Alirıza Şahin
Provincial Directorate of Food,
Agricultural and Livestock,
Tunceli, Turkey

Murat Çimen
Food Engineering Department,
Faculty of Engineering,
Munzur University, Tunceli,
Turkey

The suitability of protein/fat ratios of summer milk for making different types of cheese

Alirıza Şahin and Murat Çimen

Abstract
In this study, statistical controls were made as to whether limburger and brie cheeses can be produced according to the protein and fat ratios of milk obtained from months of summer season. The obtained monthly p/f rates of raw milk were compared with the mentioned standard p/f rates for Limburger (0.88) and Brie (0.86) cheese using one-sample t test. The p/f rates of milk samples obtained from the summer months were statistically lower than the reference value (0.88) given for Limburger cheese ($p<0.05$). These values were around 0.87 within three months and these values did not comply with the reference value. According to the statistical results, we can say that milk samples are not suitable for making Limburger cheese according to the p/f values of the summer months. Rates of p/f in milk samples for the June and July were statistically higher than the reference value (0.86) given for Brie cheese ($p<0.05$). Although p/f rates for June (0,8710) and July (0,8680) were not suitable for Brie cheese production, August (0,8650) milk samples were found to be statistically compatible with the mentioned cheese standard. According to the findings, it is possible to produce Brie cheese on a farmer basis without any manipulation to the protein and fat values only in August. In June and July, Limburger and Brie cheese production does not seem statistically possible.

Keywords: Protein/fat, cheese, milk

Introduction
Cheese is an important food in human nutrition and it is balanced and sufficient in terms of essential amino acids, essential fatty acids, vitamins and minerals. Cheese is a delightful dairy product that is eaten at any age and at different metabolic periods (Robinson, 2005) [15]. Countries have their own cheese types (Brown, 2004) [4]. Limburger is a semisoft surface-ripened cow's-milk cheese that has a rind of pungent odor and a creamy-textured body of strong flavor. Limburger originated in the Belgian province of Liege and was first sold at markets in Limburg (Crump, 2009) [5]. Brie is a soft cow's-milk cheese named after Brie, the French region from which it originated. It is pale in color with a slight grayish tinge under a rind of white mould. The rind is typically eaten, with its flavor depending largely upon the ingredients used and its manufacturing environment. It is similar to Camembert, which is native to a different region of France (Masui, 2004) [10]. Different cheese types are made in the factories by adjusting the milk protein and fat content and they are produced according to their protein/fat rate. Factories have a mechanism to adjust the protein and fat ratios by adding or removing fat. However, it is difficult to adjust these rates as desired on a farmer basis. Since it is difficult to make these adjustments on a farmer basis, it is necessary to know the protein fat ratios of milk raw material periodically. Thus, it is important to know which type of cheese will be produced according to the protein/fat ratio in which period. Recently, studies on what type of cheese can be produced according to protein / fat ratios have increased (Çelik *et al*., 2015) [6]. Researches associated with statistical control of milk components have been increased in recent years (Altürk *et al*., 2017; Ertekin *et al*., 2018; Yoldaş and Ertekin, 2016) [1, 8, 17]. Statistical controls on raw milk are important in terms of dairy product quality. In this study, statistical controls will be made as to whether limburger and brie cheeses can be produced according to the protein and fat ratios of milk obtained from months of summer season.

Material and Methods
Daily milk data (30 samples for each month) was collected from a milk company during all months of summer season.

Correspondence Author:
Alirıza Şahin
Provincial Directorate of Food,
Agricultural and Livestock,
Tunceli, Turkey

Raw milk samples were analyzed for crude protein and fat using the milk analyzer (Milkana). The data were presented as mean ± S.D and S.E. (Çimen, 2015) [7]. Protein/fat (p/f) ratio was obtained by dividing the protein value by the fat value. The obtained monthly p/f rates of raw milk were compared with the mentioned standard p/f rates for Limburger (0.88) and Brie (0.86) cheese (Anonymous, 2009) [2] using one-sample t test (Box *et al*., 2005; Ntoumanis *et al*., 2005) [13]. Comparisons were done with help of the SPSS (Norusis, 1993; Leech *et al*., 2005) [12, 11].

Results and Discussion

Descriptive statistics about the data obtained from Limburger cheese are shown in Table 1 and one sample T-test results are shown in Table 2. The average, standard deviation and standard error values of the daily data of summer months abide by the normal distribution.

Table 1: Descriptive statistics for Limburger cheese

Months	N	Mean	Std. Deviation	Std. Error
June	30	,8710	,00994	,00314
July	30	,8680	,00422	,00133
August	30	,8650	,00850	,00269

The p/f values of raw milk samples for the summer months were statistically lower than the reference value (0.88) given for Limburger cheese ($p<0.05$). These values were around 0.87 within three months and these values did not comply with the reference value. According to the statistical results, we can say that milk samples are not suitable for making Limburger cheese according to the p/f values of the summer months. Since the milk samples are not suitable for making limburger cheese in its current form, it is necessary to increase the p / f ratios to 0.88 by decreasing the fat content. This process can be done in factories since it is difficult to do on a farmer basis. In other words, it does not seem possible to produce said cheese type without subjecting the milk to any manipulation in its current form.

Table 2: One Sample T Test results for Limburger cheese

Months	T - value	Degree of Freedom	Sig. (2-tailed)	Mean Difference
June	-2,862	29	,019	-,00900
July	-9,000	29	,003	-,01200
August	-5,582	29	,002	-,01500

Parıltı *et al*. (2016) [14] the fact that the milk obtained from the winter season is not suitable for making Limburger cheese supports our research findings obtained from summer season. The fact that the p/f ratios of the milk obtained in the studies conducted in Tunceli (Eryılmaz *et al*., 2013) [19] and Elazığ (Tokmak and Çimen, 2013) [16] provinces in our country is low for the production of Limburger cheese supports our research results.

Descriptive statistics about the data obtained from Brie cheese are shown in Table 3 and one sample T-test results are shown in Table 4.

Table 3: Descriptive statistics for Brie cheese

Months	N	Mean	Std. Deviation	Std. Error
June	30	,8710	,00994	,00314
July	30	,8680	,00422	,00133
August	30	,8650	,00850	,00269

According to results from Table 3 and 4, rates of p/f in milk samples for the June and July were statistically higher than the reference value (0.86) given for Brie cheese (p <0.05). These rates were 0,8710 for June and 0,8680 for July and these values were not comply with the mentioned reference value. According to the findings, it can be say that milk samples are not suitable for making Brie cheese according to the p/f values for June and July months. Since the milk samples of June and July are not suitable for making Brie cheese, it is necessary to decrease the p / f ratios to 0.86 by increasing the fat content. Although p/f rates for June and July were not suitable for Brie cheese production, August milk samples were found to be statistically compatible with the mentioned cheese standard.

Table 4: One Sample T Test results for brie cheese

Months	T - value	Degree of Freedom	Sig. (2-tailed)	Mean Difference
June	3,498	29	,007	,01100
July	6,000	29	,002	,00800
August	1,861	29	,096	,00500

According to the current results, it has been observed that statistical controls are a technical method that can be used in determining conformity to cheese making standards.

Conclusion

According to the results obtained from the research, it is possible to produce Brie cheese on a farmer basis without any manipulation to the protein and fat values only in August. In other months of summer season, Limburger and Brie cheese production does not seem statistically possible according to the current p/f ratios.

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