

## Some Chemical Characteristics of Butters Obtained from Van Market

İbrahim ALTUN \*  
Adem ÇEÇEN \*\*\*

Seval ANDIÇ \*\*   
Osman FINDIK \*\*\*

Yusuf TUNÇTÜRK \*\*

\* Yüzüncü Yıl University, Özalp Vocational School, TR-65800 Özalp, Van - TURKEY

\*\* Department of Food Engineering, Faculty of Engineering and Architecture, University of Yüzüncü Yıl, TR-65080 Van - TURKEY

\*\*\* Food Control Laboratory, TR-65000 Van - TURKEY

Makale Kodu (Article Code): KVFD-2010-3694

### Summary

In this study, it was aimed to determine various characteristics of butters obtained from Van market and to detect their accordance with the related standard. Minimum and maximum values of the samples for non-fat dry matter, moisture, fat,  $a_w$ , PV, TBA and lipolysis were determined as; 0.74-13.01%; 13.02-41.36%; 51.5-83.2%; 0.866-0.999; 2.52-12.79 mEq O<sub>2</sub>/kg; 0.06-0.16 mg MA/kg and 0.323-37.149 ADV, respectively. Saturated, monounsaturated and polyunsaturated fatty acid contents of samples were detected to be varying between; 56.22-79.33%, 17.88-28.09% and 1.97-20.43%, respectively. When all of the criteria are taken into consideration, it was found that only one sample is in accordance with related standard entirely.

**Keywords:** Butter, Chemical characteristics, Fatty acids

## Van Piyasasından Temin Edilen Tereyağlarının Bazı Kimyasal Özellikleri

### Özet

Bu çalışmada, Van piyasasında satışa sunulan tereyağlarının çeşitli özelliklerinin belirlenmesi ve ilgili mevzuata uygunluğunun saptanması amaçlanmıştır. Örneklerin yağsız kurumadde, nem, yağ,  $a_w$ , PV, TBA ve lipoliz değerleri, en düşük ve en yüksek değerler olarak sırasıyla; %0.74-13.01; %13.02-41.36; %51.5-83.2; 0.866-0.999; 2.52-12.79; mEq O<sub>2</sub>/kg; 0.06- 0.16; mg MA/kg ve 0.323-37.149 ADV olarak belirlenmiştir. Örneklerin doymuş, tekli doymamış ve çoklu doymamış yağ asidi oranlarının sırasıyla %56.22-79.33, %17.88-28.09 ve %1.97-20.43 arasında değiştiği tespit edilmiştir. İncelenen tüm özellikler dikkate alındığında yalnızca bir örneğin ilgili standarda tümüyle uygun olduğu görülmektedir.

**Anahtar sözcükler:** Tereyağı, Kimyasal özellikler, Yağ asidi

### INTRODUCTION

Butter is a dairy product that is produced physically from milk, cream, or yogurt and it should not include fat/oil other than milk fat. Components of the product are determined by food legislation of related countries. But in general the product should include 80-84% milk fat, 15.3-15.9% water, approximately 1% non-fat dry matter and 0.03-1.8% salt <sup>1,2</sup>. Butter should be produced using cream or yoghurt and its fat content should be at least 82% according to related standard <sup>3</sup>.

Van Province is in Eastern Anatolia Region and most of the population is dealing with agriculture and animal breeding. Thus, one of the most important sources of income in this region is milk and dairy products. However, Van city is neighbor with Iran and as a result of this; dairy products are brought into the region by border trade. Milk products in the region are mainly produced in family plants and put up for sale in inappropriate conditions. For this reason, composition and hygiene qualities of dairy



İletişim (Correspondence)



+90 532 7687028



sevalandic@yyu.edu.tr

products are not controlled sufficiently. Besides, also the dairy products brought into the region by border trade are not controlled appropriately.

The compositions of these products are unknown and they are sold in open markets or shopping centers without being subjected to sufficient control. In this study it was aimed to determine some chemical properties and fatty acid composition of both the butter samples that are produced under technological conditions and the ones sold without packaging in the region.

## MATERIAL and METHODS

Butter samples were purchased at retail stores in Van, Turkey. Butter samples placed into sterile containers and transported to the laboratory in a cool box. Samples were kept in refrigerator until analysis.

### Chemical Analysis

Moisture and fat of the butter samples were determined as in methods recommended by the AOAC<sup>4</sup>. Water activity of butter was measured by using AquaLab LITE water activity meter (Decagon Devices, Inc., Washington, USA). Non-fat solid was calculated using fat and moisture content of samples. Each analysis was performed in duplicate.

