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Statistical control of suitability of protein/fat ratio in raw milk obtained from different Season for production of Cheddar cheese

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Abstract

Data of study was obtained from a milk company in Tekirdağ province of Turkey during autumn, winter, spring and summer seasons. This is the first statistical study to investigate the suitability of milk protein/fat (P/F) ratio for Cheddar cheese production during different seasons in conventional milk. The milk P/Fratios of season were compared with the Cheddar cheese reference value (0.91). The P/Fratio of milk collected from autumn, winter and spring period was suitable for Cheddar cheese production. Whereas P/F levelof summer season was not suitable for Cheddar cheese production. From the findings, we can say that Cheddar cheese can be made for all season except summer period, unfortunately Cheddar cheese is not suitable for hot conditions. The results show that P/F ratios in conventional milk obtained from different seasons for quality production of Cheddar cheese is so important. The dairy producers should consider about p/F rates in milk obtained from different season for achieving suitable production of Cheddar cheese.

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Introduction

The total fat and protein contents in milk which are determinant factors for cheese yield. Total protein and total fat in milk has economic value because higher total protein and total fat rates leads to higher cheese production. (Cicek, 2007). Milk parameters having economic importance such as fat and protein are so important for cheese production (Garimella *et al.,* 2006; Guinee, 2009; Shimp, 1985). The term "Cheddar cheese" is widely used, but has no protected designation of origin within the European Union. The style and quality of cheeses labeled as cheddar may vary greatly. It is important to know the factors that affect the changes in quality of Cheddar cheese and suitability of raw milk to production of this cheese type.

Once the effects of fat and protein contents have been taken into consideration, P/F ratio may have a significant effect on desirable Cheddar cheese type (Banks *et al*., 1981). It is necessary to standardization of milk on a fat basis or on a protein-to-fat ratio (P/F) basis for suitable cheese production (Guinee *et al.,* 2007). The desirable P/F ratio for target cheese type is due to proportions of fat and protein. The different P/F ratios obtained from different conditions can offer interesting opportunities for the made of cheese varieties (Guine and Callaghan, 2007). P/F ratio is so important for firmness and flavor of different cheese types (Rayan *et al*., 1980).

Non-standardized milks are important for determining the types of cheese that can be produced in farm conditions. The suitability of non-standardized raw milk obtained from different seasons for Cheddar cheese making should be determined. The aim of this study is to investigate the suitability of cow milk from different season for the production of Cheddar cheese.

Material and methods

Season and study area

In this study, the milk samples were collected during all seasons from Tekirdağ Province of Turkey.

Laboratory analysis of samples

The samples of milk were collected from each day of each season analyzed by using automatic Milk Analyzer (Milkana). The daily milk samples were put into vessels and stored 4°C for analyzing procedure.

Statistical analysis

The P/F ratios of different seasons were compared with the reference values in terms of P/F rates for Cheddar cheese(0.91) (Anonymous, 2009), by using one-sample t test (Çimen, 2015) with SPSS 18.0 package program (Ntoumanis, 2005).

Results and discussion

The milk protein/fat rates obtained from different seasons were indicated in Table 1. As shown the table, the lowest PF rates for the summer season were achieved. The P/F rates of milk samples for other seasons were generally similar each other.

Table 1. Descriptive statistics for P/F Rate from Seasons.

Seasons	Mean	Std. Deviation
Autumn	0,90	0,11
Winter	0,90	0,13
Spring	0,91	0,15
Summer	0,88	0,09

Autumn season

The P/F ratio of milk from autumn season was compared with the Cheddar cheese reference value in Table 2. The P/F rates (0.90) for autumn season were statistically similar (p>0.05) for reference value (0.91) of Cheddar Cheese. According to results, Cheddar cheese can be produce from milk of autumn season. There is no need to standardization of the raw milk for Cheddar cheese production. The milk samples having enough P/F ratios for this season are very suitable for announced cheese standards during this season.

Table 2. Statistical analysis for Autumn season.

	Test Value = 0.91					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
P/F Ratio	-,614	89	,181	-,011	-,02	,04

Winter season

The P/F ratio (0.90) of winter milk was compatible with the reported standards (0.91) for Cheddar cheese (Table 3). From the results, we can say that Cheddar cheese can be produce from winter milk. The winter milk samples having enough P/F ratios are so favorable for Cheddar cheese standards during this period. There is no need to manipulate for rates for cold period.

Table 3. Statistical analysis for winter season.

	Test Value = 0.91					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
P/F Ratio	,77	89	,254	,011	-,01	,05

Spring season

The P/F values (0.91) for spring season were statistically very similar (p>0.05) with reference value (0.91) of Cheddar Cheese. P/F rate of spring milk was quite favorable for the standards of Cheddar cheese (Table 4). As shown the Table 4, Cheddar cheese can be made in this period. According to research findings, it was seen that there was no need for extra arrangement of raw milk P/F rates during the spring season. Similar to other periods, the raw milk samples during this period are ideal for Cheddar cheese making.

Table 4. Statistical analysis for spring season.

	Test Value = 0,91					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
P/F Ratio	-11,6	89	,962	-,30	-,33	-,20

Summer season

The P/F ratio for summer season was compared with the Cheddar cheese reference value in Table 5. The P/F rates (0.88) for summer season were statistically lower (p<0.05) for reference value (0.91) of Cheddar Cheese. The hot, humid months depress fat content. As temperatures increase, component levels are gradually decreased. These changes may be indicative of feed intake patterns, which are lower in summer due to changes in weather and temperature (Gilbert *et al.*, 1972).

According to results, cheddar cheese cannot be produce from milk of summer season. If Cheddar cheese making is desired in summer season, arrangements should be made to increase the P/F ratios. However, the purpose of this study is to determine which season is suitable for Cheddar cheese making in farm conditions.

Table 5. Statistical analysis for summer season.

	Test Value = 0,91					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
P/F Ratio	-11,6	89	,047	-,14	-,17	-,12

Conclusion

According to results of the study, we can say that autumn, winter and spring milk samples were suitable for reference values of Cheddar cheese. Whereas, P/F rate of summer season was not suitable for the production of Cheddar cheese. Shortly, Cheddar cheese can be produce from non-standardized raw milk samples collected from autumn, winter and spring period in farm conditions, whereas Cheddar cheese production cannot be suitable for summer season.

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