

**ASSESSMENT STUDY OF LIPIDS, PROTEIN, CALCIUM, AND
CARBOHYDRATES OF HUMAN AND DAIRY MILK IN TEHSIL, QUETTA**

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Abstract

The main aim of the present study was to compare the composition analysis of chemical contents found in human (mother) and cow (dairy) milk. The study was conducted in the Bolan medical complex hospital (BMCH), Quetta, Balochistan province, Pakistan within nine months' duration from April 2018 to November 2018. Five samples of breastfeeding mother's milk and five samples of cow milk from different dairy farms were taken for in vivo assessment. The quantity of protein, carbohydrates, lipids, and calcium samples was determined in a laboratory at the Pakistan Council of Scientific and Industrial Research (PCSIR), Sariat, Quetta. Result revealed the proportion of protein in cow milk found to be 3.11 %, and in human milk was measured to be only one percent. The proportion of carbohydrates observed was 8.67 % in human milk, while its share in cow milk was noted to be 4.38 %. The percentage of fats in human and cow milk was 5.18 and 5.18 percent respectively. In human milk, the amount of calcium observed was 498.38 mg/L, and in the category of cow milk, a total of 912.70 mg/L calcium was recorded. The present study concluded that cow milk is a more enriched source of proteins and calcium. While human milk contains a high proportion of carbohydrates and fats.

KEYWORDS: Dairy Milk, Heavy, Calcium, Carbohydrates, Mammalian, Nutrition.

1. INTRODUCTION

Milk is an emulsion or colloid of butterfat globules within a water-based fluid that includes dissolved carbohydrates and protein aggregates with minerals (Abutarbush, S. M. 2008). For newborns (infant mammals including man), milk is a biogenic and essential source of nutrition before they can eat and digest other sorts of foods. The pH of milk ranges from 6.1 to 6.8 and it changes over time. Milk from other bovines and non-bovine mammals varies in composition but has a similar pH (Bosscher *et al.*, 2001).



All mammalian species produced milk but the composition of milk for each species varies widely. Bovine and another kind of milk are mostly differing from human breast milk. Human milk is thinner and sweeter than cow milk. Human milk bears 9-gram protein compared with 34 g/l in cow milk concerning lactose in the human 70g/lL and 48g/l (Cavalli *et al.*, 2006).

In cow milk, the concentration of α -lactalbumin is twice as high in humans as in cow milk and the iron-binding protein lactoferrin. In addition to these and other differences, human and cow milk have not only protective effects against infection and the immune system but also amino acid profile in human milk which full fill the need of the human infant (Coppa *et al.*, 2004). Besides, the protein fats and calcium in a whole cow's milk are more difficult for an infant to digest and absorb than the ones in breast milk (Depeters *et al.*, 2001).

In almost all mammals, milk is fed to infants through breastfeeding. The makeup of the colostrum and the period of secretion vary from species to species. The early milk from mammals is called colostrum (Jensen, 1995). Colostrum contains antibodies that give protection to the newborn baby as well as nutrients and growth factors (Jost, 2002). For humans, the guidelines recommend exclusive breastfeeding for six months and breastfeeding in addition to other food for at least two years (Keen *et al.*, 1981).

However, some studies have reported that in developing countries many of the females are under-nourished because they cannot take a proper diet consisting of proteins, fats, and carbohydrates. Due to this, their breast milk may lack important nutrients required for the proper growth of infants.

Therefore, the present study is conducted to evaluate and analyze the lipid, protein, Carbohydrate, and calcium profiles of human and cow milk. This study is helpful to analyze do we need to enhance the nutrient values of breast milk or these are adequate for the proper nutrition of infants.

2. MATERIALS AND METHODS

Study Site

The present comparative study was carried out in the Bolan medical complex hospital (BMCH) during the period from April 2018 to November 2018. A total of 10 samples were included in the analysis. Five samples were obtained from human milk and five from the cow milk.

Collection of milk samples



Samples of human mother milk were taken from different mothers in pediatrics wards of BMCH. Dairy milk samples were taken from domestic female cow breed (*Bos permiginus*) found in various dairy forms of tehsil Quetta.

Milk samples were collected in test tubes and were brought to the PCSIR laboratory Mustang Road Quetta. Test tubes were marked carefully at the same time and were preserved in the refrigerator for analysis of ingredients of protein, carbohydrates, fat, and calcium existing in milk.

Analysis of ingredient profile using chemical tests

Chemicals were used to determine the quantity of protein, carbohydrates, lipids, and calcium samples such as NaOH, $\text{CuSO}_4 \cdot 2\text{H}_2\text{O}$ for protein Iodine solution, Benedict solution, Fehling solution for carbohydrates, for lipid Sudan III solution Emulsion test and Alkaline Phosphatase and the air was used for these tests.

Data Analysis

Data compiling and analysis was performed using SPSS 20 software. An independent sample t-test was used to compare the composition of human and cow milk. P-value <0.05 was taken as significant.

3. RESULTS AND DISCUSSION

Results for milk contents such as protein, carbohydrates, fats, and calcium of human and cow milk are described below. The means and standard errors were computed by using descriptive analysis using SPSS version 20. Means were checked for by performing student t-test at $P < 0.05$ significance level by using the same version and software.