### Peroxide Value, Tiobarbutiric Acid Value and Lipolysis (ADV) Analyses

PV and TBA analyses were performed using spectrophotometric measurement methods given by Egan et al.<sup>5</sup>. Lipolysis was done using the BDI method and measured as Acid Degree Value (ADV)<sup>6</sup>.

### Determination of Fatty Acid Composition

Extraction of total lipids was carried out according to Folch et al.<sup>7</sup>. After removal of solvent phase with a rotary evaporator at 40°C, 0.2 g fat was transferred into a tube, solved in 2 ml hexane and then fatty acid methyl esters were prepared using 0.2 ml 1 N methanolic KOH. Analysis of FAME was performed on an Agilent 6890 GC equipped with a 5973 mass selective detector (Santa Clara, CA, USA) and fitted with a fused silica capillary column (DB-23, 60 m x 0.25 mm; film thickness 0.25 µm; J&W Scientific Co, Folsom, CA, USA). Helium was used as a carrier gas. Inlet temperature was 250°C. The initial oven temperature was 60°C and increased to 120°C at 10°C/min. Then oven temperature was increased to 200°C at 14°C/min and the final temperature maintained for 45 min. One µl sample was used for injection and split ratio was 1:5. Supelco FAME 37 component FAME mix (Supelco Park, Bellefonte, PA, USA) was used as standard and database of MS (NIST) was also used. Obtained chromatograms were evaluated using MS software and percentage of FAMEs was quantified according to their relative area.

## RESULTS

Chemical analysis results belonging to twenty butter samples were given in *Table 1*. Non-fat solid content of butter samples changed between 0.74% and 13.01% and value of this criterion was higher than 2% in eighteen butter samples. Moisture content of butter samples changed in a wide interval possessing between 13.02-41.36%. Moisture content of fourteen samples was higher than 16%. Besides, fat of fourteen samples was lower than 80%.

In the study, it was found that;  $a_w$  values vary between 0.866-0.999 and average  $a_w$  value is  $0.967 \pm 0.04$ . Minimum and maximum values of peroxide, TBA and lipolysis belonging to the 20 samples collected in our study were determined as follows; 2.52-12.79 mEqO<sub>2</sub>/kg, 0.06-0.16 mg malonaldehyde (MA)/kg and 0.323-37.149 ADV, respectively (*Table 1*).

Fatty acid composition of the butter samples were given in *Table 2*. Minimum and maximum values of short (C4:0-C8:0), medium (C10:0-C14:1) and long ( $\geq$ C15:0) chain fatty acids were determined to be varying between 0.51-11.74%, 4.49-23.83% and 55.66-94.99%, respectively. Saturated, mono unsaturated and poly unsaturated fatty acid values of the samples were 56.22-79.33%, 17.88-28.09% and 1.97-20.43%, respectively (*Table 2*). Additionally, in the study, the most dominant fatty acids were found to be; myristic (C14:0), palmitic (C16:0), stearic (C18:0) and oleic (C18:1) acids.

## DISCUSSION

In "TS 1331 numbered Butter Standard" (Turkish Standards Institute) there is a limitation for butter which orders it should include; maximum 16% moisture, minimum 80-82% milk fat and maximum 2% non-fat dry matter<sup>3</sup>. In this study, it was found that moisture content of 80% of butter samples not harmonious with related standard. Also non-fat dry matter content of 90% of the samples and fat content of 70% of the samples were inadequate according to Butter Standard. It can be seen from *Table 1* that 18 butter samples had water activity higher than 0.90  $a_w$  value and only  $a_w$  value of 2 butter samples were lower than this value. Thus, there is a risk of pathogen bacteria growth as well as fungi growth in the butters because of their high water activity. When all of the criteria are considered, it was found that only one sample is in accordance with related standard in terms of chemical composition.

Peroxides are the main initial products of autoxidation and it is used to determine the number of hydro peroxides in this phase<sup>8</sup>. There is no mentioning about butter's peroxide value in related Turkish Standard. However, oxidative rancidity can be sensed when PV exceeds

