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### The effect of different seasons on the milk quality

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#### ABSTRACT

Raw milk is a valuable food which its quality is important regarding both milk consumption itself and manufacturing of other dairy products. The aim of this study was to investigate the effect of different seasons on the variations of raw milk composition. To do so different samples of raw milk were taken during summer and winter from Qazvin province and their physicochemical properties including the contents of fat protein and sugar as well as microbial load were examined. The results showed that summer milk had significantly higher total solids (TS) and better microbial quality as compared to winter milk.

**Key words:** Season, chemical component, milk

#### INTRODUCTION

milk has long been recognized as an valuable food of pastoralist diets in all the world, also it is a nutrient food and is recognized to contribute a high proportion of the nutrients, such as micronutrients, include calcium, phosphorus, vitamins like B and D, high quality protein such as casein protein, also fatty acid composition of milk fat has relation to its potential health benefit and impact on the human health (Frelich *et al.*, 2012). Different factors, such as race of cows, genetic variants, stage of lactation and environmental factors which can significantly affect on milk component and properties of milk (Bernabucci *et al.*, 2002). The focused of global warming may be felt in a high variety of economic, social, and environmental sectors, including marine life, energy usage, forestry, water resources and human health, rangeland ecosystems, etc. Today's, considerable research has show been directed at an assessment of the effect of climate on most of these sectors (Klinedinst *et al.*, 1993). Between the environmental factors the feeding of cows and season of the year has a considerable influence on milk components and properties. This seasonal variation in cows diets confirm that milk properties such as taste, color, fat content and even kinds of fats differ by season for example milk will be richer in valuable fatty acids like omega 3's and antioxidants in the summer. The effects of the various season of the year have been studied by different authors for the reason that climate and geographic and conditions that cannot be affected should be considered. The different season of the year is often related to different food regimes for cows. Food intake, kind and quality of fodder are connected to the food regime. This regime offers different possibilities to the breeder because using suitable diets that contain mineral and nutritional component according to the needs of the cows and the structure of the diets that enables good digestion, adequate intake and metabolism are enabled which on the other had effects on the milk composition (Rajeevie *et al.*,

2003). Lyatuu and Eastridge (2003) approved that changes in milk component are more correlated to feeding than to genetic ones, so for better correlations among different composition the food regime is more pronounce than the level of nutrient in a diet. Nevertheless, the season of the year affects the food intake. Azad *et al.*, (2007) studied about quality and quantity of milk production in difference month in year and revealed that the lowest in September (6.46%) and the highest milk production (10.01%) was in February and milk production increased from September to February that was showed an especial production trend throughout the year. Solid not fat and fat content of milk was little highest during December to April. Bernabucci *et al.*, (2002) studied about effects of hot season on milk protein component in 40 mid-lactating Holstein. Its results showed that the decreased of milk protein level in the hot mouth was due to the decrease in the casein that it means reduction in  $\beta$ -casein and  $\alpha$ s-casein. Frelich *et al.*, (2012), investigated relation about feeding system and Seasonal diffidence in fatty acid composition of milk. The seasonal decreased in saturated fatty acids against the unsaturated fatty acids omega-6 against omega-3 polyunsaturated fatty acid confirmed that the cow's milk in summer was more beneficial to humans' health than that cow's milk in winter. According to importance of the effect of season on milk component, the aim of this study was investigated about chemical change of milk during summer and winter.

### MATERIALS AND METHODS

To investigate the seasonal variations of milk, different raw milk samples were taken from different parts of Qazvin province during summer and winter. Then different chemical properties including percentages of fat, protein, solids, sugar as well as microbial load were compared.

#### Methods:

The pH value of samples was measured using pH meter. PH and titratable acidity was measured according to the method of international standard number 2852. Moisture, protein and ash were measured according to the method of international standard number 637, 639 and 1755 respectively. Salt content was measured according to the method of international standard number 694.

