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Nutritional Evaluation and Physicochemical Properties of Fermented Shirezh Dairy Product

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Abstract
Many of the Kurdish traditional dairy products have not been studied thoroughly so far though are still produced at small scale. Dow (sour butter milk) and Shirezh are among these products. Shirezh known to Iraqi Kurds as sour concentrated Dow. The characteristics of Shirezh and Dow were: pH (5.5, 4.05), acidity (2.13%, 1.10%), total solids (18.70%, 5.32%), ash (0.62%, 0.45%), fat (2.57%, 0.8%) and total protein (13.59%, 3.28%) respectively, furthermore the amino acids of Shirezh's protein found in balanced and acceptable quality. The aim of this research is to introduce Shirezh and Dow to scientific literature and to determine their characterization and nutritional values.
Keywords: Shirezh, Dow, Dairy, Fermented, Nutrition, Physicochemical, Amino acids.

1. Introduction

Traditional foods play an important role in local identity, consumer behavior, the transfer of cultural heritage for future generations, and the interaction of this heritage with the rest of the world (Albayrak and Gunes, 2012). Fermented foods are an integral part of the world food and are well known from ancient time as a source of nutrients. It is of great potential in maintaining health and preventing diseases (Kabak and Dobson, 2011). Traditional fermented dairy products, together with contents in the gastrointestinal tract, are considered the main sources for isolation of potential probiotic organisms (Maryam, 2011). Fermented milks such as yoghurt is more digestible than the milk mixture, for instance the increased digestibility of proteins in fermented milks is related to the fine flocculation of caseins resulting from the joint action of proteolysis and acidification. Furthermore, consumption of fermented milk by lactic acid bacteria has led to a significant increase in various immune responses (Edward, 2008).

Although many types of traditional dairy products are thoroughly studied throughout the world, but to date there are no studies to cover the traditional Kurdish dairy products. In Kurdistan, both Dow and Shirezh are considered as staple foods. Dow is usually obtained by adding approximately two thirds of water to the yoghurt (in Kurdish: *Mast*) followed by a vigorous churning in a leather bag (in Kurdish: *Mashka*). There is a great similarity between Dow and other yoghurt beverages of neighboring countries such as the Iranian *Doogh* (Mostafa and et al, 2012) and the Turkish *Ayran* (Murat, 2003; Ozer et al, 2006).

Shirezh, the sour concentrated product, is made out of Dow after boiling and filtration through a cloth bag. Shirezh, can be compared with the *Lebneh* of Middle-east (Tamime and Robinson, 1999) except of the fat content, further Shirezh is boiled before the whey removal whereas *Lebneh* is not. Due to high temperature treatment, Shirezh have a longer shelf life than *Lebneh*. Shirezh also differs from Turkish *Cokelek* which is produced from churned butter milk (Turkish *Ayran*, boiled then washed with water followed by addition of 1-2 % of salt (Ozer et al. 2006), however, Shirezh is neither washed with water nor salt added.

2. Materials and Methods

The local yoghurt (known as *Mast*) was obtained from the local market of Sulaimaniah city (Kurdistan of Iraq). Dow and Shirezh samples were prepared in the dairy technology laboratory at Food Science department/Faculty of Agricultural Sciences, University of Sulaimani.

2.1 Laboratory Preparation of Shirezh

The preparation of Dow and Shirezh was done in the dairy laboratory using the available local yoghurt (known as *Mast*) made of sheep milk (or milk mix of cow, goat, and sheep). The preparation methods inspires from the traditional methods used in the local region, augmented with the scientific dairy preparation procedures (such as environment and thermal steps, i.e. suitable temperatures). Figure 1 illustrates the preparation of Shirezh.

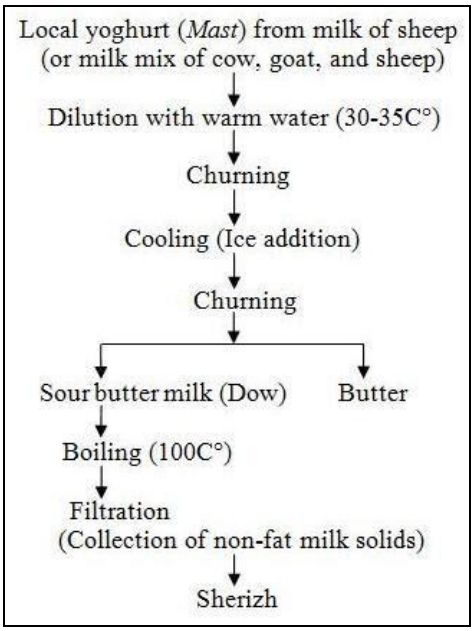

Figure 1. Preparation of Dow and Shirezh

2.2 Physicochemical and chemical analysis

Samples of Dow and Shirezh were analyzed for the following parameters:

2.2.1 Measurement of pH

Ten grams of sample were diluted with 10ml distilled water and mixed thoroughly to measure pH. The pH meter (WTW Germany) was calibrated with standard buffer solution pH=4.01 and pH=6.01 before measuring the pH.