**Table 1.** Some chemical properties of butter samples**Tablo 1.** Tereyağı örneklerinin bazı kimyasal özellikleri

Sample No	Item						
	Non-Fat Solid (%)	Moisture (%)	Fat (%)	$a_w$	Peroxide Value mEq O <sub>2</sub> /kg fat	TBA Value mg MA/kg fat	ADV mEq/100 g Fat
1	2.77	21.23	76.00	0.99	10.32	0.16	0.83
2	7.41	20.59	72.00	0.99	2.73	0.10	0.80
3	0.74	21.76	77.50	0.99	7.41	0.14	1.65
4	4.48	13.02	82.50	0.99	6.53	0.13	6.73
5	5.55	32.45	62.00	0.99	5.28	0.09	2.05
6	3.87	32.63	63.50	0.98	9.15	0.10	2.60
7	4.78	23.72	71.50	0.99	6.33	0.10	1.80
8	8.51	32.49	59.00	1.00	9.43	0.09	6.80
9	2.42	18.58	79.00	1.00	9.26	0.12	4.27
10	7.14	41.36	51.50	1.00	7.47	0.08	37.15
11	1.67	15.58	82.75	0.94	2.55	0.08	0.32
12	2.91	18.09	79.00	0.95	2.52	0.08	1.91
13	2.34	15.91	81.75	0.93	9.69	0.08	0.57
14	3.48	16.02	80.50	0.94	8.87	0.09	1.24
15	3.16	16.84	80.00	0.96	4.12	0.09	0.88
16	2.23	19.27	78.50	0.90	15.79	0.14	2.89
17	2.23	18.77	79.00	0.98	12.79	0.10	1.68
18	11.18	17.82	71.00	0.97	11.81	0.06	1.77
19	13.01	14.99	72.00	0.98	6.60	0.09	3.81
20	3.11	13.69	83.20	0.87	3.67	0.07	1.42
Min.	0.74	13.02	51.50	0.87	2.52	0.06	0.32
Max.	13.01	41.36	83.20	1.00	12.79	0.16	37.15
M±SD	4.65±3.26	21.24±7.62	74.11±8.86	0.97±0.04	7.61±3.59	0.10±0.03	4.06±7.99

M: Mean; SD: Standart deviation

3 mEq O<sub>2</sub>/kg in butter. PV was higher than 3 mEq O<sub>2</sub>/kg in seventeen samples. Lipolysis (ADV) values were rather high in three samples (over 6 ADV) and this can cause lipolytic rancidity.

In butter production fatty acid composition of milk reflects to butter. Fatty acid composition of commercial milk was analyzed by Güler et al.<sup>9</sup>. In their study SFA content changed between 59.38-61.50%, MUFA between 31.83-33.34% and PUFA between 3.14-3.19%. When PUFA ratio are taken as reference, it can be declared definitely that at least one sample (sample 10) was adulterated by vegetal oil addition.

## REFERENCES

- Tavlaşlar Hocalar B:** Butter Technologies. p.119, Ege Univ. Press, İzmir, Turkey, 2003.
- Üçüncü M:** Milk and Milk Products Technologies. p. 567, Meta Perss, İzmir, Turkey, 2005.
- Anonymous:** Turkish Standards (TS1331): Butter. Necatibey Cad. No. 112, Bakanlıklar, Ankara, Turkey, 1995.
- AOAC:** Official Methods of Analysis. 16th ed., Association of Official Analytical Chemists, Arlington, Virginia, USA, 1995.
- Egan H, Kirk RS, Sawyer R:** Pearson's Chemical Analysis of Foods. 591, 8th ed., Churchill Livingstone, London, UK, 1981.
- IDF:** International Dairy Federation. Routine methods for determination of free fatty acids in milk. *Bulletin IDF* No. 265, 26-32, 1991.
- Folch J, Lees M, Sloane-Stanley GH:** A simple method for the isolation and purification of total lipids from animal tissues. *J Biol Chem*, 232, 497-509, 1957.
- Nawar WW:** Lipids. In, Fennema OR (Ed): Food Chemistry, 3rd ed., pp. 225-331, Marcel Dekker Inc., New York, 1996.
- Güler GÖ, Çakmak YS, Zengin G, Aktümsek A, Akyıldız K:** Fatty acid composition and conjugated linoleic acid (CLA) content of some commercial milk in Turkey. *Kafkas Univ Vet Fak Derg*, 16 (Suppl-A): S37-S40, 2010.

