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### Evaluation and comparison the physicochemical properties of different commercial milk product

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#### ABSTRACT

*In this study, it was aimed to comparison the physicochemical properties and acceptability of different milk product including full and low fat milk and flavored milk such as chocolate, coffee and bananas milk. According to the result of current research the fat content in milk didn't affect on the other nutrient component of milk such as protein, calcium and phosphorus also addition of flavoring agent in milk didn't affect on protein, salt, calcium and phosphorus content in final product.*

**Key words:** Iranian dairy products, Low fat milk, Full fat milk.

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#### INTRODUCTION

According to codex standard "Milk is the normal mammary secretion of milking animals obtained from one or more milking without either addition to it or extraction from it, intended for consumption as liquid milk or for further processing" [1]. In dietary guidelines for Americans, 2010 milk and its products are recommended because of their positive effect to dietary intake. Cow's milk contains proteins, fats, vitamins like B and D, minerals like calcium, phosphorus and iodine and it is a suitable substitute to Omega3. Calcium of this natural product has good affect on strengthening the bones. Also cow's milk contains potassium that known to control blood pressure. To obtain the valuable nutritional of milk while limiting fat and caloric intake, low-fat milk and its products are recommended by dietary guidelines for Americans, 2010 and the American academy of pediatrics [2]. Milk is produced in the entire world. The EU-15 and South Asia show the highest amount of milk producing regions and have more than 42% of world milk production. As explained in different studies, the world dairy product market is small. Only around 7% of milk product is traded in the form of different dairy products. However around 22% of the tradable dairy products (cheese, butter, flavored milk, condensed milk, dry products) are traded among countries. Around 68% of world milk is used for fresh products, and just the remaining 32% are converted into different dairy products. Among the different countries in the world the processing structure differs sharply. High shares of tradable dairy products are produced in the European countries, Australia and New Zealand, but the share of different dairy product low in developing countries, like Africa, Asia and some countries in Latin America [3]. Since mid, 1990th the global milk consumption is growing in average 10-15 million ton per year. Since 1980 the demand for the dairy products increased especially in Asian from 32 kg per capita in 1981 to 64 kg per capita in 2007, the Asian people presented about a half of the world demand for dairy products. In the world per capita milk consumption is 113 Kg in 2007.

The highest annual per capita consumption of milk in the world related to Finland and Sweden people that were about 360 Kg in 2007. In Iran, the per capita consumption of different dairy product was 95 Kg, in 2003. This amount of consumption in compare to other country is very low [4]. In order to increase milk consumption, different types of milk should be produced. Today's different type of milk are available, for example full fat milk, low fat milk and flavored milk, include bananas milk, strawberry milk, chocolate milk and coffee milk. When different flavored milk is provided, more people and especially children choose milk, and drink more amount of milk and so get more calcium, and also drink less fruit drinks and sodas. Ingesting a beverage containing high quality protein and carbohydrate has been shown to favorably exercise performance and improve body composition. Chocolate milk supplies both high valuable proteins (whey and casein) and carbohydrate and therefore, chocolate milk has become an increasingly popular and suitable beverage [5]. This product is a beverage that is easily available and generally found in many household refrigerators [6]. Flavored milk such as chocolate and bananas milk has popularity but consumption of coffee milk is low even though ingesting of coffee has increased. According to production of new different kind of milk, the aim of this study was to compare of the physicochemical characteristics of some different commercial milk include high and low fat milk, bananas, coffee and chocolate milk, in Iran.

## MATERIALS AND METHODS

### Material

Randomly selected different stores located in Tehran and different milk product include banana, coffee, chocolate, low and full fat milk were obtained from local store. Sampling of each product is carried out according to International standard number: 326 [7].

### Methods:

pH and titratable acidity was measured according to the method of international standard No .2852 [8]. Moisture, protein and ash were determined, using the international standard method number 637 [7], 639 [9] and 1755 respectively. Salt content was measured according to the method of international standard number: 694 [7]. Calcium and phosphorus were measured according to AOAC, 1990 [10].

### Data Analysis

Data collected from the aforementioned study samples were analyzed based on 0.05% coefficient of error by a software program. The data analysis was performed using MINITAB statistical software, release 14.2 (MINITAB Inc., state college, PA and USA). At first such software program proved samples normal conditions and then the significant difference among data was precisely studied via one-way analysis of variance (ANOVA).

### Sensory Analysis

A 5 point hedonic scale (1= lowest desirability, 5= highest desirability) was designed to evaluate the sensory characteristics by using 30 trained panelists including overall acceptability, consistency, odor and taste properties. Water was provided to wash the mouth between two oral tests.