2.2.2 Measurement of Titratable acidity

Diluted sample with an equal volume of distilled water were measured by titration with 0.1N NaOH in the presence of phenolphthalein indicator, expressed as grams of lactic acid/100g of sample, outlined by (AOAC, 2000).

2.2.3 Measurement of Total Solids

The total solids were measured according to (AOAC, 2000). Weighing 5g sample mixed with 25g sand then dried at 105C° in oven with the constant weight (for at least three hours) and results recorded as grams of total solid /100g of sample.

2.2.4 Measurement of Fat

The measurement of fat contents was carried out according to (AOAC, 2000) using Hexane and petroleum ether as solvent for soxhlet extraction. 5g of sample transferred to thimble and extracted at 40 – 60C° for overnight, after extraction the solvent was evaporated in an oven at 100C° weighed and the results recorded as grams of fat/100g of sample.

2.2.5 Measurement of Protein

The concentration of the protein was measured by micro kjeldahl procedure based on the (AOAC, 2000) method using (Buchi 430, Germany). The sample analyzed for total nitrogen then converted to protein by using conversion factor of 6.38 and the results were recorded as grams of protein/100g of sample.

2.2.6 Measurement of Ash

The ash content was measured by incineration of the furnace (Midas, UK) according to (AOAC, 2000). Briefly 3g of sample was dried in an oven then ashed in muffle furnace at 55C° for 8h (the color of ash became whitish grey), cooled in a desiccators, re-weighted, and the results recorded as grams of ash /100g of sample.

2.2.7 Sensory evaluation

Sensory evaluation of Shirezh carried out with 10 volunteers to evaluate the samples for color, appearance, taste, odor, and flavor, each on a 0-20 score.

2.2.8 Amino acid profile

The amino acids of Shirezh were analyzed by a UK-based firm laboratory (Alta Bioscience of the University of Birmingham). Dissolved samples were loaded on ion exchange chromatography column and the free amino acids were detected using Ninhydrin. Proteins are hydrolyzed to their amino acids with constant boiling HCl, in standard hydrolysis conditions of 24 hours at 110°C, under vacuum.

2.2.9 Tryptophan determination

The procedure of Al-Saadi et al (2012) has been adopted with some modification for protein extraction. Shirezh sample was skimmed by chloroform and methanol (2:1) by using soxhlet extraction method. The skim sample

was mixed with TCA (20%) 1:2 (Sample:TCA) for 30 min. The precipitin protein was collected using centrifugation, and the liquid supernatant layer was discarded. The protein precipitate was washed twice with 12% TCA to remove the traces of lactose then dissolved in distilled water while adding NaOH (2M) to pH 7. Dried for 24h, frozen, and finally frozen acetone was added to dry the extracted protein completely.
Tryptophan estimated according to (Beaven and Holiday, 1952). Two mg of the protein was added to 2ml NaOH (0.1M). The Tryptophan was estimated by the tryptophan/tyrosine Molar ratio according to the following equation:

$$\frac{M_{tyr}}{M_{trp}} = \frac{0.592\ D_{294.4} - 0.263\ D_{280}}{0.263\ D_{280} - 0.170\ D_{294.4}}$$

Where *D* is the optical density

2.2.10 Amino acids score (chemical score)
Amino acid scoring was done according to (Robert and Denis 2000). Amino acids score is the commonly used method for assessing protein quality, and this method requires that a particular test and reference protein be analyzed for their essential amino acids content. The expression is:

$$chemical\ score = \frac{mg\ amino\ acid\ in\ 1g\ test\ protein}{mg\ amino\ acid\ in\ reference\ protein}$$

