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A survey on the quality of traditional butters produced in West Azerbaijan province, Iran

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Abstract

Food safety include all health aspects of the food especially adulterations. Butter, particularly traditionally produced butters is one of the highly consumed foods in Iran. The aim of this study was to investigate of the chemical and microbial quality of traditional butters produced in west Azerbaijan province, northwest of Iran. Chemical, microbial quality and fatty acid profile of randomly purchased butter samples from 12 cities (10 sample of each city) of west Azerbaijan province were analyzed according to Iranian national standard protocols. Moisture of all samples, Peroxide value of 58.3%, Acidity and Iodine index of 83.3% and Saponification value of 91.7% of samples were out of range in comparing with Iranian national standard. Coliform, mold and yeast contamination were seen in all samples. *Staphylococcus aureus* and *Escherichia coli* were seen in 8.3% and 50% of samples, respectively. Lowest and highest contents of C18:1 fatty acid was 21.27 and 33.34%, respectively. Minimum and maximum content of Linoleic acid isomers were 1.37 and 6.82%, respectively. C18: 3 isomers were seen in 3.8% of samples. Obtained results of this study showed presence of vegetable oils, high degree of oxidation of fatty acids and presence of microorganisms in animal butter samples that represented poor hygienic status of traditional butters currently marketed in West Azerbaijan

Introduction

Carbohydrate, proteins, fat and oils are the main components of the food products. Nowadays plant oils greatly reduce animal fats consumption in the diet, nevertheless benefits of animal fats especially milk fats cannot be denied. Recent studies have proven particular composition of animal fats, presence and usefulness of their necessary unsaturated fatty acids (Willett, 2012). Milk and dairy products are one of the most important groups in the daily food pyramid. Economical, commercial, quality and safety aspects of these products are very important. Butter as the oldest dairy products has a significant role in human nutrition (Tvrzicka *et al*., 2011).

Butter was made industrially of cream and directly from milk in traditional way. Therefore, its quality will depend largely on the quality of milk. Ability to consumption and storing of butter depends on its chemical and biological characterizations that affect by health condition of producing and maintenance (Tofangsazan *et al.*, 2009). At present, in many areas of Iran, butter is produced and supplied in both manner, industrial and traditionally (Tofangsazan *et al*., 2009). Non-standard production at all stages of processing, packaging and supply cause reducing quality and sometimes economic problems and pathogenesis, therefore, quality of these products is important. Due to the nature of butter making in traditional type, adulteration in its production is easier (Lees, 1999).

Chemical and microbiological characteristics of milk made butters have studied by many researchers (Saremnezhad *et al*., 2008; Zhao *et al.*, 2000; Berhea *et al.*, 2013; Dervisoglu *et al.* 2013). Even the newer methods such as stable isotope analysis (Stable isotope analysis) and near-infrared spectroscopy (Near Infra- Red Spectroscopy) were applied in determining the quality of butter (Gunstone, 2000; Samet-Bali *et al*., 2009). Bacterial diversity in butter samples, Lactococci, Lactobacilli, Entrococci, and yeasts such as *Saccharomyces cerevisiae* was shown in many studies (Lees,1999; Benkerroum and Tamime, 2004; Samet-Bali *et al*., 2009).

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Adulteration was performed mainly by adding plant oils, non-edible oils, old used oils or industrial cream to both industrial or traditional produced butters, which impacts on their quality and nutritional value. Bad conditions of storage and transportation are other important factors that reduce quality and nutritional value of butter (Koca *et al.*, 2010). Due to high consumption of produced butters and different conditions of storage and supplying, the aim of this study was evaluating chemical and biological characteristics and quality matching of traditional butters with Iranian national standard marketed in West Azerbaijan province, North West of Iran. Regarding the effect of the presence of Trans- fatty acids on human health, in addition to fatty acids profile, trans-fatty acid content was measured and evaluated by gas chromatography (GC).

Materials and Methods

Sampling

In this study, 120 samples of traditional butter made from cow's milk were purchased randomly in 12 city (Urmia, Mahabad, Salmas, Khoy, Piranshahr, Naghadeh, Miandoab, Maku, Bukan, Sardasht, Oshnaviyeh, Shahindezh) of West Azerbaijan province (10 samples from each city) since May to September 2013. All samples were transferred to laboratory in cold condition. Chemical and biological characteristics of all samples were tested according to standard methods provided by the National Institute of Standards and Industrial Research of Iran and repeated three times. Routine equipment of laboratory was used. All used chemicals and media were manufactured by Merck of Germany. Fatty acids profile of butter samples was analyzed by gas chromatography (Agilent 6890 N, USA) with BPX70 column, N_2carrier gas, FID detector with 1 microliter volume injection.