Protein (%)

The proportion of protein was compared for the cow and human milk. The results revealed that both kinds of milk have significant values for protein concentration in milk. The proportion of protein in cow milk was 3.11 ± 0.26 and in human milk was 1.00 ± 0.04 is given in table 1 and figure 1.1. The protein percentage was much lower in human milk as compared to the milk of cows. This study suggests that cow milk is more valuable concerning protein content.

Table 1. Comparison of Human and Cow Milk Contents.



Ingredients	Human Milk (N=5)	Cow Milk (N=5)	P-value
Protein (%)	1.00±0.04	3.11±0.26	<0.0001
Carbohydrates (%)	8.67±0.85	4.38±0.08	<0.0001
Fat (%)	5.18±0.29	5.68±0.62	0.14
Calcium (mg/L)	498.38±35.31	912.70±156.65	0.0004

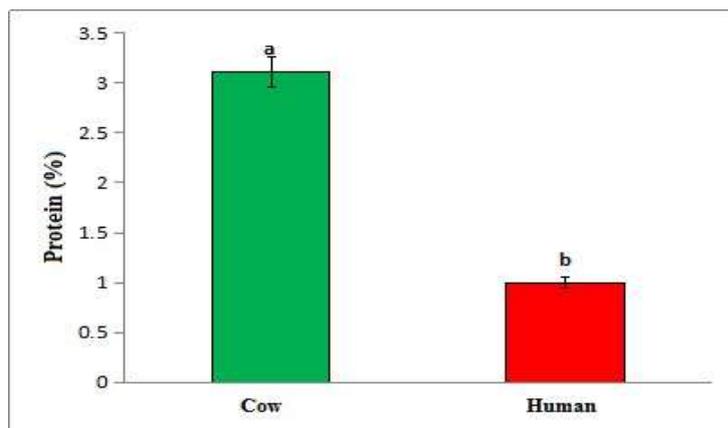


Fig. 1. Graphical Presentation of Protein Percentage in Human versus Cow Milk.

Carbohydrates (%)

Regarding the percentage comparison for carbohydrates in cow and human milk, the results revealed that both kinds of milk have a significant concentration of carbohydrates in milk. Hence the observed %age of carbohydrate in cow milk was 4.38 ± 0.08 , and that of human milk was 8.67 ± 0.85 as shown in table 1 and figure.2. The carbohydrates share was much higher in human milk as compared to dairy milk. This study suggests that human milk is more valuable concerning carbohydrates contents.

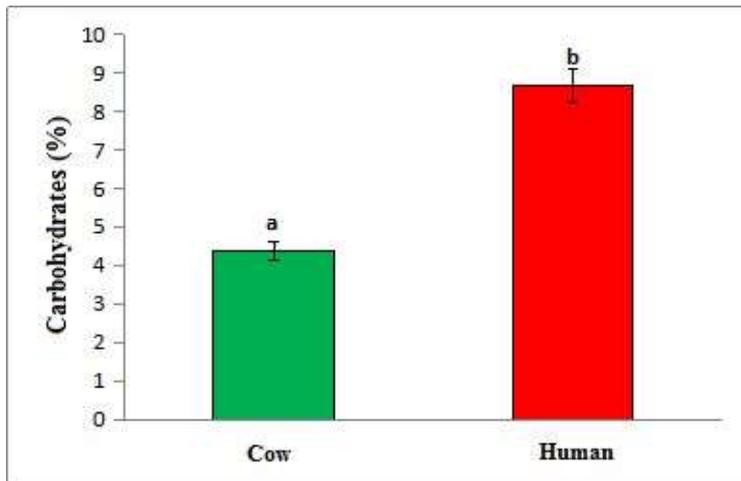


Fig. 2. Graphical Presentation of Carbohydrates Percentage in Human versus Cow Milk.

Fats (%)

Fats are insignificant in both cow and human milk. The result reveals that the value of fats percentage in mother milk was 5.18 ± 0.29 and in the cow milk was 5.68 ± 0.62 as described in table 1 and figure 3. This study suggests that both human and cow milk have the same concentration for fats and having the same importance. Both kinds of milk are suggested to use regarding fats percentage.

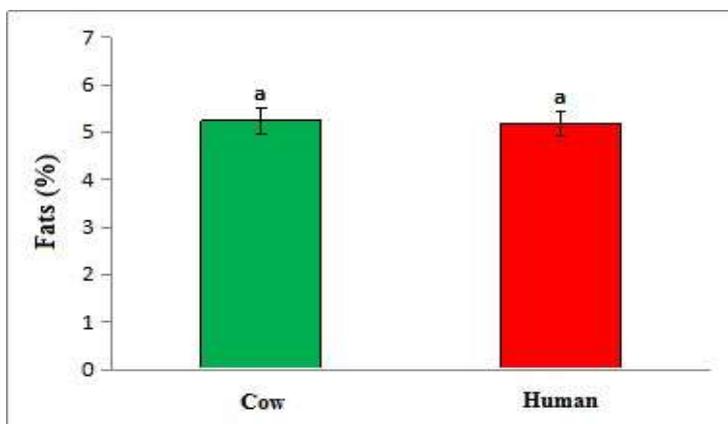


Fig. 3. Graphical Presentation of Fat Percentage in Human versus Cow Milk.