3. Results and discussion

Results obtained were put in (Table 1). Dow average figures for pH, acidity (as lactic acids), total solids, ash, fat, and protein contents were: 4.05, 1.10%, 5.32%, 0.45%, 0.8%, and 3.28% respectively. The pH value was found to be lower than the acceptable 4.5 pH of similar products such as *Doogh* reported by Arezoo (2013), while the sourness taste of Dow as dairy beverage was more favorable. Also, the Dow average results found in agreement with Murat (2003), regarding the non-fatty *Ayran* which should contain acidity between 0.6%-1.6%. Though the fat content was low because of the Dow processing that requires the separation of fat after churning, but the fat content and total solids percents were found in agreement with that of (Murat, 2003) regarding the non-fatty *Ayran*; the fat was less than 0.8% and the total solids ≥4.5%.
Table 1. Average Physicochemical Properties of Dow and Shirezh

Property	Dow			Shirezh		
	DS1	DS2	Average	SS1	SS2	Average
pH	4.0	4.1	4.05	5.5	5.5	5.5
Acidity%	1.12	1.08	1.10	2.13	2.14	2.13
Total Solids%	5.22	5.42	5.32	18.81	18.60	18.70
Ash%	0.45	0.45	0.45	0.63	0.62	0.62
Fat%	0.8	0.8	0.8	2.57	2.58	2.57
Protein%	3.27	3.29	3.28	13.53	13.66	13.59

DS1=Dow Sample 1, DS2= Dow Sample 2, SS1= Shirezh Sample 1, SS2=Shirezh Sample 2

Also, according to (Table 1), Shirezh average figures for pH, acidity (as lactic acids), total solids, ash, fat, and protein contents were: 5.5, 2.13%, 18.70%, 0.62%, 2.57%, and 13.59% respectively. In a study of *Cokelek* by (Ayşe, 2012) that reported the pH value to be within 4.96-5.35, such figure is in agreement with the average pH value of 5.5 obtained from Shirezh. The titratable acidity was within the data range reported by (Tarakci et al. 2003) of 0.45-2.37%, but it was higher than the range of 0.25-0.79 reported by (Ayşe, 2012). The fat content of Shirezh samples were lower than the results given by (Ayşe, 2012) of 8.90-26.60g/100g and in agreement with the data obtained from two studies (Kurt and Caglar, 1988; Tarakci et al. 2003), ranged within 2-5g/100g, 2.70-24.00g/100g respectively. The protein content of Shirezh was less than the results ranges reported by both (Ayşe, 2012) and (Kurt and Caglar, 1988) of 16.59-42.75g/100g and 16.91-31.76g/100g respectively. The ash content according to international standards should be below 2.5% (Arezoo, 2013) and as shown in (Table 1) the ash content of Shirezh was below 2.5%. Previous studies (Ayşe, 2012; Kurt and Caglar, 1988; Tarakci et al. 2003) reflects that the ash content were 2.78-5.28g/100g, 0.72-1.45g/100g, 1.36-3.43g/100g respectively. Therefore, the obtained ash content was only in agreement with (Kurt and Caglar, 1988) and less than both (Murat, 2003) and (Tarakci et al. 2003).
As shown in (Table 2), the sensory evaluation (taste, flavor, color and appearance) of both Dow and Shirezh were acceptable. The total score for Dow was 93.65, and for Shirezh it was 92.331. Such scores confirm the requirements of marketable products based on their sensory parameters.

Table 2. Sensory Evaluation Scores for Dow and Shirezh

Samples	Color 0-20 score	Appearance 0-20 score	Taste 0-20 score	Odor 0-20 score	Flavor 0-20 score	Total Score 100
Dow	20	18	18.77	17.88	19	93.65
Shirezh	20	15.93	18.22	20	18.19	92.34

A protein basic function is to supply adequate amounts of essential amino acids. Essential and non-essential amino acids content of the Shirezh protein are shown in (Table 3). The Shirezh sample was found to contain nine essential amino acids: Threonine, Valine, Methionine, Isoleucine, Leucine, Phanylalanine, Histidine, Lysine, and Tryptophan, with nine non-essential amino acids. Data obtained show that all the eighteen amino acids were present in the Shirezh sample in varied amounts. Glutamic acid showed the highest values followed by Proline, Leucine, Aspartic acid and Lysine. Asparagine and Glutamin are completely converted to Aspartic and Glutamic acids during the acid hydrolysis of protein. Both of Aspartic and Glutamic acids are the storage form of nitrogen in addition to being the starting compounds from which the backbones of amino acids are made (Maduka et al 2013).