Chemical tests

Chemical quality of butter samples was investigated by measurement of saponification value, Iodine value, peroxide value, moisture, Acidic value, and also determination of fatty acid profiles according to standard protocols provided by the national institute of standards and industrial research of Iran, according to Iranian national standards No.10501, 4888, 4179, 8389-1 and 4178, respectively (ISIRI No. 10501, 2007 ; ISIRI No. 4888, 2000 ; ISIRI No. 4179, 1998 ; ISIRI No. 8389-1, 2007; ISIRI No. 4178, 1996). Determination of fatty acid composition was analyzed in accordance with Iranian national standard No. 8818 (Preparation of fatty acid methyl esters) and 8819 (measuring of fatty acids) using gas chromatography (ISIRI No. 8818, 2006; ISIRI No. 8819, 2006).

Microbial tests

Microbial quality of produced traditional butter was investigated according Iranian national standard protocols. Total count of bacteria, coliforms, *Escherichia coli, Staphylococcus* and mold was evaluated accordance Iranian national standard No. 2406 (ISIRI No.2406, 2008).

Statistical analysis

Statistical analysis (Mean±SD) of all samples was performed using SPSS software version 16 software.

Results

Obtained results of chemical and microbial investigation in 120 samples of traditional butters from 12 city of West Azerbaijan province and analysis of fatty acids profile have been shown in Tables 1-3. The moisture content of all samples was out of national standard range. Average moisture content of samples was 27.33±4.46 % (Table 1). Peroxide value of seven cities was out of standard range. Average peroxide value was 2.44±2.01 mEq/kg (Table 1). Only samples of two cities had Iodine value within standard range. Average Iodine value was 15.74±8.89 (Table 1). Acidic value of ten city samples was incompatible with national standard limits with average 1.56±1.15 (Table 1). Average measured saponification value of butter samples was 250.93±34.10 (Table 1). Samples of a city were in standard range (City No. 3). Fatty acids content of butter samples showed in Table 2. Minimum and maximum content of C18: 1 fatty acid was seen in samples of cities No.7 (21.27%) and No.9 (33.34 %), respectively (Figure 1 and Table 2). Minimum content of linoleic acid belonged to samples of city No.9 (1.37%) and maximum was for samples of city No.1 (6.82%) (Figure 2 and Table 2).

Coliform, mold and yeast contamination was found in all butter samples. *Staphylococcus aureus* has found only in samples of a city (City No. 6 but *Escherichia coli* contamination was found in samples from six understudy cities. Coliform, mold and yeast, *S.aureus, E.coli* count of all contaminated samples was over 100 CFU/gr.All analyzed samples had coliform contamination (Table 3).

Discussion

Evaluating of chemical and biological

Table 1. Mean of moisture, peroxide value, acidity, iodine value, saponification value

Cities code	Moisture (%)	Peroxide value (mEq/kg)	Acidity (%)	Iodine value	Saponification value
1	20.73	0.99	1.67	29.14	250.56
2	26.44	7.33	1.01	9.4	261.02
3	29.46	1.62	0.56	12.84	225.69
4	31.51	4.22	1.39	7.55	274.88
5	35.07	3.21	4.54	9.42	295.86
6	25.65	2.54	1.67	9.95	270.26
7	32.62	2.38	2.74	20.41	284.33
8	30.81	2.59	2.11	16.6	192.11
9	23.56	1.22	0.47	11.02	247.6
10	25.55	3.16	0.78	36.64	287.02
11	23.12	0	1.16	14.7	214.62
12	23.53	0	0.67	11.3	207.55
Mean± SD	27.33±4.46	2.43±2.01	1.56±1.15	15.74±8.89	250.95±34.10
Standard limit	16	1.7	0.3- 0.5	26-40	225-235

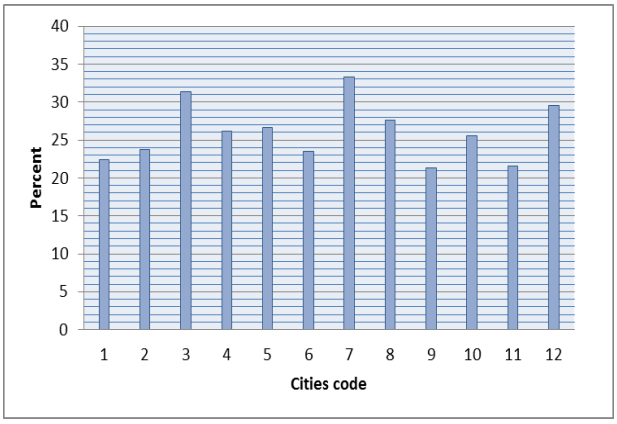

Figure 1. Average content of C18:1 in butter samples of 12 city of west Azerbaijan province, Iran