Calcium (mg/L)

The calcium concentration (mg/L) for the cow and human milk was compared, the results revealed that both types of milk have significant values for the calcium concentration in milk. The data presented in table 1 and figure 4 indicated 912.70 ± 156.65 calcium concentration in cow milk and 498.38 ± 35.31 in human mother milk. The calcium

concentration was noted to be much higher in cow milk as compared to mother milk. This study suggests that cow milk is more valuable for calcium content.

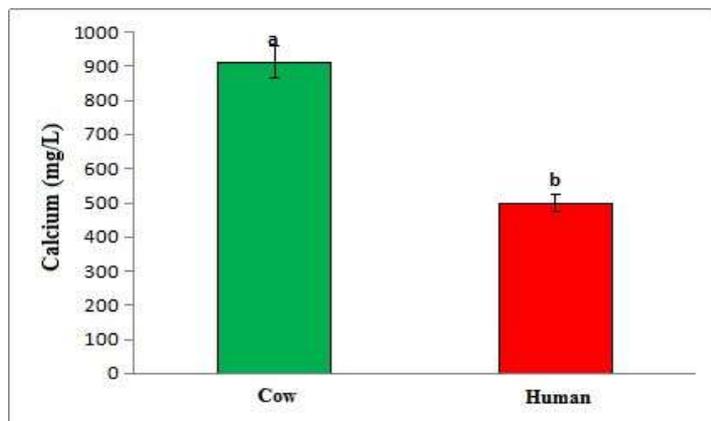


Fig. 4. Graphical Presentation of Calcium Levels in Human versus Cow Milk.

Milk is an important component of our diet. Milk contains essential components for the proper functioning of life. The composition of milk depends upon the animal species. Quality of milk is much essential for the intake of all biogenic nutrients present in it. Milk composition also varies with season and quality of food available to animals. Milk yield (fat and protein) increased in the winter and decreased in the summer (Leung *et al.*, 2003).

Milk fat and protein are important ingredients from the biological and economic point of view. Protein concentration reaches on the peak in mid-winter and became a minimum in July noted in the present study. According to the results, the quantity of protein in cow milk was significantly higher than the of human milk. The percentage of protein in cow milk was 3.11 % and in human milk was only one percent (Table 1 and Fig. 1). Masters *et al.* (2002) reported similar observations related to fat percentages in human milk (Martin-Álvarez *et al.*, 2020).

The carbohydrate percentage in the present study was significantly higher in human milk than in cow milk. In mother milk, the share of carbohydrates was 8.67 % and in cow was found to be 4.38 %. These findings are comparable with the study of Coppa *et al.* (2004) who reported a similar percentage of carbohydrates in human milk but was different in dairy products, it may be due to the season and food availability to the cow (Masters *et al.*, 2002).

Our study is also in line with the findings of Cavalli *et al.* (2006). In this study fat percentage was insignificant between human and cow milk. The proportion of fats in human milk was 5.18 %, and in cow milk fats share was also 5.18 % (Fig. 3).

The same amount of fats in both kinds of milk indicated that for the fat contents both kinds of milk are good to use for infants or this amount of fats should be maintained for the artificially prepared milk. A similar study was also conducted by Michalski *et al.* (2005) who reported fat globules in human and cow milk. The findings of Depeters *et al.* (2001) also are in line with our study where they reported canola importance for milk composition related to fats in cow's milk (Parodi *et al.*, 2004). Other studies by Roig *et al.* (1999) and Sischo *et al.* (2017) reveal similar observations.

Calcium is very useful for bone and teeth health. Milk with good calcium amount is preferable. In the present study, the recorded amount of calcium was 498.38 mg/L in mother milk compared to the amount of calcium in cow milk was 912.70 mg/L (Table 1 and Fig. 4). This indicated a significantly higher amount of calcium in cow milk than in human milk. The amount of calcium is lower in human milk may be due to the requirement of the baby because the mass of newborn babies is less so the amount of calcium is less in human milk. Further about calcium cow milk is not preferable for newly born but cow milk is good for babies more than three years old and adults. This study is similar to the study of who reported that calcium overdose of a newborn is not good for health (Roig *et al.*, 1999).

Observations related to calcium present in human mother milk and cow milk were reported by Zhao *et al.* (2005), Neville (2005), and Bosscher *et al.* (2001).

4. CONCLUSIONS AND RECOMMENDATIONS

Human and cow milk both are rich sources of energy for human beings. Cow milk is a more enriched source of proteins and calcium. While human milk contains a higher percentage of carbohydrates and fat.

This study is limited by a small sample size because of budget constraints. Therefore, there is a need to conduct a large sample size study on comparison of chemical composition and probiotics profile of both human and cow milk. Therefore, the benefit of giving cow milk to the neonates of malnourished women can be elaborated more.

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