## RESULTS AND DISCUSSION

### Full and low fat milk

Some physicochemical properties of pasteurized full and low fat milk are shown in Table 1. Milk fat is composed of a mixture of different kind of lipids. Triglycerides are the most important type of lipid in milk. Lipid of Milk is the valuable source of fat used by the neonate for accumulating body adipose in the first days after birth. Whole milk is a suitable product for children and adults who fat consumption is not consideration. According to national standard [7] whole milk must contain at least 8% solids not fat (carbohydrate, protein, vitamins and minerals) and minimum 3.00% fat. Also its density is 1.029. All of natural milks are approximately 87% water. Low fat milk is a suitable for those seeking moderate limitation of their fat intake. Low fat milk is natural milk that fat content has been reduced and acceptable limit is 0.5 to 1.8 %. This product have higher density than whole milk and according to national standard density should be at least 1.030 and for both of them acceptable limit for acidity and pH is 0.14% to 0.16 % and 6.6 to 6.8 respectively [11]. Similar to whole milk, it contains at least 8.00% SNF and is about 87% water. Moisture of low fat milk (90.01%) was higher than full fat milk (83.00%) and this difference was significant ( $p \leq 0.05$ ). Acidity of whole and low fat milk was 0.18% and 0.20% respectively and according to statistical analysis was similar. ( $p \leq 0.05$ ). Fat content for whole and low fat milk was 3.22 % 1.56 % respectively and this difference was statistically significant, but protein content of both of them was similar ( $p \leq 0.05$ ). The level of pH for both of

them was similar and in acceptable limit. The only carbohydrate present in milk is lactose. Carbohydrate content of low and full fat milk was 4.59% and 4.70% respectively and statistically were similar. Salt content for low fat milk was 0.24% and for full fat milk was 0.21%.

The calcium and phosphorus is essential and valuable nutrients in the human diet. Calcium and phosphorus content for low fat milk were 0.10% and 0.11% and for full fat milk were 0.13% and 0.11% respectively. There weren't any significant difference between the salt, calcium and phosphorus content in low fat and full fat milk ( $p \leq 0.05$ ). All of this data confirmed that the fat content in milk didn't affect on the other nutrient component of milk such as protein, calcium and phosphorus. The sensory properties of whole and low fat milk include flavor, taste, texture, mouth feel, color and total score were shown in Table 2. All of these measurements statistically were similar, except color that low fat milk has higher score, may be due to the lower content of fat ( $p \leq 0.05$ ). The presence of fat globule in milk tends its color from white to yellow, therefore in skim milk that its fat was removed; the color of milk changed and tends to be more whither than before. In terms of color, the panels preferred low fat milk that has whither color than full fat milk.

**Table 1: physicochemical properties of different kind of milk**

Properties (%)	Banana milk	Coffee milk	Chocolate milk	Full fat milk	low fat milk	Acceptable* limit for flavored milk
pH	6.50±0.03 <sup>a</sup>	6.47±0.01 <sup>a</sup>	6.55±0.00 <sup>a</sup>	6.40±0.00 <sup>a</sup>	6.54±0.01 <sup>a</sup>	6.6- 6.8
Acidity	0.20±0.02 <sup>a</sup>	0.23±0.05 <sup>a</sup>	0.27±0.03 <sup>a</sup>	0.18±0.01 <sup>a</sup>	0.20±0.07 <sup>a</sup>	Max 0.16
moisture	82.60±1.32 <sup>b</sup>	83.00±2.50 <sup>b</sup>	83.10±2.01 <sup>b</sup>	83.00±1.92 <sup>b</sup>	90.01±3.04 <sup>a</sup>	Max 86
Fat	2.41±0.02 <sup>b</sup>	2.71±0.04 <sup>b</sup>	2.21±0.03 <sup>b</sup>	3.22±0.02 <sup>a</sup>	1.56±0.05 <sup>c</sup>	-
Protein	3.32±0.05 <sup>a</sup>	3.41±0.02 <sup>a</sup>	3.20±0.08 <sup>a</sup>	3.26±0.02 <sup>a</sup>	3.41±0.03 <sup>a</sup>	-
Carbohydrate	14.11±1.04 <sup>a</sup>	9.02±0.71 <sup>b</sup>	11.02±0.78 <sup>b</sup>	4.59±1.03 <sup>c</sup>	4.70±0.57 <sup>c</sup>	5-8
Salt	0.22±0.10 <sup>a</sup>	0.22±0.04 <sup>a</sup>	0.24±0.08 <sup>a</sup>	0.24±0.04 <sup>a</sup>	0.21±0.01 <sup>a</sup>	-
Calcium	0.15±0.02 <sup>a</sup>	0.09±0.01 <sup>a</sup>	0.13±0.03 <sup>a</sup>	0.10±0.06 <sup>a</sup>	0.13±0.01 <sup>a</sup>	-
Phosphorous	0.12±0.03 <sup>a</sup>	0.11±0.02 <sup>a</sup>	0.10±0.08 <sup>a</sup>	0.11±0.04 <sup>a</sup>	0.11±0.02 <sup>a</sup>	-