**Table 2.** Fatty acids composition of butter samples  
**Tablo 2.** Tereyağı örneklerinin yağ asidi bileşimleri

FA (%)	Samples																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C4:0	2.00	2.43	2.38	2.91	1.89	2.30	2.27	1.87	1.76	0.20	2.08	2.12	1.93	2.16	2.14	4.39	2.53	4.21	4.05	4.21
C6:0	1.76	2.31	2.08	2.78	1.88	2.16	2.09	1.84	1.65	0.17	2.13	1.91	1.87	2.08	2.00	4.39	2.83	4.66	4.28	4.46
C8:0	1.57	1.97	1.74	2.30	1.78	1.90	1.83	1.74	1.41	0.15	2.06	1.75	1.84	1.96	1.81	2.84	4.96	2.87	2.89	2.91
C10:0	3.29	4.21	3.66	6.45	3.94	3.83	3.90	3.71	2.97	0.33	4.50	3.77	4.25	4.38	3.84	4.84	5.07	4.97	5.08	4.98
C11:0	0.00	0.14	0.10	0.09	0.14	0.09	0.10	0.07	0.05	0.00	0.12	0.07	0.14	0.14	0.09	0.08	0.12	0.12	0.19	0.08
C12:0	3.98	4.91	4.12	4.23	4.72	4.23	4.37	4.72	3.59	0.74	5.75	4.33	4.96	5.04	4.32	4.31	18.18	4.57	4.33	4.47
C13:0	0.26	0.22	0.21	0.21	0.24	0.21	0.20	0.24	0.22	0.08	0.22	0.19	0.22	0.22	0.19	0.11	0.16	0.15	0.19	0.16
C13:1	0.40	0.00	0.28	0.24	0.38	0.00	0.27	0.00	0.12	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C14:0	12.03	11.65	11.55	10.19	12.33	11.45	11.88	12.99	11.68	2.70	12.53	11.45	11.64	11.64	11.29	10.11	10.58	10.93	10.01	10.89
C14:1	1.47	0.92	1.00	1.21	1.39	1.37	1.06	1.64	1.73	0.65	0.71	0.94	0.85	0.91	0.92	0.93	0.00	0.85	0.51	0.39
C15:0	1.94	1.11	1.87	1.97	1.96	2.87	1.92	2.50	3.14	0.00	1.57	1.49	1.72	1.68	1.60	1.34	0.15	2.12	1.38	1.92
C15:1	0.75	0.27	0.42	0.39	0.66	0.48	0.43	0.79	0.60	0.00	0.24	0.36	0.27	0.27	0.33	0.30	0.20	0.51	0.29	0.48
C16:0	28.60	27.08	29.86	23.65	31.70	31.77	29.87	30.33	29.95	37.04	28.92	27.84	25.75	25.79	27.88	25.38	20.48	30.95	26.27	29.38
C16:1	1.71	1.10	1.31	1.19	1.39	1.57	1.34	1.59	1.89	0.70	0.89	1.14	1.07	1.10	1.14	1.14	0.61	0.78	1.03	0.67
C17:0	1.69	1.55	2.21	1.91	1.65	2.52	2.14	2.06	2.59	0.00	1.35	1.32	1.59	1.55	1.43	1.43	0.36	1.87	0.65	1.08
C18:0	14.13	14.86	12.94	11.37	12.31	11.95	11.52	12.92	13.31	14.26	13.78	14.62	12.78	15.81	15.45	15.45	13.71	7.70	11.09	9.18
C18:1	20.62	21.43	19.74	21.94	17.94	17.72	21.13	17.42	19.55	22.00	19.78	21.52	24.54	21.41	21.52	21.52	17.06	20.27	25.21	22.56
C18:2	2.19	2.14	2.57	3.72	1.88	1.89	2.23	1.92	1.86	8.96	2.65	3.32	2.55	2.14	2.31	2.31	2.38	1.64	1.96	1.38
C18:3	1.08	1.71	0.81	1.82	0.81	0.96	0.46	0.84	1.17	11.47	0.73	1.15	1.69	1.70	1.14	1.14	0.42	0.52	0.42	0.59
C20:0	0.52	0.00	1.14	1.42	1.00	0.72	0.97	0.80	0.77	0.57	0.00	0.65	0.35	0.00	0.61	0.61	0.19	0.30	0.19	0.28
SCFA	5.32	6.71	6.20	7.99	5.55	6.37	6.19	5.45	4.82	0.51	6.28	5.77	5.64	6.20	5.95	11.62	10.32	11.74	11.22	11.50
MCFA	21.43	22.05	20.93	22.62	23.16	21.18	21.79	23.37	20.35	4.49	23.83	20.81	22.06	22.34	20.65	20.40	34.11	21.60	20.31	20.98
LCFA	73.24	71.25	72.88	69.38	71.29	72.46	72.02	71.18	74.82	94.99	69.90	73.42	72.30	71.46	73.39	67.99	55.66	66.66	68.47	67.53
SFA	71.77	72.44	73.86	69.48	75.55	76.01	73.07	75.79	73.09	56.22	75.01	71.50	69.03	72.46	72.65	69.09	79.33	75.43	70.58	73.93
MUFA	24.96	23.71	22.76	24.98	21.75	21.14	24.24	21.44	23.88	23.35	21.61	24.03	26.73	23.69	23.90	28.09	17.88	22.41	27.04	24.10
PUFA	3.27	3.85	3.38	5.53	2.70	2.85	2.69	2.77	3.03	20.43	3.38	4.47	4.24	3.84	3.45	2.82	2.80	2.16	2.37	1.97

FA: Fatty acids; SCFA: Short chain fatty acids; MCFA: Medium chain fatty acids; LCFA: Long chain fatty acids; SFA: Saturated fatty acids; MUFA: Monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids