot be evaluated for Calories from Fat (g)

[b] Contrast cannot be evaluated for Saturated Fat (g)

[c] Contrast cannot be evaluated for Trans Fat (g)

[d] Contrast cannot be evaluated for Cholesterol (mg)

[e] Contrast cannot be evaluated for Dietary Fiber (g)

[f] Contrast cannot be evaluated for Protein (g)

[g] Contrast cannot be evaluated for Vitamin C (%)

[h] Contrast cannot be evaluated for Vitamin D (%)

The final contrast test between normal and organic liquid almond milks did not demonstrate any significance in nutrient content among the milks. Evaluation was only possible for calories ($p=0.500$), sodium ($p=0.656$), total carbohydrates ($p=0.500$), sugars ($p=1.00$), vitamin A ($p=0.500$) and calcium ($p=0.126$).

Powdered Milk

Means test on the nutrient content between overall regular and alternative powdered milks showed that alternative milk had higher amounts of calories, calories from fat, total fat, sodium, sugar, vitamin A, vitamin D and iron content than the regular milks. However, the alternative milks had lower amounts of saturated fat, cholesterol, total carbohydrate, protein, vitamin C, and calcium. Trans fat was not observed for any of the powdered milk options (Figure 14 and Table 8)

Through the creation of ANOVA contrast coefficients, for the "30 gram" servings of regular and alternative powdered milks, a contrast test was carried out as shown in Table 9. This contrast test was a comparison between the regular and alternative options to determine whether mean nutrient content differences observed were significant (Table 10)

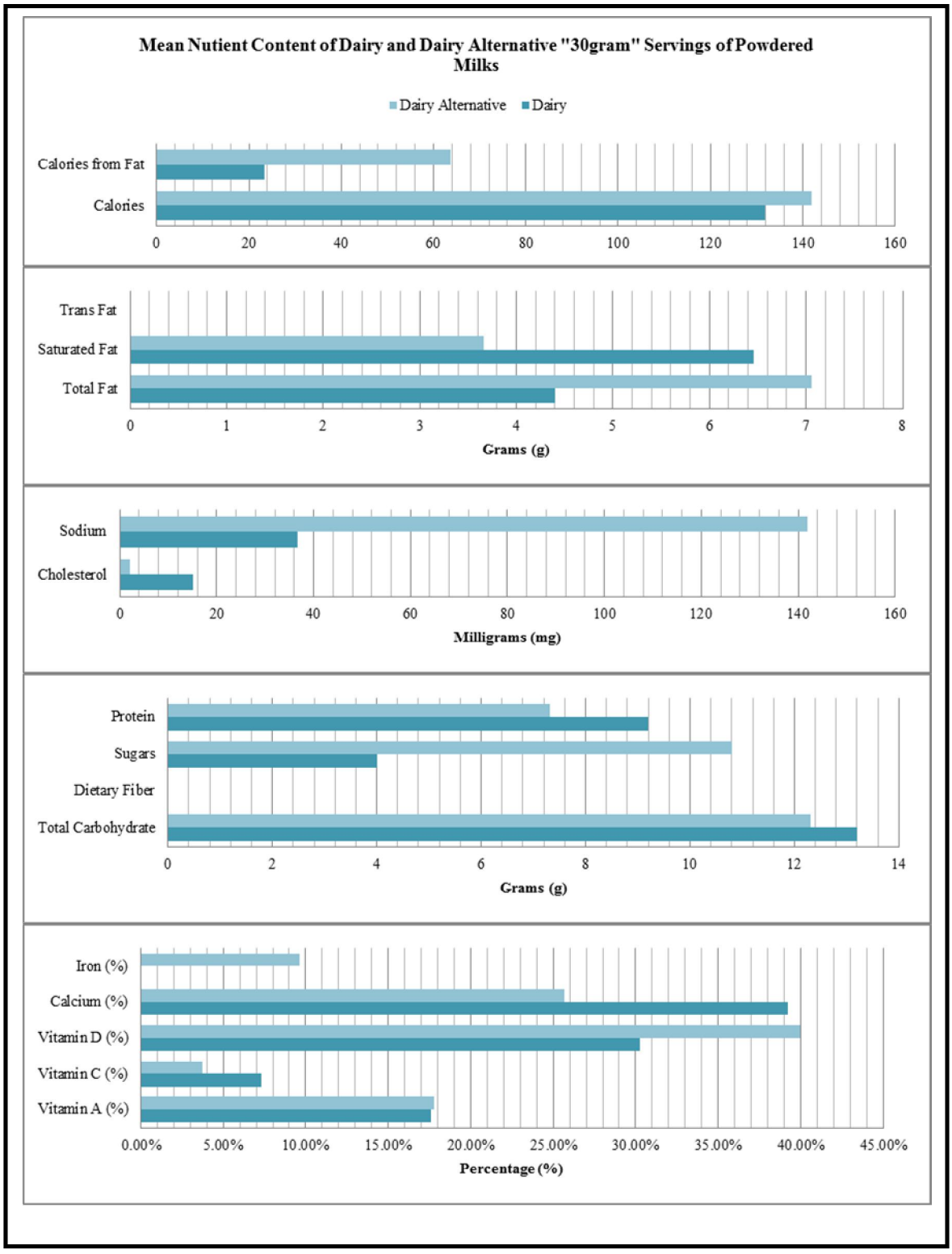


Figure 14. Overall Comparison of Mean Nutrient Content of Dairy and Dairy Alternative Powdered Milks Available in Trinidad

Table 8. Mean Nutrient Contents of Milk and Milk Aletrnattive Powdered Milks of Original Flavor

Option		Calories	Calories from Fat	Total Fat (g)	Sat. Fat (g)	Trans Fat (g)	Cholest. (mg)	Sodium (mg)	Total Carb. (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)	Vit. A (%)	Vit. C (%)	Vit. D (%)	Calcium (%)	Iron (%)
Dairy	Mean	131.79	23.33	4.40	6.46	0.00	15.19	36.67	13.21	0.00	4.00	9.19	17.61	7.31	30.25	39.25	0.00
	N	7	3	7	5	3	5	3	7	3	3	7	6	5	4	7	3
	Std. Deviation	22.85	40.41	3.47	8.02	0.00	15.24	63.51	1.80	0.00	6.93	1.49	4.63	6.68	22.90	10.08	0.00
Dairy Alternative	Mean	141.88	63.75	7.06	3.66	0.00	2.19	141.88	12.30	0.00	10.81	7.31	17.81	3.75	40.00	25.69	9.63
	N	4	4	4	4	2	4	4	4	4	4	4	4	4	2	4	4
	Std. Deviation	10.68	12.50	1.30	0.69	0.00	2.58	31.05	3.30	0.00	5.03	1.38	4.38	0.50	0.00	5.79	6.75
Total	Mean	135.46	46.43	5.37	5.22	0.00	9.41	96.79	12.88	0.00	7.89	8.51	17.69	5.73	33.50	34.32	5.50
	N	11	7	11	9	5	9	7	11	7	7	11	10	9	6	11	7
	Std. Deviation	19.33	33.00	3.09	5.87	0.00	12.87	70.63	2.33	0.00	6.47	1.67	4.28	5.09	18.44	10.86	7.02

Table 9. Contrast Coefficients for “30 gram” Servings of Dairy and Dairy Alternative Powdered Milks

Contrast		1
Contrast Test		Dairy Milk and Dairy Alternative Milk
Base and Type	1% Cow's Milk	-1
	Skim Cow's Milk	-1
	Whole Cow's Milk	-1
	Normal Soy Milk	3

Table 10 displays that the nutrient content differences observed between regular dairy and alternative milk bases were significant for most of the nutrients ($p<0.05$); except for; calories ($p=0.081$), saturated fat ($p=0.668$), cholesterol ($p=0.093$), total carbohydrates ($p=0.419$), sugars ($p=0.773$), vitamin A ($p=0.969$), vitamin C ($p=0.267$), vitamin D ($p=0.327$) and iron ($p=0.063$).

Table 10. ANOVA Contrast Test "1" of Dairy and Dairy Alternative Powdered Milks [ǂ,*a]

	Value of Contrast	Std. Error	t	df	Sig. (2 tailed)
ǂCalories	40.9333	20.08473	2.038	7	.081
ǂCalories from Fat	121.2500	28.64110	4.233	3	.024
ǂTotal Fat (g)	9.6858	1.63761	5.915	7	.001
***Saturated Fat (g)**	-5.1825	9.08959	-.570	1.027	.668
***Cholesterol (mg)**	-31.4075	8.45058	-3.717	1.575	.093
ǂSodium (mg)	315.6250	52.07135	6.061	4	.004
ǂTotal Carbohydrate (g)	-3.5650	4.14880	-.859	7	.419
ǂSugars (g)	20.4375	8.43663	2.422	4	.073
ǂProtein (g)	-6.3442	1.74141	-3.643	7	.008
ǂVitamin A (%)	.4075	10.15750	.040	6	.969
***Vitamin C (%)**	-13.1300	8.65220	-1.518	2.030	.267
ǂVitamin D (%)	59.5000	50.95995	1.168	3	.327
ǂCalcium (%)	-45.3375	11.34268	-3.997	7	.005
ǂIron (%)	28.8750	11.32009	2.551	4	.063

[ǂ]Equal Variance Assumed

[*]Equal Variance Not Assumed

[a] Contrast cannot be evaluated for Trans Fat (g)

When the means test was carried done between the regular milk of different fat content and the regular soy alternative milk, the results showed the following: Whole milk had the highest content for both calories and calories from fat., and the 1% and skim milk had no calories from fat (Table 11 and Figure 15)

Table 11. Base and Milk Type Mean Nutrient Content of “30 gram” Servings of Dairy and Dairy Alternative Original Flavor Powdered Milks

Base and Type		Calories	Calories from Fat	Total Fat (g)	Sat. Fat (g)	Trans Fat (g)	Cholest. (mg)	Sodium (mg)	Total Carb. (g)	Dietary Fiber (g)	Sugars (g)	Protein (g)	Vit. A (%)	Vit. C (%)	Vit. D (%)	Calcium (%)	Iron (%)
1% Cow's Milk	Mean	124.28	0.00	3.62	11.31	0.00	7.50	0.00	13.47	0.00	0.00	9.49	19.69	6.10	24.00	45.00	0.00
	N	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Std. Deviation	.74		.19	12.77	.00	10.61	.00	.47	.00	.00	.16	3.97	8.62	33.94	10.61	.00
Skim Cow's Milk	Mean	107.25	.00	.12	.00		.00		15.45			11.03	16.88	12.19		47.44	
	N	2	1	2	1		1		2			2	1	1		2	
	Std. Deviation	3.18		0.17					0.64			0.32				0.79	
Whole Cow's Milk	Mean	153.17	70.00	7.77	4.85	0.00	30.47	110.00	11.55	0.00	12.00	7.77	16.46	6.10	36.50	29.96	0.00
	N	3	1	3	2	1	2	1	3	1	1	3	3	2	2	3	1
	Std. Deviation	14.75		0.25	0.22		0.66		0.40			0.25	6.26	8.62	16.26	4.33	
Normal Soy Milk	Mean	141.88	63.75	7.06	3.66	0.00	2.19	141.88	12.30	0.00	10.81	7.31	17.81	3.75	40.00	25.69	9.63
	N	4	4	4	4	2	4	4	4	4	4	4	4	4	2	4	4
	Std. Deviation	10.68	12.50	1.30	0.69	0.00	2.58	31.05	3.30	0.00	5.03	1.38	4.38	0.50	0.00	5.79	6.75
Total	Mean	135.46	46.43	5.37	5.22	0.00	9.41	96.79	12.88	0.00	7.89	8.51	17.69	5.73	33.50	34.32	5.50
	N	11	7	11	9	5	9	7	11	7	7	11	10	9	6	11	7
	Std. Deviation	19.33	33.00	3.09	5.87	0.00	12.87	70.63	2.33	0.00	6.47	1.67	4.28	5.09	18.44	10.86	7.02

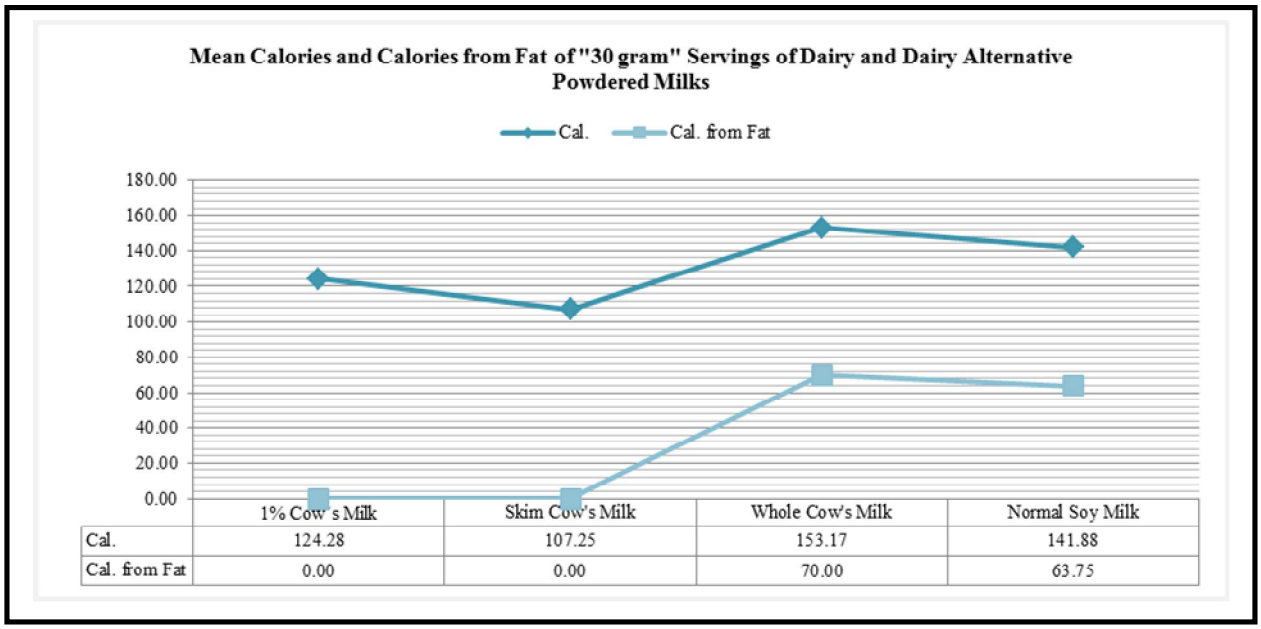
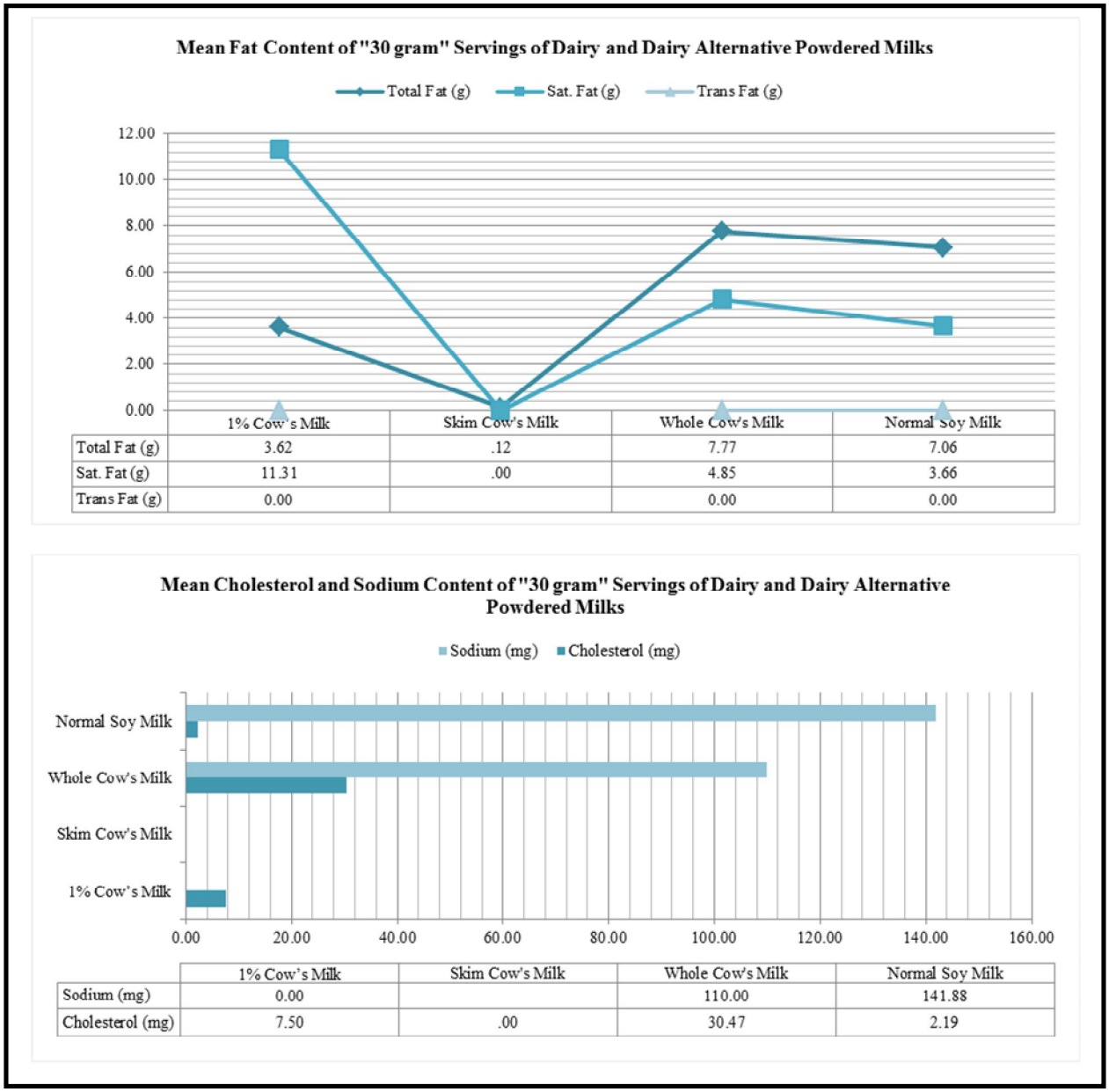


Figure 15. Line Graph of Mean Calories and Mean Calories from Fat Content

Regular 1% milk had the highest saturated fat content and the regular whole milk had the highest cholesterol content., while the normal soy alternative had the highest sodium content (Table 17 and Figure 16).



	1% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	Normal Soy Milk
Total Fat (g)	3.62	.12	7.77	7.06
Sat. Fat (g)	11.31	.00	4.85	3.66
Trans Fat (g)	0.00		0.00	0.00

	1% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	Normal Soy Milk
Sodium (mg)	0.00		110.00	141.88
Cholesterol (mg)	7.50	.00	30.47	2.19

Figure 16. Line and Bar Graphs of USDA Grouping "Limited These Nutrients", Mean Total Fat, Saturate Fat, Trans Fat, Cholesterol, and Sodium Content

From Table 17 and Figure 17, the regular skim milks show the highest mean total carbohydrate and protein content. However, both the regular1% and skim milks had no sugar content.

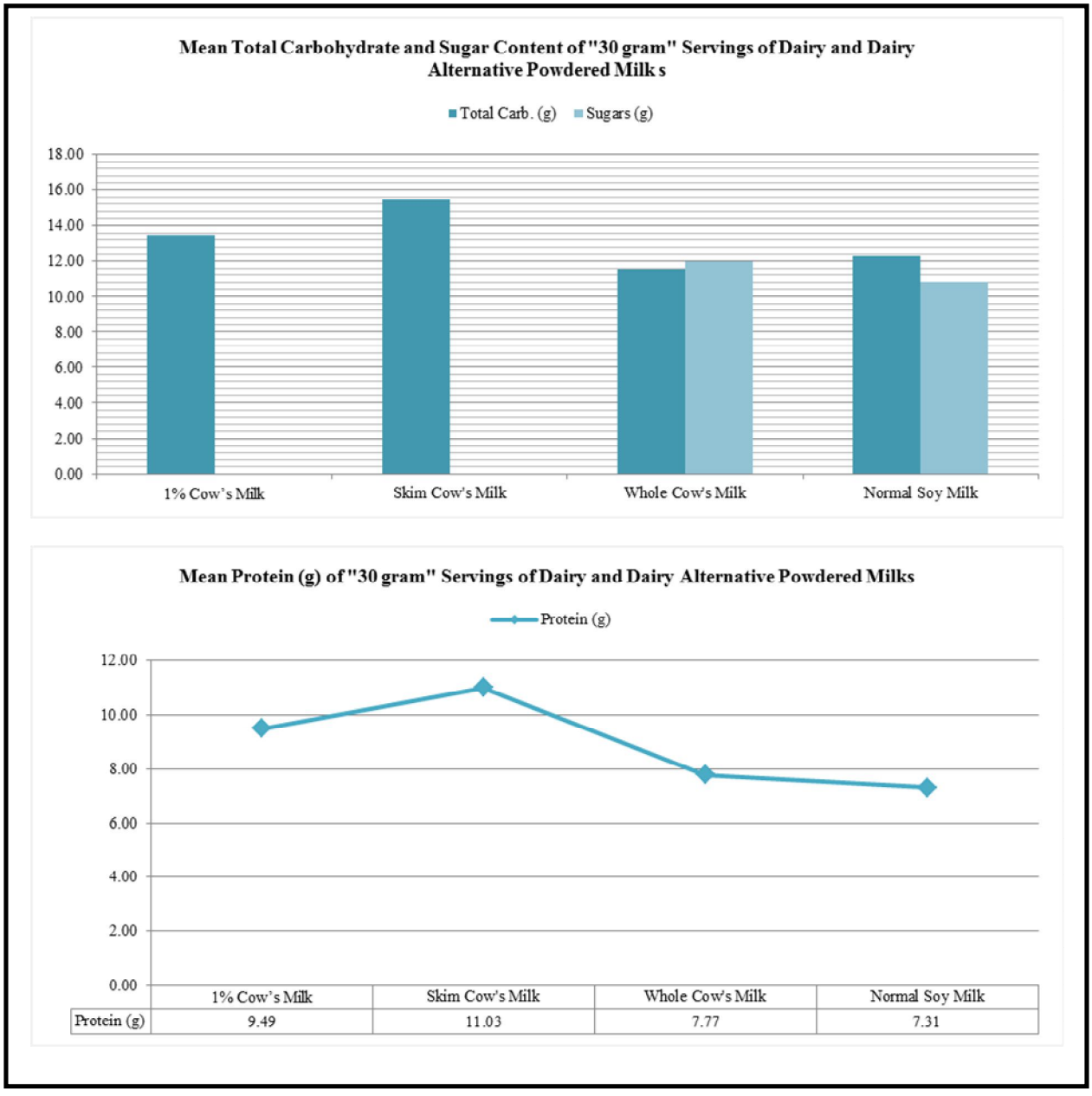
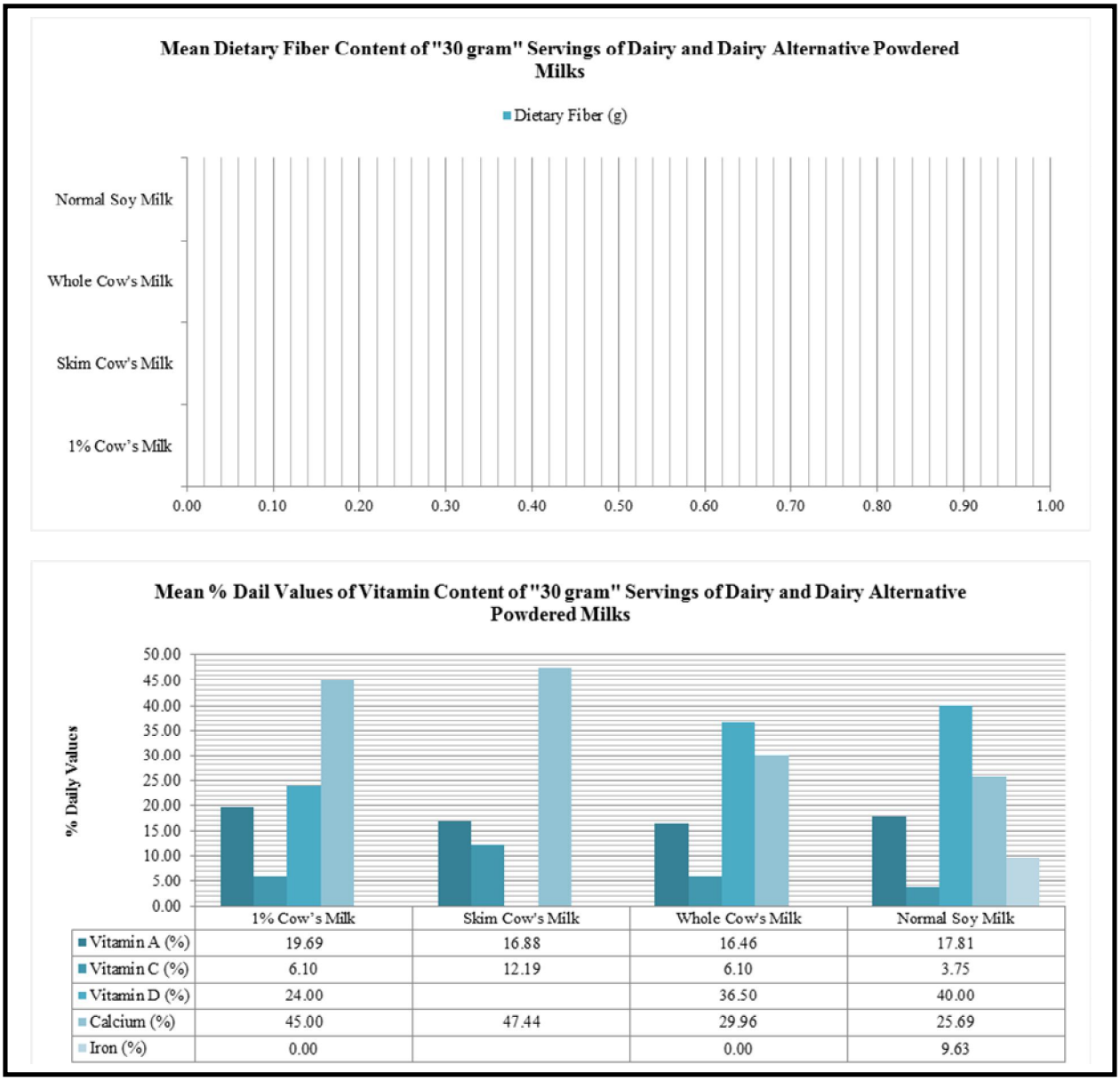


Figure 17. Column Graph of Mean Total Carbohydrates and Sugar Content and Line Graph of Mean Protein Content, Based on USDA Grouping Limit These Nutrients

Neither of the regular or alternative milk options had a mean dietary fiber content, as shown in Figure 18 and Table 17. The normal soy alternative milk had the highest mean content for vitamin D and iron, while the regular 1% milk showed the highest content for vitamin A. Regular skim milk had the highest content of Vitamin C and calcium, but had not vitamin D content.



	1% Cow's Milk	Skim Cow's Milk	Whole Cow's Milk	Normal Soy Milk
Vitamin A (%)	19.69	16.88	16.46	17.81
Vitamin C (%)	6.10	12.19	6.10	3.75
Vitamin D (%)	24.00		36.50	40.00
Calcium (%)	45.00	47.44	29.96	25.69
Iron (%)	0.00		0.00	9.63

Figure 18. Mean Dietary Bar Graph and a Column Graph of Mean Vitamin Content, Based on the USDA Grouping "Get Enough of These Nutrients"

DISCUSSION

Regular and Alternative Milk

Milk is a white liquid produced by the mammary glands of mammals. It is also the primary source of nutrition for young mammals before they are able to digest other types of food. The precise components of raw milk vary by species and by a number of other factors, but it contains significant amounts of saturated fat, protein and calcium as well as vitamin C. It is also interesting to note that cow's milk has a pH ranging from 6.4 to 6.8, making it slightly acidic (Bowen WH 2005). In many cultures of the world, especially the western would, humans continue to consume milk beyond infancy, using the milk of other animals as food products. For many years, cow's milk has been processed into dairy products such as cream, yogurt, ice cream and especially the more durable and easily transportable product cheese. Humans are an exception in the natural world for consuming milk past infancy, despite the fact that many humans show some degree of lactose intolerance.

Lactose is a type of sugar that occurs naturally in many dairy products and remains present – and can actually increase in concentration- after some form of processing. Like many sugars, they are complementary enzymes that are produced in nature to digest sugars and convert them from one form to another. To make a food product that is lactose free the enzyme know as lactase is introduced into a dairy product and allowed to interact with the lactose causing it to be converted into the sugars glucose and galactose. The enzyme lactase reaches its highest levels in the small intestines after birth and begins a slow decline unless milk is consumed on a regular basis. A person who is lactose intolerant, meaning they cannot process lactose, is usually able to process these two sugars, so the treated dairy products can be consumed without any adverse side effects. The process of making dairy products

lactose free is done largely to allow persons who are lactose intolerant to have dairy in their diet. A lactose-free product is nearly identical in nutritional value to a product that has not had the lactose remove.

Powdered milk is a manufactured dairy product made by removing all the water from the milk through evaporating. Powdered milk is convenient as it can be stored far longer, having a longer shelf life than liquid milk and does not need to be refrigerated until it is mixed with water for use in cooking, baking or drinking, due to its low moisture content. Another purpose of drying milks is to reduce bulk for economic transportation. Powdered milks a said to have a different flavor than fresh milk but the difference is not noticeable in baking or prepared foods, making milk powder products a good option when fresh milk is unavailable.

Butterfat or milkfat is the fatty portions of milk. Both liquid and powdered milks are often sold according to the amount of butterfat they contain. Products of liquid and powdered milks available in Trinidad include the low fat milk; contains between 0.5-2% fat, that is the 1% and 2% varieties, skim (non-fat) milk; contains less than 0.5% fat and whole milk; contains at least 3.25% fat (USDA 2001). The term milk is also used for white colored, non-animal beverages resembling milk in color and texture such as soy milk, rice milk, almond milk, and coconut milk. These non-animal beverages are commonly referred to as dairy alternative products. Milk alternatives, once only desired or required by a respectively small percentage of consumers, have become increasingly popular in the past few years. In Trinidad of the dairy alternative products available are the soy, rice, and almond milks varieties.

The first milk alternatives offered were frequently shunned based on their additives. Some consumers also found the flavors or aftertaste of the substitutes to be somewhat unfavorable. These original milk substitutes were frequently used to flavor beverages or used in cooking and were not

generally consumed alone. Soy milk was the first milk substitute on the market to gain public acceptance, the concoction is made by adding sweeteners and water to ground soyabeans. Soy milk is low in fat and carbohydrates, is a source of fiber and protein, it does not, however, have the calcium or protein found in real milk. Rice milk, which contains brown rice mixed with sweeteners and water, is said to have the vitamin D and calcium found in real milk. It is also believed to have considerably less fat than soy milk and is low in calories. Furthermore, per serving it is said to have a few more carbohydrates than soy milk but contains no fiber or protein. Almond milk on the other hand is thought to have a much more distinct flavor than either soy milk or rice milk. It is produced by mixing ground almonds with a sweetener and adding water; it is claimed to be low in fat, calories, and carbohydrates.