#### 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 were normal conditions and then the significant difference among data was precisely studied via Anova –one – way test and *p*-value was determined

### RESULTS AND DISCUSSION

The results from conducted tests on the milk samples taken during summer and winter are presented in Table 1. One of the most important components of milk is protein which affects directly its nutritional value. The protein content of summer and winter milks statistically did not show any significant difference ( $p>0.05$ ), however, the amount of protein contained in summer milk was higher than winter milk as its amounts in summer and winter milks were 3.71% and 3.01%, respectively.

Another important component of milk is fat. Fat content not only affect directly nutritional value of the product but also has effect on sensory properties such as flavor and aroma. Also, the quality of milk products such as cheese, butter and cream are highly dependent on the quantity and quality of the fat contained in the original milk. Fat content in raw milk is so important that many factories tend to estimate the price of milk based on its fat content. The amount of fat in summer and winter milk was reported as 3.39% and 3.41 respectively, and statistically showing no significant difference ( $p>0.05$ ). There is only one carbohydrate in milk, lactose, being in balance with other milk components. In this study there was no significant difference regarding lactose content between summer and winter milks being reported as 4.61% and 4.58% respectively.

One of important parameters when evaluating the quality of milk is total solids (TS) content. In other words, it represents the amount of water contained in milk. The higher TS content the better nutritional quality of milk meaning that it contains more valuable compounds including proteins, fats, minerals and other micronutrients. The results of statistical analysis suggest that summer milk has significantly higher TS content than winter milk as its content in summer and winter milks were 13.31% and 12.02% respectively. One parameter which indicates the quality of milk is milk density as it increases when the evaluated milk has lower water content and thus higher solids

such as proteins. The density of summer and winter milks were 1.032 and 1.030 respectively being statistically similar.

Microbial load of raw milk being directly dependent on the hygienic conditions of the farm is a very important parameter with respect to milk quality having great effect on its price. Microbial load of winter milk was significantly higher than that of summer milk as the microbial load of summer and winter milks were 72345.12 and 78262.54 CFU/mL respectively suggesting that summer milk was produced under more favorable hygienic conditions.

The results of this study demonstrated that: In general summer milk showed better quality regarding both nutrients such as proteins and microbial load. The noticed difference is likely due to different animal feeding during summer and winter. The grazing on natural pastures during summer results in higher quality milk being rich in protein lactose and total solids as compared to winter milk. In winter the animals feed on dry forage being never comparable to fresh grass. Thus it is predictable that summer milk would have higher quality than winter milk. Regarding microbial load it was predicted that summer milk would show higher microbial load because of higher temperatures, but the results were the reverse of what had been expected as the microbial load of summer milk was significantly lower than winter milk. The reason is likely that animals are less frequently transferred to outside because of feeding on dry forage so contamination is developed in closed farms affecting milk microbial load. Various studies have been conducted on seasonal variations of milk. Azad *et. al.*, (2007) investigated milk seasonal variations, the results showed that the fat content, TS and density exhibited no significant difference among different seasons. However, summer milk had slightly less fat content being consistent with the results obtained in this study. Bansal *et. al.*, (2009) conducted a similar study and reported that fat and protein content were higher in mid-April than in early February whereas lactose content was higher in early February than mid-April.

**Table 1: the effect of season on components and total count of milk**

	Total count	Protein	Fat	Lactose	Total solid	Density
Summer	72345.12±123 <sup>b</sup>	3.71±0.31 <sup>a</sup>	3.39±0.12 <sup>a</sup>	4.61±0.52 <sup>a</sup>	13.31±0.89 <sup>a</sup>	1.032±0.01 <sup>a</sup>
Winter	78265.54±154 <sup>a</sup>	3.01±0.20 <sup>a</sup>	3.41±0.09 <sup>a</sup>	4.58±0.32 <sup>a</sup>	12.02±0.41 <sup>b</sup>	1.030±0.02 <sup>a</sup>

<sup>a-b</sup> significant difference between raw at confidence level of  $p \leq 0.05$ .

## CONCLUSION

Seasonal variations result in varied composition of milk predominantly due to animal feeding. In summer animals feed on fresh pasture while in winter they feed on dry forage. As noted above feeding on green pastures not only has direct effect on nutritional value of milk but it may result in reduction of microbial load of raw milk.

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