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A Comparative Analysis of the Nutritional Contents of Soy Bean Milk and Cow Milk

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Abstract: *This research work aimed at determining and comparing the nutritional content of cow milk and soy bean milk, which is regarded as the first natural milk. Different methods were adopted in the course of the analysis. The results show that cow milk contains 2.11% protein, 3.58% fat, 5.53% carbohydrate, 0.61% ash, and 88.17% moisture. Comparatively, soy milk contains 2.31% protein, 1.80% fat, 3.53% carbohydrate, 0.57% ash, and 91.80% moisture. However, due to its low amount of carbohydrates and fat, soy milk is suitable for those suffering from hypolactosemia and is thus favoured over cow milk.*

Keyword: *Comparative Analysis, Nutritional Contents, Soy Bean Milk, Cow Milk..*

INTRODUCTION

Milk is an emulsion or colloid of butter fat globules within a water-based fluid that contains dissolved carbohydrates and protein aggregates with minerals (Rolf, 2002). Because it is produced as a food source for the young, all of its contents provide benefits for growth. The basic requirements are energy (protein and lipids), biosynthesis of non-essential amino acid supplied by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and Inorganic elements, and water (Fox, 1995).

Soya milk (also called soy milk, fake milk, soy juice or soy drink) is a beverage made from soy beans. It is produced by soaking dry soy beans and grinding them with water. Soy was able to replace animal protein, foods high in saturated fats, and other sources of dietary fiber, vitamins and minerals (Sacks *et al.,* 2006).

Natural milk is a white liquid produced by the mammary gland of mammals. It is the primary source of nutrition for young mammals before they are able to digest other types of food. Early lactation milk contains colostrums and many other nutrients, which carries the mother's antibodies to the baby reducing the risk of many diseases in the baby (Pehrsson *et al.,* 2000). As an agricultural product, milk is extracted from mammals during or soon after pregnancy and used as food for humans. Worldwide, dairy farms produced about 730 million tones of milk in 2011 alone (FAO, 2012). There are more than 6 billion consumers of milk and milk Products throughout the world and over 750 million people live within dairy farming households. Milk is a key contributor to improving nutrition and food security particularly in developing countries. In view of this, this research focuses on the comparison between nutritional values of Soya bean milk and Cow milk. Soymilk is the first and the most popular alternative milk. In terms of nutrition, soymilk surpasses all other non diary milk substitutes like almond and rice milk with a complete panel of essential nutrients which the body relies on for growth and development. It also contains disease preventing phytosterols, which are not found in cow's milk (Brigid, 2014). Fresh soymilk made from grinding and then straining soaked dried milk has protein content similar to cow's milk as evident from this work.

Soybeans and soy products contain significant amounts of purines. For people who suffer from gout, eating foods containing moderate or high levels of purines may make the condition worse. The U.S. National Institutes of Health (NIH) recommends that soy may have health benefits by reducing the risk of heart disease (NIH, 2010). However, other researchers have found little or no association between consumption of purine-rich vegetables (including beans) and gout (Choi *et al*, 2004; Weaver, 2008).

The composition of milk varies widely among species (Geff, 2014). Cow's milk contains an average 3.4% protein, 3.6% fat and 4.6% lactose, 0.7% mineral per 100g.

Materials and Method

Sample Collection

Fresh early morning cow milk was collected from Goni Damgari ward behind rail station Maiduguri, Borno State. Soy milk was prepared domestically from soy beans purchased from Monday Market, Maiduguri, using kitchen utensils, and both samples were then taken to the food laboratory at the National Agency for Food, Drug Administration, and Control (NAFDAC), Maiduguri, for analysis.

Method of Production of Soya Milk

- Soy beans were soaked in water overnight in a large bowl.
- Loosed skins and beans that have softened or expanded were separated.
- The beans were then rinsed and blended to smoothness, adding more water as necessary.
- It is then strained with cheesecloth, pressing or squashing beans to remove milk.
- Soy milk plus two (2) cups of water were put in a pot and heated to a certain temperature before boiling.
- The milk was then filtered again and allowed to cool.

Procedures

Physical parameters such as Brix, Refractive Index, and pH values were determined using appropriate standard methods.