Health conscious consumers therefore need to be certain that when compared to regular dairy products, the dairy alternatives intended for options that are more "healthful" are indeed providing nutrient profiles that are more conducive to health and less contributory to diet-related chronic disease risk. This research sought to compare the nutrient content of similar units of regular and alternative milk, through statistical analysis of the nutrients found on the nutrition fact labels, of products available in Trinidad. The analyses served to compare regular milk and alternative milk in terms of calories and nutrients such as fats, cholesterol, sodium, carbohydrates, protein, and vitamins.

Most often dairy and dairy alternative milk products contain nutrient fact labels. These nutrient fact labels provide information on the amounts of specified nutrients contained in a serving of the food product. Information in the main or top section of a food label, varies with each product, it contains product specific information such as serving size, calories and nutrients. Serving sizes are standardized to make it easier to compare similar foods; they are provided in like units, such as cups or pieces followed by the metric amount, for example, the number of calories.

The serving size on the food packaging influences the number of calories and all the nutrient amounts listed on the top part of the label. The top of the nutrient section of any nutrition label shows the key nutrients that impact on health, this section entails two groups (see Figure 19). The group of nutrients identified as "Limit these Nutrients", may increase risk of certain chronic diseases, like heart disease or high blood pressure, if consumed in great quantities, they include, total fat, saturated fat, trans fat, cholesterol and sodium (USDA 2005).The other grouping, identified as "Get Enough of these Nutrients" include, dietary fiber, vitamin A and C, calcium, and iron, consuming enough of these can improve health and help reduce the risk of some diseases and conditions (USDA 2005). The vitamin information of a nutrient fact label is usually given centered on the percentage daily value. The percentage daily value (%DVs) are based on the daily value recommendations for key nutrients.

	Nutrition Facts	
Servings {	Serving Size (ml) Servings Per Container	
Calories {	**Amount Per Serving** **Calories** Calories from Fat	
	% Daily Value*	
Limit these Nutrients {	**Total Fat (g)** Saturate Fat (g) Trans Fat (g) **Cholesterol (mg)** **Sodium (mg)** **Total Carbohydrate (g)** Dietary Fiber (g) Sugars (g) **Protein (g)**	*} Quick Guide to % DV*
Get Enough of these Nutrients, inclusive of x_{10} {	Vitamin A (%) Vitamin C (%) Vitamin D (%) Calcium (%) Iron (%)	
Footnote {	*Percentage Daily Values are based on a 2000-calorie diet. Your daily values may be higher or lower depending on your calorie needs	

Figure 19. USDA Nutrition Facts Label

Using the conversion factor, common units of 240 milligrams and 30 gram serving size respectively for the liquid and powdered milks, regular and alternative milks were compared for the nutrient profiles that reflected the more "healthful" option. Also based on the nutrient content, the health implications associated with regular milk products were compared for association with the alternative milk options.

Calories and Calories from Fat Content

Calories provide a measure of how much energy is obtained from a serving of particular food products. A well-balanced diet is one that delivers an adequate amount of calories while providing the maximum amount of nutrients. The body breaks down food molecules to release the energy stored within them. This energy is needed for vital functions like movement, any activity a person may do requires the use of fuel. The body stores energy it does not need in the form of fat cells for future use. The process of breaking down food for use as energy is called metabolism. Increased activity results in increased metabolism as the body needs more fuel. The opposite is also true. With decreased activity, the body continues to store energy in fat and does not use it up. Therefore, weight gain is the result of increased intake of food, decreased activity, or both. Other health impacts of high calorie diets include changes in body composition and increased risk of certain diseases (Taubes G 2007).

To have a high caloric intake involves either one of two things either high-calorie foods or large amounts of low-calorie foods are being consumed, both of which place a great deal of stress on the body. High-calorie foods tend to be high in fats and/or sugars. High intake of these foods increases your risk factors for type 2 diabetes, heart disease and certain cancers (World Health Organization n.d.). Eating a large amount of food stresses your digestive processes. There is also

some evidence, that the stress placed on the body by eating a lot of calories may decrease longevity, and restricting calories may increase it (Anderson RM 2008). The nutrition labels on food packages indicate the number of calories contained in the food.

Using the ANOVA contrast test, significance was seen in the dairy and dairy alternative liquid milks. This significance showed the dairy options having higher calorie content than the dairy alternative options available. Mean calorie content of the dairy liquid milks were 127.60 whereas the mean calorie content of the dairy alternative milks were 101.00, when further analyzed it was shown that the lactose-free cow's dairy milks had the higher mean calorie content. Among the dairy alternative options, there was no significance represented for the mean calorie content of the soy and non-soy dairy alternative liquid milks, where the significance was observed was actually between the non-soy products. The non-soy, dairy alternative almond milks had a lower mean calorie contents than the rice milks available. From Figure 10, it may also be observed that the almond alternative milks had the lowest mean calorie content of this actual study.

In terms of the powdered dairy and dairy alternative milk products, although no significance was shown, data from Table 16 suggest the dairy milks to have had lower mean calorie content. From figure 16, close attention is placed on the fact that both the 1% and skim cow's powdered milks had lower mean calorie content than the powdered soy dairy alternative option available. However, the whole cow's dairy powdered milks still had the higher mean calorie content as was also observed in the liquid milks.

Calories from fat, may be one of the most misunderstood labels in the entire dietary equation. Calories from fat in some ways, are actually no different than calories from any other source, they however take longer to burn than 'regular calories' and their caloric value when compared to calories in the same food are no different. Nevertheless, they vary in how easily the body is able to store fat.

Calories from carbohydrates and proteins are harder to convert to fat for storage, this is because calories from fat are already in the form of fat and therefore are easier to store. Thus, fat calories tend to get stored quicker and with less energy expended by the body. It is interesting to note that even the process of converting protein and carbohydrate calories to fat requires burning some of those calories (Insel P 2002).

When comparing the calories from fat of powdered and liquid, regular and alternative milks, the liquid milks show the dairy options having the higher significance of mean calories from fat content, while the powdered milks reflected the alternative options. Both the skim cow's milk of both the liquid and powdered varieties had zero mean calories from fat content. Skim milk is a dairy product with an extremely low fat percentage. As a general rule, products labeled as "skim milk" have less than 0.5% fat, thus the zero mean calorie content observed (USDA 2001). Whole milk is 3.25% fat and as results observed show, had the highest mean calorie content of the liquid cow's and lactose-free cow's milks and the cow's powdered milks. When the ANOVA contrast was test in Table 10 , a significance was made known for the dairy alternative powdered milks, however looking at Figure 15, the normal dairy alternative milks, still had a lower mean calorie content than the whole cow's powdered milk options.

Because no significance was observed for the caloric content of the powdered milks, neither the regular nor the alternative milk options reflected a more "healthful" calories and calories from fat content option. However, in terms of the liquid milks, the alternative options reflected the more "healthful" option, having the significantly lower content of calories and calories from fat. As caloric intake varies from person to person, alternative liquid milks when combined with a healthy lifestyle choices, such as exercise, will not show health implications normally associated with high caloric foods such as dairy milks.

Fat Content

Fats that a person may consume, called dietary fats, are a vital source of energy for the body. Dietary fats are important for proper growth, healthy skin, and hair. They also help the body absorb the fat soluble vitamins A, D, E and K, meaning these vitamins can only be digested, absorbed and transported in conjunction with fats (Insel P 2002). Fats also serve as a useful buffer towards a host of diseases, for example in pregnant mothers (Huffman SL 2011). When a particular substance, be it chemical of biotic, reaches unsafe levels in the bloodstream, the body can effectively dilute or at least maintain equilibrium of the offending substance by storing it in new fat tissue. This help to protect vital organs until such time as the offending substances can be metabolized and/or removed from the body by means excretions, urination, accidental or intentional bloodletting, sebum excretion and hair growth.

While it is nearly impossible to remove fat completely from the diet, it would also be unhealthy to do so. Fats are also sources of essential fatty acids, an important dietary requirement (Koletzko B 2008). There are two main type of dietary fats: saturated and unsaturated. Hydrogenated fats, also called trans fats, are another type of dietary fat, they are basically unsaturated oils that have been chemically processed into a solid or semi-solid fat, based on comparisons done neither of the dairy or dairy alternative liquid, or powdered milks had trans fat content.

The American Heart Association recommends that people limit their total fat intake to 25-35% of their total calorie intake, it also says to limit saturated fats to less than 7 % of total daily calories, and limit hydrogenated fats to less than 1% of daily calorie intake. Based on a 2000 calorie diet, this translates to approximately 65 grams total fat and less than 20 grams of saturated fat (USDA 2010). Dairy products contain large amounts of saturated fats (American Heart Association Nutrition Committee 2006). When compared to dairy alternative liquid and powdered milks the regular dairy

options illustrated a higher mean saturated content with a content significance being showed with the powdered milks [saturated fat $_{1\% \text{ Cow's milk}}$= 11.31 grams] (see Figure 16). Powdered normal soy dairy alternative milks had a mean saturated fat content of 3.66, this evidence proved the skim cow's dairy milk to be the healthy options, having zero grams mean saturated fat content.

Although no significance was shown for the dairy and dairy alternative liquid milks, Figure 11, depicts the dairy alternative options having the lower mean saturated fat content, that is, both the rice and almond milks had 0 grams of saturated fat and the soy milks had 0.5 grams of saturated fat each. As previously mentioned, due to the nature of skim milk being a product of whole milks that has had the milkfat content removed, both the cow's and lactose-free cow's options of skim milks demonstrated a mean saturated and a mean total fat content of zero.

Diets high in saturated fat raise "bad cholesterol levels in the blood"; bad cholesterol is called Low Density Lipoprotein (LDL) cholesterol. High LDL cholesterol increases the risk of Coronary Heart Disease (CHD) (USDA 2005). Saturated fats increase cholesterol levels, which in turn increase the buildup of plaques. This buildup of fatty deposits (plaques) in the arteries block blood supply to the heart and lead to CHD and myocardial infractions. Research from the 1980s by Frank M. Sacks, on "Plasma Lipoprotein Levels in Vegetarians" identified dairy products as a major source of saturated fat (Jenkins DJ 2006). However, due to the fact that neither the regular nor the alternative milks showed a significance in saturated fat content, in either the liquid or the powdered milks, within this study neither reflect a more "healthful" option.