Figure 2. Average content of C18:2 in butter samples of 12 city of west Azerbaijan province, Iran

characteristics and quality matching of traditional butters with Iranian national standard marketed in West Azerbaijan province was the aim of this study. Chemical parameters such as moisture, peroxide value, Iodine value, acidity, saponification value and fatty acids profile and microbial quality of traditional butter samples was determined in this study. According to obtained results, maximum standard limit for moisture in butter is 16% (ISIRI No. 8818, 2006; ISIRI No. 8819, 2006). High moisture content in traditional butters is justified because of the traditional butters preparation method. Since unlike industrial preparation protocol, milk's fat not removes completely and water substitute as a fat replacer in butter formulation (Saremnezhad *et al*., 2008; Idoui *et al*., 2013). High moisture predispose lipase activity, stimulates the growth of microorganisms and hydrolysis of the triglycerides (Idoui *et al*., 2013).

Three cities samples peroxide value were in range of national standard and of two cities was zero. Standard limit for peroxide value is 1.7 mEq/kg. This value is measured as an indicator of fat oxidation. Oxygen, metal ions and light as oxidant factors can affect on this value (ISIRI No. 4179, 1998). According to Iranian national standard, Iodine value for butter samples is 26-40. This value shows unsaturated fatty acids content and their resistance to oxidation which confirmed by showed results in table 2 (ISIRI No.4888, 2000). Maximum limit of acidity in Iranian national standard is 0.3 % and 0.5% for imported and internal produced butters, respectively. Butters high acidity represents the presence of high levels of free fatty acids according to oleic acid (ISIRI No.4178, 1996).

According to Iranian national standard, saponification value of butter sample should be in the range 225-235 (Table No. 1) (ISIRI No. 10501,

Table 2. Mean content of Fatty acids in Butter samples of 12 cities in West Azerbaijan province, Iran (Mean ± Sd)

Cities	C6	C8	C10	C12	C14	C14:1	C16	C16:1	C18:0	C18:1	C18:2	C18:3	C20
1	0.84 ± 0.16	0.66 ± 0.07	1.84 ± 0.16	0.66 ± 0.21	10.8 ± 0.49	1.44± 0.14	35.5± 0.82	1.85± 0.17	9.4 ± 1.22	22 ± 1.14	6.82 ± 0.07	0.42 ± 0.15	0.77 ± 0.21
2	0.92 ± 0.44	0.28± 0.28	1.69 ± 0.61	2.45± 0.9	10.5 ± 3.32	1.44 ± 0.53	38.04± 6.4	1.78± 0.64	8.0 ± 1.68	23.7 ± 6.5	3.84 ± 7.11	0	0.64 ± 0.24
3	0.32 ± 0.4	0.23 ± 0.3	0.84± 0.7	1.39 ± 0.79	6.82± 3.66	0.84± 0.55	35.37± 6.3	0.57± 0.27	9.2 ± 1.48	31.4 ± 6.6	4.82 ± 3.43	0	0.52 ± 0.18
4	0.34 ± 0.74	0.57 ± 0.26	1.56 ± 0.73	2.24 ± 0.96	9.13 ± 3.64	1.26 ± 0.66	37.68± 4.9	0.42± 0.19	8.8 ± 3.17	26.2 ± 6.7	3.23 ± 3.14	0	0.5 ± 0.16
5	0.79 ± 0.04	0.6 ± 0.01	1.67 ± 0.1	2.33 ± 0.21	10.12± 0.9	1.23 ± 0.26	33.85± 2.8	0.48 ± 0.02	11.8 ± 1.6	26.6 ± 2.8	1.92 ± 0.36	0	0.49 ± 0.09
6	0.83 ± 0.42	0.62 ± 0.31	1.68 ± 0.85	2.35 ± 1.21	10.23± 4.5	1.35 ± 0.77	39.92± 4	0.41± 0.23	7.3 ± 1.38	23.5 ± 7.7	4.37± 3.29	0	0.5 ± 0.06
7	0.73 ± 0.13	0.66 ± 0.12	1.98 ± 0.26	1.35 ± 1.22	8.23 ± 4.4	1.55 ± 0.78	36.92± 3.1	1.41 ± 0.34	8.3 ± 1.29	33.3 ± 7.4	3.47 ± 2.34	0	0.54 ± 0.17
8	0.78 ± 0.24	1.2 ± 0.23	1.58 ± 0.44	2.25 ± 0.23	11.23± 4.3	1.15 ± 0.59	36.92± 2.1	2.41± 0.35	9.85± 1.4	27.6 ± 8.7	3.31 ± 1.36	0	0.49 ± 0.18
9	0.88 ± 0.35	0.82± 0.34	0.98 ± 0.58	2.05 ± 1.24	10.23± 4.6	1.45 ± 0.80	35.92± 3.2	0.6 ± 0.26	9.2 ± 1.11	21.3 ± 2.6	1.37 ± 0.32	0	0.6 ± 0.26
10	0.81 ± 0.26	0.42± 0.15	1.78 ± 0.69	1.35 ± 1.35	6.23 ± 4.13	1.55 ± 0.61	37.92± 3.1	0.91± 0.37	7.45± 1.89	25.5 ± 1.8	2.37 ± 0.83	0	0.55 ± 0.41
11	2.5 ± 0.47	0.52 ± 0.33	1.58 ± 0.9	2.45 ± 28	11.23± 4.6	1.25 ± 0.82	39.42± 3.4	1.21± 0.28	9.33 ± 1.73	21.3 ± 3.51	3.37 ± 0.9	0	0.65 ± 0.12
12	1.3 ± 0.48	0.32 ± 0.37	1.65 ± 0.91	2.15 ± 1.17	10.23± 3.6	0.95 ± 0.93	37.52± 3.1	1.21± 0.19	8.14 ± 1.9	29.5 ± 4.8	5.37± 2.35	0	0.51± 0.52
Control	0.8 – 3.6	0.5 – 1.8	1.7 – 3.9	2.2 – 4.5	5.4 – 14.6	0.5 – 1.85	22 – 41	0.7 – 6	6 – 15	18.26 – 38.2	0.68 – 5.5	0	0.05 – 1