\*: Iranian national standard

**Table 2: Sensory properties of different kind of milk**

Sources properties	Whole fat milk	Low fat milk	Coffee milk	Chocolate milk	Banana milk
Flavor	4.80±0.03 <sup>a</sup>	4.80±0.06 <sup>a</sup>	4.60±0.07 <sup>a</sup>	4.60±0.03 <sup>a</sup>	4.00±0.13 <sup>a</sup>
Taste	4.41±0.23 <sup>a</sup>	4.21±0.10 <sup>a</sup>	4.40±0.11 <sup>a</sup>	4.60±0.05 <sup>a</sup>	3.80±0.08 <sup>b</sup>
Color	5.00±0.23 <sup>a</sup>	4.01±0.31 <sup>b</sup>	4.00±0.17 <sup>b</sup>	4.81±0.07 <sup>ab</sup>	4.00±0.05 <sup>b</sup>
Texture	4.41±0.11 <sup>a</sup>	4.40±0.08 <sup>a</sup>	4.20±0.23 <sup>a</sup>	4.64±0.13 <sup>a</sup>	3.41±0.31 <sup>a</sup>
Mouth Feel	4.80±0.03 <sup>a</sup>	4.61±0.03 <sup>a</sup>	4.60±0.03 <sup>a</sup>	4.80±0.03 <sup>a</sup>	3.42±0.03 <sup>a</sup>
Total Score	4.68±0.50 <sup>a</sup>	4.60±0.25 <sup>a</sup>	4.36±0.21 <sup>a</sup>	4.68±0.16 <sup>a</sup>	3.72±0.07 <sup>b</sup>

### Flavored milk

Flavored milk like chocolate or bananas milk helps children to get their recommended of dairy product each day. In order to produce flavored milk different flavoring agent include banana, cocoa or cocoa powder, strawberry and a sweetener have been added. Physicochemical properties of 3 pasteurized flavored milk include banana, coffee and chocolate milk were shown in Table 1. The mean value for pH of flavored milk was 6.50, and from a statistical standpoint all of samples were similar. ( $p \leq 0.05$ ). According to national standard for flavored milk [8] acceptable limit for pH is 6.6- 6.8. Therefore none of the samples were not acceptable. It should be noted that all of the samples showed a little lower level than acceptable limit standard. The mean value of acidity for the samples was 0.23% and according to national standard acceptable limit is lower than 0.16%, so all of samples not acceptable. Average fat content of flavored milk was 2.44% and all of them statistically were similar. The fat content of flavored milk was significantly lower than whole milk; actually flavored milk is divided into low-fat group of dairy product and so suggested for people who use weight loss diets. Dalim et al in 2012 [12] investigated about properties of flavored milk, pH value of its samples was about 6.5, that was similar with this study, but fat content of its samples was lower than current study, its due to different composition of samples, process condition, flavoring agent and its concentration. Mean value of protein content in flavored milk was 3.31 %. Coffee milk are shown the highest protein percent (3.41%), also there wasn't any significant difference between coffee milk with other samples including flavored milk, whole and low fat milk ( $p \leq 0.05$ ). This result was agreed with Dalim, et al in 2012 [12], who reported protein content of banana and chiko milk was 4.14% and 3.56% respectively. In flavored milk the mean value of salt, calcium and phosphorous content were 0.23%, 0.12% and 0.11% and all of them according to statistical analysis were similar ( $p \leq 0.05$ ). Mean value of moisture content was 82.6% and there wasn't significant

difference between the samples ( $p \leq 0.05$ ). According to national standard acceptable limit for moisture is lower than 0.86%, so all of samples were acceptable. This data was matched with Dalim, et al in 2012 [12], who reported moisture percents of banana and chiko milk were 83.57% and 84.00% respectively. Carbohydrate content in the banana milk was 14.11% and it was statistically higher than other samples ( $p \leq 0.05$ ). Generally carbohydrate percent of flavored milk significantly was higher than whole milk due to addition of flavoring agent. Carbohydrate content of coffee milk and chocolate milk was 9.02% and 11.02% respectively and statistically were similar. According to national standard [8] acceptable limit for carbohydrate content of flavored milk was 5 – 8% therefore all of them showed higher carbohydrate content than standard. Dalim, et al in 2012 [12] reported that carbohydrate of banana and chiko milk was 11.51% and 10.96 % respectively, that was similar with current research.

According to the results of Table 2, bananas milk showed the lowest score in different properties between the samples. Color and total score of banana were lower than another samples and these difference was significant.

### CONCLUSION

Study concludes that carbohydrate contents were significantly higher in flavored milk than usual milk including full and low fat milk, whereas fat contents comparatively lower in flavored milk than whole milk. However addition of flavoring agent in milk not affected on the protein, salt, calcium and phosphorus content in final product. Flavored milk is nutritious, refreshing, healthful and light, but less acidic than fruit beverage.

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