Cholesterol Content

Cholesterol is a substance in the human body that is needed for building and regulating cells. Cholesterol may be ingested in the food consumed, but most of the body's store, is made in the liver and other organs and circulates in the bloodstream, where it does its work. From a dietary perspective, cholesterol is not found in significant amounts in plant sources (Behrman EJ 2005) and (USDA 2011). Cholesterol is needed in the body to make up the structure membrane -outer layer- of every cell in the body and insulate nerve fibers. They also make hormones, such as sex hormones and steroid hormones and bile acids, which are needed for the digestion and absorption of fat. There are however, two types of cholesterol only one of which is bad for you, Low-Density Lipoproteins (LDL), frequently referred to as 'bad cholesterol' and High-Density Lipoproteins, on the other side of the equation.

HDL cholesterol circulates through the bloodstream rounding up excess cholesterol and taking it back to the liver to be processed out of the body system. Whereas, LDL cholesterol is the substance that carries the building materials around the body to wherever there is need. If there is too much LDL cholesterol, it can line the artery walls of the bloodstream, forming plaque and making the arteries narrower and less efficient at blood circulation. This plaque on the artery walls can if left untreated, lead to a heart attack or stroke if it interferes with blood flow to the heart or brain.

It is debatable that a diet, changed to reduce dietary fat and cholesterol, can lower blood cholesterol levels and thus reduce the likelihood of development of, among others, coronary artery disease leading to coronary heart disease (NHS 2009). James Le Fanu, in his 2000 book on "The rise and fall of modern medicine", however implied that any reduction to dietary cholesterol intake could be counteracted by the organs compensating to try to keep blood cholesterol levels constant. Also pointed out in the 'The China Study' in the book by TC Campbell, is the experimental discovery that

in the diet, digested animal protein can raise blood cholesterol more than ingested, than the injected saturated fat or any cholesterol (Lanou AJ 2004). Thus, avoiding animal products may decrease the cholesterol levels in the body, not only by reducing the quantity of cholesterol consumed, but also by reducing the quantity of cholesterol synthesized (Mensink RP 2003).

The dairy liquid milks showed a higher significance of cholesterol content than the dairy alternative liquid milks that had a mean cholesterol content of zero milligrams per 240 milliliter servings. From the line graph of mean cholesterol and sodium content, we observe the whole dairy options having the higher mean cholesterol content (see Figure 11). No significance was show however for the compared powdered milks. Oxysterols are derivatives of cholesterol that are produced either by free radicals of by enzymes (Dabrowski WM 2004). In a 1980's journal article by Hubbard, Ono, and Sanchez on the atherogenic effects of oxidized products of cholesterol, certain free radicals-derived oxysterols have been suspected of being initiators of atherosclerotic plaques. Consequently, powdered milks contain higher amounts up to 30 µg per gram of oxysterols versus the trace amounts in fresh (Dabrowski WM 2004).

From Figure 16, the whole cow's powdered milk had the highest mean cholesterol content at 30.47 milligrams per 30 gram serving; we also detected the normal soy dairy alternative powdered milks having a mean cholesterol content of 2.19 milligrams. Although unlike cow's milk, soy milks are said to contain little saturated fat and no cholesterol. This cholesterol content shown may be a result of the manufacturing process, commercial milk powders are reported to contain oxysterols, oxidized cholesterol, in higher content than fresh milk (Fox PF 2006).

Liquid alternative milk therefore, reflected the more "healthful" option in term of cholesterol content, this however could not be determined for the powdered milks, due to the lack of significance

when contrasted. Therefore having zero cholesterol content, no health implications usually associated with high LDL cholesterol levels, may be reveal with the liquid alternative milks consumption.

Sodium Content

Sodium occurs naturally in many foods and is also added in the form of salt or other sodium-containing substances. The human body needs some sodium to work properly, sodium helps with the function of nerves and muscles, it also helps to keep the right balance of fluids in the body (Insel P 2002). The kidneys control how much sodium is in the body, however, if there is too much sodium present and the kidneys are not able to get rid of it, sodium builds up in the blood. This can lead to high blood pressure, and high blood pressure may lead to other health problems (National High Blood Pressure Education Program 2003).

Sodium is an essential nutrient that regulates blood volume, blood pressure, osmotic equilibrium, and pH; the minimum physiological requirement for sodium is 500 milligrams per day (Food and Nutrition Board 2004). Sodium chloride is the principal source of sodium in the diet, and is used as a preservative; most of it comes from processed foods (USDA 2010). Before processing, soybeans are naturally low in sodium. The DRI for sodium is 1.5 grams per day, but most people in the consume more than 2.3 grams per day, the minimum amount that promotes hypertension; this in turn causes 7.6 million premature deaths worldwide (USDA 2010), (Geleijnse JM 2004) and (Lawes CM and International Society of Hypertension 2008). A key to healthy eating is to choose foods low in salt and sodium. Reading food fact labels can help a person to see how much sodium is actually present in prepared foods.

Contrast analysis of the regular and alternative liquid milks resulted in no significance of sodium content, however, upon further analysis between the regular and lactose-free milks, the lactose-free milks showed a higher sodium content. This high significance shown with the lactose-free liquid milks, also reflected the fact that of the regular and alternative milk options compared, the whole lactose-free milks had the highest mean sodium content. The skim cow's milk showed a mean sodium content of zero, when compared to its lactose-free equivalent the skim cow's milk proved to be the lower sodium content option [sodium content $_{\text{lactose-free liquid milk}}$= 170 mg]. The regular skim milk and the normal rice milk dairy alternative, showed the lowest mean sodium content within this study. The contrast of the regular and alternative powdered milks resulted in the alternative option having the significantly higher sodium content, with the regular 1% and skim powdered milks having zero milligram content. Therefore, in terms of sodium content, dairy alternative powdered milks do not reflect a more "healthful" option.

Carbohydrate Content

Carbohydrates are a large family of compounds including sugars, starches, dextrins, dietary fiber, and functional fiber. Thus, 'total carbohydrate' is composed of all these types added together. The typically chief sources of carbohydrates are fruits, vegetables, grains, and dairy products. The current suggestion for calories from carbohydrates ,is set at half of a person's daily caloric intake, for example based on a 2,000 calorie diet carbohydrate intake should be 250 grams [2,000 divided by 2 =1,000 and the 1,000 divided by 4= 250] (USDA 2010).

Nutrition fact labels of dairy and dairy alternative milk products, entailed sugars, and dietary fiber, for the total carbohydrate content. The term milk sugar refers to a single molecule of glucose linked to a single molecule of galactose to form a carbohydrate. Milk sugar is also the primary

carbohydrate in cow's milk and is commonly known as lactose. Lactose is a type of sugar that occurs naturally in many dairy products, remains present -and can actually increase in concentration- after some form of processing. As previously mentioned, to make a food product that is lactose free the enzyme know as lactase is introduced into a dairy product and allowed to interact with the lactose causing it to be converted into the sugars glucose and galactose. Thus, lactose free milk just has no sugar in the form of lactose, it still has sugars. This sugar content may also be a result of additives during the manufacturing process.

Analysis of the sugar content per 240 milliliter serving of liquid regular and alternative dairy milks showed that dairy liquid milks had a significantly higher sugar content than the alternatives. This may have been the result of the dairy alternative being inherently lactose free, sugar content may be a result of naturally occurring sugars for example the disaccharide sucrose found in soy milk or the addition of sugars for flavoring. Although when contrasted no significance was observed, from Figure 16, we note the lactose-free dairy milks having a higher sugar content than their dairy milk complements. Data would suggest that having the milk sugar lactose remove would result in a lower sugar content, however, this higher sugar content may be a result of a combination of other naturally occurring sugars and flavor enhancers by the manufactures to make the products more acceptable to consumers. Both the regular 1% and skim powdered milks had 0 grams of sugar.

Plant materials that are indigestible to humans are a complex carbohydrate known as dietary fiber. Since fiber is not technically a nutrient, there is no recommend daily allowance, however the American Dietary Association recommends a minimum of 20-35 grams per day for healthy adults depending on caloric intake. Based on a 2000 calorie diet this translates to 25 grams of fiber. Dietary fiber comes from vegetables, fruits grain and legumes, thus neither of the original flavors of cow's or lactose-free cow's, liquid or powdered milks had a mean dietary fiber content. The dairy alternative liquid milks contained dietary fiber, however the ANOVA contrast test of Table 9, depicted the soy

dairy alternatives having the significant higher content of fiber than the non-soy, almond and rice dairy alternative milks. This evidence was particularly clear due to the fact that the rice dairy alternative milks had zero mean dietary fiber content.

Proper amounts of dietary fiber improve health in ways other than digestion, studies have shown that fiber seems to lower cholesterol, in combination with a balanced dies. There is also an inexplicable link between a diet high in fiber and a lowered risk of heart disease (Ramos SC 2011). In the stomach, fiber seems to affect the speed with which sugars enter the bloodstream (Ramos SC 2011). This means, blood sugar levels stay more consistent, insulin does not work as hard and the resulting benefit is a reduced risk of developing diabetes. Therefore, dietary fiber found in dairy alternative milks, may reduce health implications usually associated in regular milks.

Therefore, based on the significance of dairy alternative liquid milks showing lower sugar content and higher dietary fiber content, the alternative liquid milks reflect a more "healthful" product option than the regular liquid milks. An interpretation however could not be drawn to reflect the healthier option for the powdered milks.

Protein Content

Protein is a complex structure comprised of amino acids that the body uses to replenish and rebuild muscle tissue. While there are fundamentally limitless different kinds of protein, raw cow's milk has all 8 essential amino acids in varying amounts, depending on stage of lactation casein protein, the main source of protein found in milk, is a common source (Górka P 2011)**.** Milk protein obliges many purposes within the human body; however, two functions are considered essential. The first

function that milk provides within the human body is as a source of energy for muscles when other energy stores are low. Under starvation conditions, the body will break down protein into glucose that can be readily used as energy. While this process only occurs when the body has broken down and used all of its available fat and energy stores, it is an important life-preserving role for protein. The second and crucial role of milk protein, is to provide both essential and non-essential amino acids for muscle repair and growth.

There are two main categories of protein in milk, the caseins, and the whey proteins, and there are multiple proteins within each category. The effects of whey protein on human health are of great interest and are currently being investigated as a way of reducing disease risk, as well as a possible supplementary treatment for several diseases (Krissansen GW 2007). Although whey proteins are responsible for some milk allergies, the major allergens in milk are the caseins (Wal JM 2004) and (Burks W 2001). The use of whey protein as a source of amino acids and its effect on reducing the risks of diseases such as heart disease and cancer is the focus of ongoing research (Krissansen GW 2007). However, another study suggested that large amounts of whey protein can increase cellular glutathione levels (Zavorsky GS 2007). Glutathione is an antioxidant that defends the body against free radical damage and some toxins.

An early 1990 study on “Human Milk Proteins” by Kunz and Lonnerdal showed that casein makes up 80% of the proteins in cow’s milk. T. C. Campbell's “The China Study” (2005), describes a direct correlation between casein administered to rats and the promotion of cancer cell growth when exposed to carcinogens. Other studies conducted by Dr. Campbell on humans confirmed this correlation between the amount of protein consumed and the promotion of cancerous cell growth. Basically, he discovered that cancer growth could be turned on and off by adjusting the amount of animal protein in the diet. A 2001 study suggests that the other milk protein, whey protein, may play a

protective role against colon tumors in rats (Hakkak R 2001). According to a study from the Australian Dairy Council, casein has a reducing rate of mutation effects (Parodi PW 2007)

Milk can be thought of as “liquid meat” because of its high protein content, which in concert with other proteins, may actually leach calcium from the body. From the analysis of protein, it was observed that both the dairy liquid and powdered milks had a significantly higher protein content than the dairy alternative options available. Observations of Figures 12 and 16 though suggest the soy dairy alternative milks have similar proteins contents to the dairy milks. Where the difference was also significant was among the dairy alternative options, both the almond and rice dairy alternatives reflected a mean protein content of 1 gram. This lower content observed may have health implications such as decreased energy and lower immune functions. According to a 2006 medical study published in the "American Journal of Clinical Nutrition," low protein intake causes your body to produce lower levels of certain growth factor hormones . Higher levels of these hormones are linked to an increased risk of cancer. Thus, researchers concluded that a low protein diet may have "protective effects" against the disease. However, because there has been controversial associations between protein and health implications, it cannot be determined if milk alternatives reflect options that are considered more “healthful”.

Vitamin and Mineral Content

Daily Values (DVs) are reference numbers based on the Recommended Dietary Allowances (RDAs). They were developed to help consumers determine if a food contained a lot or a little of a nutrient. Most food labels do not list actual vitamin content, they are instead listed as percentage daily value per one serving in the percent daily value column. A food providing 5% or less of the DV is a

low source, while a food that provides 10% to 19% of the daily value is a good source. A food however that provides 20% or more of the DV is high in that nutrient (USDA 2010).

Vitamin A

Vitamin A is fat soluble, which means the body can store a supply of this vitamin in the liver. Although is it essential for good health, vitamin A can be toxic in large doses. The disease caused by toxicity is known as hypervitaminosis A, and it can cause birth defects, liver problems, hair loss, skin discoloration, skin dryness, and high intracranial blood pressure. In addition, this disease can increase the risk of osteoporosis (Penniston KL 2006). Hypervitaminosis A occurs when the amount of the vitamin in the body exceeds the amount that the liver can store, causing the excess to enter into circulation throughout the body (Insel P 2002).

Similar to all vitamins, vitamin A is essential and cannot be made by the body in the amount necessary to maintain well-being. Vitamin A has strong antioxidant activity and is particularly important for eye and skin health, immune system function and bone health. As with most other vitamins and minerals, the best way to get the recommended healthy amount is by consuming a wide variety of foods. Many foods are rich sources of this essential vitamin including animal sources such as whole milk. However, when compared the regular and lactose-free whole milks had the lowest mean vitamin A content in the powdered milks and the second lowest in the liquid milks. No significance however was shown between or among the regular and alternative, liquid and powdered milks for vitamin A content. Therefore, it cannot be said that the alternative milks contain nutrient profiles that reflect options that are more “healthful” in terms of vitamin A content.

Vitamin C

Vitamin C, also known as L-ascorbic acid, is a water-soluble vitamin that is naturally present in some foods and may be added to others. Humans, unlike most animals, are unable to synthesize vitamin C endogenously, so it is an essential dietary component (Li Y 2007). Ongoing research is examining whether vitamin C, by limiting the damaging effects of free radicals through its antioxidant activity, might help prevent or delay the development of certain cancers, cardiovascular disease, and other diseases in which oxidative stress plays a causal role. In addition to its biosynthetic and antioxidant functions, vitamin C plays an important role in immune function (Jacob RA 2002). Insufficient vitamin C intake causes scurvy, which is characterized by fatigue or lassitude, widespread connective tissue weakness, and capillary fragility (Li Y 2007), (Jacob RA 2002).

Due to its function as an antioxidant and its role in immune function, vitamin C has been promoted as a means to help prevent and/or treat numerous health conditions. The overwhelming majority of species of animals –but not humans- and plants synthesize their own vitamin C, therefore, some animal products can be used as sources of dietary vitamin C. Vitamin C is present in mother's milk but, not present in raw cow's milk. While plants are generally a good source of vitamin C, the amount in foods of plant origin depends on the precise variety of the plant, soil condition, climate where it grew, length of time since it was picked, storage conditions, and method of preparation (Danish Veterinary and Food Administration n.d.).

Results of scientific studies on whether vitamin C is helpful for preventing heart attack or stroke are mixed. Vitamin C does not lower cholesterol levels or reduce the overall risk of heart attack, but evidence suggests that it may help protect arteries against damage. Some studies - though not all - suggest that vitamin C, acting as an antioxidant, can slow down the progression of atherosclerosis

(hardening of the arteries). It helps prevent damage to LDL ("bad") cholesterol, which then builds up as plaque in the arteries and can cause heart attack or stroke. Other studies suggest that vitamin C may help keep arteries flexible. In addition, people who have low levels of vitamin C may be more likely to have a heart attack, stroke, or peripheral artery disease, all potential results of having atherosclerosis (Babaev VR 2010).

Skim milks of both the liquid and powdered varieties showed the highest mean percentage daily value of vitamin C content. The liquid alternative milks had zero percent vitamin C content, but the powdered version of the normal soy milks did have vitamin C. There was no significance observed with the powdered milks, nevertheless, the alternative liquid milks have zero percent vitamin C content resulted in a observed significance in favor of the regular milks. Because vitamin C is said not to be present in cow's milk, this vitamin C content observed may have been added during manufacturing process. Because there has been mixed associations between vitamin C and health implications, it cannot be determined if milk alternatives reflect options that are considered more healthful.

Vitamin D

Vitamin D is a fat-soluble vitamin that is naturally present in very few foods. Vitamin D promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate concentrations to enable normal mineralization of bone and to prevent hypocalcemic tetany (Food and Nutrition Board 2010). It is also needed for bone growth and bone remodeling by osteoblasts and osteoclasts (Cranney A 2008). Without sufficient vitamin D, bones can become thin, brittle, or misshapen, this disease is known as osteoporosis. Osteoporosis is a disease characterized by low bone mass and structural deterioration of bone tissue that increases bone fragility and significantly increases the risk of bone fractures (The NIH Osteoporosis and Related Bone Diseases 2011). Osteoporosis is

most often associated with inadequate calcium intakes, but insufficient vitamin D contributes to osteoporosis by reducing calcium absorption (Heaney RP 2003). Although rickets and osteomalacia are extreme examples of the effects of vitamin D deficiency, osteoporosis is an example of a long-term effect of calcium and vitamin D insufficiency.

Laboratory and animal evidence as well as epidemiologic data suggest that vitamin D status could affect cancer risk. Strong biological and mechanistic bases indicate that vitamin D plays a role in the prevention of colon, prostate, and breast cancers. Emerging epidemiologic data suggest that vitamin D may have a protective effect against colon cancer, but the data are not as strong for a protective effect against prostate and breast cancer, and are variable for cancers at other sites (Davis CD 2008). For this study, only the original flavors of liquid and powdered milks were analyzed, this meant that no products were fortified with any type of nutrients based on packaging information. Based on the mean percentage daily value of vitamin D content both the regular 2% and skim dairy, the 1% lactose-free cow's milk and the almond milk alternatives had values higher than 20%, making them a high source of this nutrient. The rice milk showed zero mean percent daily value for vitamin D, not making this particular dairy alternative option a source for this nutrient.

Results of Table 14 show the dairy alternative powdered milks having a mean daily value of 40%, whereas regular milks showed 30.25%. Again looking at the mean nutrient content of dairy and dairy alternative liquid milks although the percent difference is not great, the dairy alternatives did have the higher mean vitamin D percent daily value (Table 1). While the contrast could not be evaluated for vitamin D in the liquid milks, contrast results of Table 16 showed no significance between the powdered milks. As such the nutrient profiles of the alternative milks cannot be said to reflect a healthier option, based on this it can there for not be determined if the health implications associated with regular milk products are not associated with alternative milk products due to vitamin D content.

Calcium

Calcium, the most abundant mineral in the body, is found in some foods and even added to others. The body needs calcium to maintain strong bones and to carry out many important functions. Calcium is required for vascular contraction and vasodilation, muscle function, nerve transmission, intracellular signaling and hormonal secretion, though less than 1% of total body calcium is needed to support these critical metabolic functions (Food and Nutrition Board 2010). Serum calcium is very tightly regulated and does not fluctuate with changes in dietary intakes; the body uses bone tissue as a reservoir for, and source of calcium, to maintain constant concentrations of calcium in blood, muscle, and intercellular fluids (Food and Nutrition Board 2010). The remaining 99% of the body's calcium supply is stored in the bones and teeth where it supports their structure and function (Food and Nutrition Board 2010). Bone itself undergoes continuous remodeling, with constant resorption and deposition of calcium into new bone.

The balance between bone resorption and deposition changes with age. Bone formation exceeds resorption in periods of growth in children and adolescents, whereas in early and middle adulthood both processes are relatively equal. In aging adults, particularly among postmenopausal women, bone breakdown exceeds formation, resulting in bone loss that increases the risk of osteoporosis over time (Food and Nutrition Board 2010). Not all calcium consumed is actually absorbed in the gut. Humans absorb about 30% of the calcium in foods, but this varies depending upon the type of food consumed (Food and Nutrition Board 2010). Other factors that also affect calcium absorption include the amount consumed: the efficiency of absorption decreases as calcium intake increases, and age and life: net calcium absorption is as high as 60% in infants and young children, who need substantial amounts of the mineral to build bone . (Food and Nutrition Board 2010).