1. **Moisture content**

A flat dish made of silica was dried in an oven and cooled in desiccators. The cooled dish was weighed as (W_1). 5 grams of the sample were put into the dish and weighed as (W_2). The dish and its content were transferred into an air oven at 105 °C to dry for about 3 hours. Using a pair of tongs, the dish was transferred into dissectors and allowed to cool. The dish was re-weighed as W3.

$$\% \, Moisture = \frac{W2 - W3}{W2 - W1} \times 100$$

2. Ashing

A clean silica dish was weighed as (W_1). 5g of the sample was added to the dish and weighed again as (W_2). The sample was put on boiling water bath to dryness. This was transferred into a muffle furnace at 500 °C until fully ashes. It was then cooled in a desiccator' and weighed as (W_3).

$$\% \, Ash = \frac{W3 - W1}{W2 - W1} \times 100$$

3. Acidity

10 ml of sample was measured into a conical flask; 1 ml of phenolphthalein was then added with 0.1M HCl in a burette and titrated until the color changed to pink.

$$\% \, Acidity = \frac{Titre\ value \times 0.00908}{Volume\ of\ sample\ taken}$$

4. Protein

After obtaining the acidity value above, 2 drops of formaldehyde were added to the conical flask and titrated again against 0.1M HCl.

$$\% \, Protein = Titre\ value - 0.1 \times 1.95$$

5. Fat

10ml of the sample (Wo) was measured into a separating funnel. 10ml of ethanol, 2ml of ammonia and 50ml of petroleum spirit was added into it and was shaken and separated

into a weighed conical flask (W_1). The conical flask was put on boiling water, and heated to dryness. The dried conical flask was cooled in a desiccator and re-weighed as (W_2).

$$\% \, Fat = \frac{W2 - W1}{W0} \times 100$$

6. Carbohydrate
It was calculated as follows

% carbohydrate = 100- (Protein Value+ Fat +Moisture + Ash).

Results

The physical parameters such as Brix, PH, and refractive index for the two samples are shown in Table 1. Table 2 shows the percentage concentrations of the nutrients determined in the samples.

Table 1: Physical Parameters

Parameters	**Cow milk`**	**Soy milk**
Brix (ºBx)	12.33	7.25
pH	7.88	7.93
Refractive index	1.35243	1.34336

Table 2: Nutritional Levels/Contents of The Samples

Nutrients	**Cow milk** (%)	**Soy milk** (%) **Value**	**USDA Ref.**
Protein	2.11	2.31	3.22
Fat	3.58	1.80	3.25
Carbohydrate	5.53	3.53	4.52
Ash	0.61	0.57	0.69
Moisture	88.17	91.80	88.32

DISCUSSION

The above tables present the results of the comparative analysis of some nutrients and physical parameters in cow milk and domestically prepared soy milk.

The parameters analyzed were protein, fat, carbohydrate, ash, and moisture. Protein was found to be 2.11% and 2.31% for cow and soy milk, respectively. The concentrations of fat and carbohydrates were greater in cow milk (3.58%, 5.53%) than in soymilk (1.80%, 3.53%), respectively. The ash level in both samples presented close values (0.61 % and 0.57%) for cow milk and soymilk, respectively. However, the soy milk appeared to contain a higher amount of moisture (91.80%) than the cow milk (88.17%). Other physical parameters such as Brix, PH, and refractive index were also determined, with Brix showing a clear difference between the two samples favoring cow milk, while they had close values for pH and refractive index, as all shown in Table 1. The P^H of milk ranges from 6.4 to 6.8, and it

changes over time. Milk from other borines and non-borines varies in composition but has a similar P^H.

From the results, the protein content of soymilk is almost the same as that of cow milk. However, cow milk is reported to contain two types of proteins: casein protein (80%) and whey protein (20%) (McGee and Harold, 2004). Soy milk, being a plant food, contains only soy protein. Normal bovine milk contains 30-35g of protein per liter, of which about 80% is in casein micelles. Total protein in milk represents 3.2% of its composition. According to Fox (1995), cow milk contains lactose, which contributes about 40% of the total milk calories. This also explains why Brix is higher in cow milk than in soymilk in this research. Whereas lactose-free soy milk contains less carbohydrate than cow milk. Bovine milk averages 4.8% anhydrous lactose, which amounts to 50% of the total solids of skimmered milk. Factors such as the type of protein, the proportion of protein, fat, and sugar, the levels of various vitamins, the size of the butter fat globules, and the strength of the curd are among those that may differ. Moreover, Fox (1995 also found that cow milk contains saturated fatty acids, which comprise cholesterol, while soymilk is reported by Sacks *et al. (*2006), to contain more unsaturated fatty acids with no cholesterol. Similarly, when fully ashes were in the furnace, cow milk and soy milk gave close values (0.61% and 0.57%, respectively).

The result also shows that soymilk contains more water than cow milk. This is because water has been added artificially to the dried soy beans during preparation, which is responsible for the mild variation.

CONCLUSION

The analysis shows that every 10 ml of cow milk contains 2.11% protein, 3.58% fat**,** 0.61% ash, and 5.53% carbohydrates compared to soymilk, which contains slightly more protein (2.32%), low fat (1.8%), and lower carbohydrates (3.5%).

In view of the findings of this analysis, soymilk may be recommended for consumption, especially for those who are at risk of diabetes, gout, or cholesterol deposits, as it contains low Brix, carbohydrate, and fat levels.

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