2007). This index shows presence of long-chain fatty acids which confirmed by showed results in Table 2. Presence of unsaturated fatty acids accelerates butter spoilage if hygienic conditions of production, maintenance and supply were incorrect (Saremnezhad, 2008; Samet-Bali, 2009). Isomers of C18:3 were found only in samples of one city (City No. 1) that represented using vegetable oils in formulation of butter (Table 2). Permissible amount of fatty acids in butter samples showed in Table 2 (ISIRI No.8818, 2006; ISIRI No.8819, 2006). High price, presence of triglycerides and specific fatty acids differentiated animal butter of plant oils. Edible oils and fats are different from point of view carbon chain length of fatty acids, degree of saturation (number of double bonds in the carbon chain), location and geometric condition of bands (cis or Trans isomers) (Idoui *et al.*, 2013). Any changing of unsaturated fatty acids content in butter samples influenced on Iodine, peroxide and saponification values as indicators for presence of them.

Maximum permissible content of coliforms in Iranian national standard for imported butters and internal produced butters is zero and 20 CFU/gr, respectively (Table 3) (ISIRI No. 2406, 2008). Packaging equipment and personnel contamination are the main causes of coliforms presence in butter samples (Tofangsazan *et al.*, 2009). According to national standard of Iran, *S. aureus* should not be observed in butter (Table 3) (ISIRI No. 2406, 2008). Contamination with *S. aureus* may be due to the manipulation and transferring agents during butter packaging.

Table 3. Microbial contamination of butter samples

Microbe	Results	Standard limit (CFU/gr)
Coliforms	Contamination was found in all cities samples (50-100 cfu/gr in all samples)	≤ 20
E. coli	Contamination was found in samples of 6 city (cities No: 3,4,5,6,7,10) (50-60 cfu/gr)	Negative
S. aureus	Contamination was found in samples of a city (city No: 6) (50 cfu/gr)	Negative
Mold and Yeast	Contamination was found in all cities samples 150-200 cfu/gr	≤ 100

Maximum permissible level of molds in standard is 100 CFU/gr (Table 3) (ISIRI No. 2406, 2008). Since the main source for entrance of molds and yeasts to butter samples is environment of making site, therefore presence of this type of microbes is justified particularly in traditionally produced butters. According to national standard permissible level for presence of *E.coli* is zero (Table 3) (ISIRI No. 2406, 2008). *E.coli* is an indicator of fecal contamination in foods. Therefore, presence of *E.coli* in butter was due to non-compliance with hygienic

conditions in all steps of production, maintenance and supplying. Other researchers have studied chemical and biological quality of different types of butter. Obtained results of this study corresponded with the results of other researchers in Iran and other parts of the world (Rady and Badr, 2003; Idoui and Karam, 2008; Saremnezhad *et al.*2008; Tofangsazan *et al.*, 2009; Honfo *et al.*, 2011).

Conclusion

Obtained results of this study showed presence of vegetable oils, high degree of oxidation of fatty acids and presence of microorganisms in animal butter samples that represented poor hygienic status of traditional butters currently marketed in West Azerbaijan province of Iran. Avoiding to mixing vegetable oils with animal butters, personal hygiene, environment, equipment and tools sanitizing, preventing microbial contamination of samples during production, transportation, storage and distribution, control of hygienic conditions and storage temperature at retails, keeping the cold chain until the consumption are the best suggestions to producing high quality butters.

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