Some absorbed calcium is eliminated from the body in urine, feces, and sweat. This amount is affected by such factors such as those shown in the late 1990's research on, sodium and protein intakes: high sodium intake increases urinary calcium excretion and another that high protein intake also increases calcium excretion and was therefore thought to negatively affected calcium status. However, research that is more recent suggests that high protein intake also increases intestinal calcium absorption, effectively offsetting its effect on calcium excretion, so whole body calcium retention remains unchanged (Kerstetter JE 2005).

There are many claim about calcium's potential benefits in health promotion and disease prevention and treatment, such as bone health and osteoporosis; cardiovascular disease; blood pressure regulation and hypertension; cancers of the colon, rectum, and prostate; kidney stones; and weight management, but often controversial studies show up rejecting these claims. For example, Calcium has been proposed to help reduce cardiovascular disease risk by decreasing intestinal absorption of lipids, increasing lipid excretion, lowering cholesterol levels in the blood, and promoting calcium influx into cells (Food and Nutrition Board 2010). In an early 1990 study, it was found that higher calcium intake was associated with reduced ischemic heart disease mortality in postmenopausal women (Bolland MJ 2010).

Nevertheless, results from other prospective studies have shown no significant associations between calcium intake and cardiac events or cardiovascular mortality. Data for stroke are mixed, with some studies linking higher calcium intakes with lower risk of stroke, while others have found no associations or trends in the opposite direction (Chung M 2009). A 2010 systematic review of 17 prospective studies and randomized trials found no increased risk of cardiovascular disease from calcium supplements with or without vitamin D among adults (Wang L 2010).

Bones increase in size and mass during periods of growth in childhood and adolescence, reaching peak bone mass around age 30. The greater the peak bone mass, the longer one can delay serious bone loss with increasing age. Everyone should therefore consume adequate amounts of calcium and vitamin D throughout childhood, adolescence, and early adulthood. When calcium intake is low or ingested calcium is poorly absorbed, bone breakdown occurs as the body uses its stored calcium to maintain normal biological functions. Bone loss also occurs as part of the normal aging process, particularly in postmenopausal women due to decreased amounts of estrogen. Many factors increase the risk of developing osteoporosis, including being female, thin, inactive, or of advanced age; smoking cigarettes; drinking excessive amounts of alcohol; and having a family history of osteoporosis (National Osteoporosis Foundation 2011)

In 1993, the U.S. Food and Drug Administration authorized a health claim related to calcium and osteoporosis for foods and supplements (USDA 2009). In January 2010, this health claim was expanded to include vitamin D. Model health claims include the following: "Adequate calcium throughout life, as part of a well-balanced diet, may reduce the risk of osteoporosis" and "Adequate calcium and vitamin D as part of a healthful diet, along with physical activity, may reduce the risk of osteoporosis in later life (USDA 2009).

Upon analysis of the original flavors of liquid milks, that is no fortification of products, no significance was shown of the dairy and dairy alternative options, and however where significance was observed was between the dairy liquid milks. The lactose-free cow's milks presents a higher percentage daily value of calcium content that the cow's dairy milks. Powdered milks on the other hand did show a significance with the dairy milks having a higher percentage daily value of calcium content. Regular skim powdered milks had the highest mean percent daily value of calcium content within this study, on the other hand the organic almond milk showed the lowest calcium content at zero percent.

Vegetarians might absorb less calcium than omnivores because they consume more plant products containing oxalic and phytic acids. However, vegans, who eat no animal products and ovo-vegetarians (who eat eggs but no dairy products), might not obtain sufficient calcium because of their avoidance of dairy foods (American Dietetic Association; Dietitians of Canada 2003). In the Oxford cohort of the European Prospective Investigation into Cancer and Nutrition, bone fracture risk was similar in meat eaters, fish eaters and vegetarians, but higher in vegans, likely due to their lower mean calcium intake (Appleby P 2007). It is difficult to assess the impact of vegetarian diets on calcium status because of the wide variety of eating practices and thus should be considered on a case by case basis. However, because there has been controversial associations between calcium and health implications, it cannot be determined if milk alternatives reflect options that are considered more healthful.

Iron

Analysis of the powdered milks showed no significance between the regular and alternative milks, however significance was shown both between and among the alternatives . Alternative milks showed a higher significance of iron content than the regular milk, further analysis also identified the soy alternative milks to be significantly high in iron content than the non-soy that is almond and rice, alternative milks. Neither the liquid nor the powdered, dairy milks had any percent daily value for iron content. The normal soy powdered milks had 9.36% mean iron content, the highest of the alternative milks, while the organic almond milk was the only one of the alternatives with zero percent mean daily value of iron content.

Iron is an integral part of many proteins and enzymes that maintain good health. In humans, iron is an essential component of proteins involved in oxygen transport (Food and Nutrition Board

2010). A deficiency of iron limits oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity (Haas JD 2001) and (Bhaskaram P 2001). On the other hand, excess amounts of iron can result in toxicity and even death (Chang TP 2011). Because known risk factors cannot explain all cases of heart disease, researchers continue to look for new causes. Some evidence suggests that iron can stimulate the activity of free radicals (Galatro A 2011). Free radicals are natural by-products of oxygen metabolism that are associated with chronic diseases, including cardiovascular disease. Free radicals may inflame and damage coronary arteries, the blood vessels that supply the heart muscle (McCord JM 2004). This inflammation may contribute to the development of atherosclerosis, a condition characterized by partial or complete blockage of one or more coronary arteries. Other researchers suggest that iron may contribute to the oxidation of LDL ("bad") cholesterol, changing it to a form that is more damaging to coronary arteries. For the reason of controversial associations between iron and health implications, it cannot be determined if milk alternatives reflect options that are considered more healthful.

LIMITATIONS

i. Each food stores has ≥ 2 locations, therefore assuming that each location carries the same dairy and dairy alternative brand and product type may place restrictions on finding a variety of products.

ii. The survey used for data gathering of brands available in Trinidad only allotted for 4 brands to be listed, this may have played a great loss to the investigator because some vital brands may not have been made acknowledgeable

iii. This research, made comparison based on nutrient content at point of manufacture, however, because product are not consumed at point of manufacture, actual nutrient contents of the milk products may be different at point of consumption.

iv. Using the original flavors of the liquid and powdered milks, limited the number of products that could have been compared in this study.

CONCLUSIONS

Due to the many controversial claims on health implications of protein, vitamin C, vitamin D, calcium and iron, no conclusions can be made on whether the nutrient profiles of alternative milks reflect a more “healthful” option. However as caloric intake varies from person to person, based on the significance observed it can be concluded, that when combined with healthy life style choices, alternative liquid milks reflect the more “healthful” option for calories and calories from fat content.

Diabetes Mellitus and Disease of the Heart, being two of the top ten causes of death in Trinidad are normally associated with foods high in sugar and cholesterol content, respectfully, hence a conclusion can be made that liquid alternative milks reflect the more healthful options having lower cholesterol and sugar content. Also based on studies, on the effects dietary fiber lower the risk of heart disease and reducing the risk of developing diabetes, the significantly higher dietary fiber content of alternative milks reflect the more “healthful” option.

Powdered alternative milks were to shown to have a higher sodium content that the regular powdered milks, from this significance observed it can be concluded that the powdered alternative milks do not reflect a more “healthful” option for person who may seeking to reduce their sodium intake or risk of heart disease.

RECOMMENDATIONS

i. Most often, consumers purchase products based on product claims, it can therefore be recommended that a stud similar to this one can be conducted to compare the fortified or enriched regular and alternative milks products to those not fortified or enriched with vitamins and nutrients.

ii. This study is based on the nutrient contents of regular and alternative milks at point of manufacture, however consumer do not consume these products at that point in time. These products must be distributed to suppliers for purchase and consumption by consumers, and in some cases distribution may take long period of time due to exportation and importation. Therefore, this study should be repeated with an inclusion of the biochemical analysis of nutrient content based on actual shelf life status.

iii. Milks, only make up one part of the foods from dairy products equation, another of the foods from dairy products that should be looked at are the cheese products. Cheese is said to be valued for its portability, long life, and high content of fat, protein, calcium, and phosphorus, it is also known to be more compact and has a longer shelf life than milk, therefore extending this study to include the cheese alternatives available may prove vital for persons trying choose the healthier option.

iv. It can be said, that most often persons do not find the taste and flavor of the lactose-free milks or the alternative milks appealing, as such manufactures have made possible a variety of flavors to suit individual pallets. Therefore, a comparison of regular and alternative milks, between and

among different flavors may prove to be of some interest. This means comparing regular and alternative options of a particular flavor milks and then comparing options to other flavors.

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APPENDIX A

Dairy and Dairy Alternative Milk Products Available in Trinidad Survey

Part A

1. Name of Establishment:
   ……

2. No. of locations within Trinidad:
   ……

Part B

3. Does this establishment currently sell/supply any of the following products within Trinidad? ***(Please tick those that apply and list brands available.)***

a. Dairy Products
   Milk
   - i. Liquid Cow's Milk
     1. ……
     2. ……
     3. ……
     4. ……
   - ii. Powdered/ Dry Cow's Milk
     1. ……
     2. ……
     3. ……
     4. ……
   - iii. Lactose-free Milk
     1. ……
     2. ……
     3. ……
     4. ……

Part C

4. Does this establishment currently sell/supply any of the following products within Trinidad? ***(Please tick those that apply and list brands available.)***

a. Alternatives of Dairy Products
   Milk
   - i. Soy Milk
     1. ……
     2. ……
     3. ……
     4. ……

- ii. Almond Milk
    1. ……
    2. ……
    3. ……
    4. ……

- iii. Rice Milk
    1. ……
    2. ……
    3. ……
    4. ……

Part D

5. In the recent 5 years, has your establishment noticed any greater demand for "Alternatives of Dairy Products"?
    - Yes
    - No

RAW DATA

An Example of the Response on the Dairy and Dairy Alternative Milk Products Availability Survey

Survey Response # 5

1 Name of Establishment

Hi-Lo Food Stores

2 Type of Food Store?

General

3 No. of locations within Trinidad?

16

4 Option	Product	Base	Composition	Brands Available
Dairy	Milk	Cow's Milk	Liquid	*Nestlē* *Farmland Dairies*
			Powdered	*Kerrygold* *Dairy Dairy* *Nestlē*
		Lactose-free Cow's Milk	Liquid	*Farmland Dairies*
			Powdered	-
Dairy Alternative	Milk	Soy	Liquid	*Eden Foods* *Natural Delight* *Silk* *Soy Dream*
			Powdered	*Lasco*
		Almond	Liquid	*Silk* *Blue Diamond* *Almond Dream*
			Powdered	-
		Rice	Liquid	*Rice Dream*
			Powdered	-

5 Greater demand for "Dairy Alternative Products" in recent 5yrs?

Yes

RAW DATA

An Example of the Response on the Dairy and Dairy Alternative Milk Products Availability Survey

Survey Response #14

1 Name of Establishment

Peppercorns

2 Type of Food Store?

Health

3 No. of locations within Trinidad?

2

4

Option	Product	Base	Composition	Brands Available
Dairy	Milk	Cow's Milk	Liquid	*Farmland Dairies*
			Powdered	-
		Lactose-free Cow's Milk	Liquid	*Lactaid*
			Powdered	-
Dairy Alternative	Milk	Soy	Liquid	*Soy Dream* *Eden Foods* *Silk*
			Powdered	-
		Almond	Liquid	*Blue Diamond* *Silk* *Almond Dream*
			Powdered	-
		Rice	Liquid	*Rice Dream*
			Powdered	-

5 Greater demand for "Dairy Alternative Products" in recent 5yrs?

Yes

APPENDIX B

Product Nutrient Profile Form

Item #	……..
Product Name	…….....
Brand	……..…...
Dairy Product or Dairy Alternative Product	……..
Type	…….....
Amount per Serving Size (ml)	……..
Calories	……..
Calories From Fat	……..
Total Fat (g)	……..
Saturated Fat (g)	……..
Trans Fat (g)	……..
Cholesterol (mg)	……..
Sodium (mg)	……..
Total Carbohydrate (g)	……..
Dietary Fiber (g)	……..
Sugars (g)	……..
Protein (g)	……..
Vitamin A (%)	……..
Vitamin C (%)	……..
Vitamin D (%)	……..
Calcium (%)	……..
Iron (%)	……..

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Milk

Liquid Milk, Original Flavor

Product Name and Brand	Whole Milk Nestle
Serving Size (ml)	250.0
Calories	150.0
Calories from Fat	70.0
Total Fat (g)	8.0
Saturated Fat (g)	5.0
Trans Fat (g)	0.0
Cholesterol (mg)	25.0
Sodium (mg)	110.0
Total Carbohydrate (g)	12.0
Dietary Fiber (g)	-
Sugars (g)	-
Protein (g)	8.0
Vitamin A (%)	-
Vitamin C (%)	NSS
Vitamin D (%)	-
Calcium (%)	20.0
Iron (%)	-

Product Name and Brand	Whole Milk, Dairy Ease Land O Lakes
Serving Size (ml)	240.0
Calories	160.0
Calories from Fat	80.0
Total Fat (g)	9.0
Saturated Fat (g)	5.0
Trans Fat (g)	0.0
Cholesterol (mg)	20.0
Sodium (mg)	125.0
Total Carbohydrate (g)	11.0
Dietary Fiber (g)	0.0
Sugars (g)	11.0
Protein (g)	8.0
Vitamin A (%)	6.0
Vitamin C (%)	0.0
Vitamin D (%)	-
Calcium (%)	30.0
Iron (%)	0.0

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Milk

Liquid Lactose-free Milk, Original Flavor

Product Name and Brand	1% Milk, Low Fat Lactaid
Serving Size (ml)	240.0
Calories	110.0
Calories from Fat	20.0
Total Fat (g)	2.5
Saturated Fat (g)	1.5
Trans Fat (g)	0.0
Cholesterol (mg)	15.0
Sodium (mg)	125.0
Total Carbohydrate (g)	13.0
Dietary Fiber (g)	0.0
Sugars (g)	12.0
Protein (g)	8.0
Vitamin A (%)	10.0
Vitamin C (%)	0.0
Vitamin D (%)	25.0
Calcium (%)	30.0
Iron (%)	0.0

Product Name and Brand	2% Milk, Reduced Fat Lactaid
Serving Size (ml)	240.0
Calories	130.0
Calories from Fat	45.0
Total Fat (g)	5.0
Saturated Fat (g)	3.0
Trans Fat (g)	0.0
Cholesterol (mg)	20.0
Sodium (mg)	125.0
Total Carbohydrate (g)	13.0
Dietary Fiber (g)	0.0
Sugars (g)	12.0
Protein (g)	8.0
Vitamin A (%)	10.0
Vitamin C (%)	0.0
Vitamin D (%)	25.0
Calcium (%)	30.0
Iron (%)	0.0

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Alternative Milk

Liquid Soy Milk, Original Flavor

Product Name and Brand	Organic Edensoy
Serving Size (ml)	240.0
Calories	140.0
Calories from Fat	40.0
Total Fat (g)	5.0
Saturated Fat (g)	0.5
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	105.0
Total Carbohydrate (g)	14.0
Dietary Fiber (g)	<1
Sugars (g)	7.0
Protein (g)	11.0
Vitamin A (%)	-
Vitamin C (%)	-
Vitamin D (%)	-
Calcium (%)	10.0
Iron (%)	10.0

Product Name and Brand	Organic Soy Milk Silk
Serving Size (ml)	240.0
Calories	100.0
Calories from Fat	35.0
Total Fat (g)	4.0
Saturated Fat (g)	0.5
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	120.0
Total Carbohydrate (g)	8.0
Dietary Fiber (g)	1.0
Sugars (g)	6.0
Protein (g)	7.0
Vitamin A (%)	10.0
Vitamin C (%)	0.0
Vitamin D (%)	30.0
Calcium (%)	30.0
Iron (%)	6.0

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Alternative Milk

Liquid Almond Milk, Original Flavor

Product Name and Brand	Almond Dream Almond Dream
Serving Size (ml)	240.0
Calories	50.0
Calories from Fat	25.0
Total Fat (g)	2.5
Saturated Fat (g)	0.0
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	100.0
Total Carbohydrate (g)	6.0
Dietary Fiber (g)	<1
Sugars (g)	5.0
Protein (g)	1.0
Vitamin A (%)	20.0
Vitamin C (%)	0.0
Vitamin D (%)	25.0
Calcium (%)	30.0
Iron (%)	2.0

Product Name and Brand	Almond Breeze Blue Diamond
Serving Size (ml)	240.0
Calories	60.0
Calories from Fat	25.0
Total Fat (g)	2.5
Saturated Fat (g)	0.0
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	150.0
Total Carbohydrate (g)	8.0
Dietary Fiber (g)	1.0
Sugars (g)	7.0
Protein (g)	1.0
Vitamin A (%)	10.0
Vitamin C (%)	0.0
Vitamin D (%)	25.0
Calcium (%)	45.0
Iron (%)	2.0

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Alternative Milk

Liquid Rice Milk, Original Flavor

Product Name and Brand	Rice Dream Rice Dream
Serving Size (ml)	240.0
Calories	120.0
Calories from Fat	20.0
Total Fat (g)	2.5
Saturated Fat (g)	0.0
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	100.0
Total Carbohydrate (g)	24.0
Dietary Fiber (g)	0.0
Sugars (g)	11.0
Protein (g)	1.0
Vitamin A (%)	0.0
Vitamin C (%)	0.0
Vitamin D (%)	-
Calcium (%)	2.0
Iron (%)	2.0

Product Name and Brand	Rice, All Natural Pacific Natural Foods
Serving Size (ml)	240.0
Calories	130.0
Calories from Fat	20.0
Total Fat (g)	2.0
Saturated Fat (g)	0.0
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	60.0
Total Carbohydrate (g)	27.0
Dietary Fiber (g)	0.0
Sugars (g)	14.0
Protein (g)	1.0
Vitamin A (%)	10.0
Vitamin C (%)	0.0
Vitamin D (%)	-
Calcium (%)	25.0
Iron (%)	6.0

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Milk

Powdered Milk, Original Flavor

Product Name and Brand	Skim Milk Dairy Dairy
Serving Size (ml)	32.0
Calories	112.0
Calories from Fat	-
Total Fat (g)	0.0
Saturated Fat (g)	0.0
Trans Fat (g)	-
Cholesterol (mg)	0.0
Sodium (mg)	-
Total Carbohydrate (g)	16.0
Dietary Fiber (g)	-
Sugars (g)	-
Protein (g)	12.0
Vitamin A (%)	18.0
Vitamin C (%)	13.0
Vitamin D (%)	-
Calcium (%)	50.0
Iron (%)	-

Product Name and Brand	Skim Milk Kerrygold
Serving Size (ml)	40.0
Calories	146.0
Calories from Fat	-
Total Fat (g)	0.32
Saturated Fat (g)	-
Trans Fat (g)	-
Cholesterol (mg)	-
Sodium (mg)	-
Total Carbohydrate (g)	21.2
Dietary Fiber (g)	-
Sugars (g)	-
Protein (g)	14.4
Vitamin A (%)	-
Vitamin C (%)	-
Vitamin D (%)	-
Calcium (%)	64.0
Iron (%)	-

RAW DATA

An Example of the Product Nutrient Profiles as Stated on the Nutrition Fact Labels

Dairy Alternative Milk

Powdered Soy Milk, Original Flavor

Product Name and Brand	LaSoy Lactose Free Lasco
Serving Size (ml)	30.0
Calories	150.0
Calories from Fat	70.0
Total Fat (g)	8.0
Saturated Fat (g)	4.0
Trans Fat (g)	0.0
Cholesterol (mg)	0.0
Sodium (mg)	150.0
Total Carbohydrate (g)	11.0
Dietary Fiber (g)	0.0
Sugars (g)	5.0
Protein (g)	8.0
Vitamin A (%)	20.0
Vitamin C (%)	4.0
Vitamin D (%)	-
Calcium (%)	30.0
Iron (%)	15.0

Product Name and Brand	Vanilla Lasco
Serving Size (ml)	40.0
Calories	170.0
Calories from Fat	60.0
Total Fat (g)	7.0
Saturated Fat (g)	3.5
Trans Fat (g)	0.0
Cholesterol (mg)	5.0
Sodium (mg)	130.0
Total Carbohydrate (g)	23.0
Dietary Fiber (g)	0.0
Sugars (g)	23.0
Protein (g)	7.0
Vitamin A (%)	15.0
Vitamin C (%)	4.0
Vitamin D (%)	-
Calcium (%)	25.0
Iron (%)	10.0

APPENDIX C

Milk Product Grouping for Analysis Based on Composition