Table 3. Amino Acids Profile of Shirezh

AA	m.g/mg	g/100g
Cysteic acid*	0.00463	0.463
Aspartic acid	0.0456	4.56
Threonine	0.0254	2.54
Serine	0.0328	3.28
Glutamic acid	0.129	12.90
Proline	0.0635	6.35
Glycine	0.00975	0.975
Alanine	0.0188	1.88
Valine	0.0378	3.78
Methionine	0.0179	1.79
Isoleucine	0.0307	3.07
Leucine	0.0570	5.70
Tyrosine	0.0306	3.06
Phanylalanine	0.0322	3.22
Histidine	0.0228	2.28
Tryptophan	0.0033	0.33
Lysine	0.0454	4.54
Arginine	0.0209	2.09
Totals	0.6283	62.83

*Cyc is usually observed as Cystine and its recovery is variable using standard hydrolysis conditions.

Due to the use of high thermal treatment in acidic condition and due to the filtration during processing, this will lead to degradation and decrease in the values of some amino acids like Tryptophan, Cystein and Glycine. During fermentation of milk, the amino acid profile changed as a result of proteolysis activity of lactic acid bacteria, such proteolysis affects the fermented milks to have a higher content of peptides and free amino acids (especially Valine, Histidine, Serine and Proline) than milk does (Tamime and Deeth, 1980; Vaitheeswaran and Bhat, 1988).

The quality of protein source is measured by comparing the amount of essential amino acids in food with the amount required for good nutrition. The essential amino acid composition and amino acid score (chemical score) of Shirezh are below in (Table 4). The comparison was made with FAO/WHO (1991 and 2007) reference pattern for adult. According to FAO/WHO (1991) the limiting Amino acid was only Tryptophan while according to FAO/WHO (2007) the limiting amino acid were Tryptophan and slightly limiting in Valin and Leucine.

Table 4: Essential amino acids of Shirezh protein and scores based on FAO/WHO (1991 and 2007) amino acid requirements for human mg/g protein

	Thr.	Cys. + Met.	Val.	Ile.	Leu.	Tyr. + Phe.	His.	Lys.	Trp.
FAO/WHO mg EAA/g protein for adult 1991.a	9	17	13	13	19	19	16	16	5
FAO/WHO 2007à	23	22/16	39	30	59	30	15	45	6
Shirezh EAA composition mg/g protein.b	25.4	22.53	37.8	30.7	57	62.8	22.8	45.4	3.3
Amino acid score b/a 1991.	282.22	132.53	290.77	236.15	300	330.53	142.50	283.75	66.00*
Amino acid score b/à 2007.	110.43	102.41	96.62*	102.33	96.61*	209.33	152.00	100.89	55.00*

* Chemical score

In spite of milk perfect resource for all essential amino acids, but a derivative such as Shirezh (and due to its concentrated fermented nature) has a declined amino acids profile and this is mainly due to its multiple processing steps such as heat treatment, filtration and concentration. Therefore, this definitely can lead to the decrease in its amino acids and peptide chain.

The heat treatment during processing (in addition to the low pH value of Shirezh) will decrease the sulfur-containing amino acids and others such as Phenylalanine and Tryptophan, because the sulfur amino acids oxidized to Methionine sulfoxide and Cystic acids according to (Al.Kahtani 1989). Overall, the amino acid profile suggests that Shirezh can serve as a good source of amino acids except Tryptophan.

4. Conclusions

Fermented milk is considered an important part of human nutrition in all over the world. Dow and Shirezh are considered the main fermented dairy products, produced in Kurdistan of Iraq using traditional methods. Despite the high demand and consumption of those products but they did not receive any research interest. The current study considered the first step concerning Dow and Shirezh research. According to our results, Shirezh is an ideal food due to its good protein content and essential amino acids except Tryptophan. Other good nutritional features of Shirezh are: its low content of fat carbohydrates (lactose) and thus it can be classified as a low calorie product, and its shelf life is longer than milk, plus it is more digestible than milk. Therefore, it is highly encouraged to widen Dow and Shirezh consumption, and to promote their large-scale production using the modern technology, careful standardization of its raw material with more hygienic procedures to produce better quality product.

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References

A.O.A.C. (2000) Association of official Analytical Chemists, "Official Methods of Analysis", 17th ed. Virginia USA.

Arezoo Noori, Fariba Keshvarzian, Sepideh Mahmoudi, Morvarid Yousefi and Leila Nateghi. (2013) Comparison of traditional Doogh (yoghurt drinking) and Kashk characteristics (Two traditional Iranian dairy products). Pelagia Research Library, European Journal of Experimental Biology, 2013, 3(6): 252 – 255.

Ayşe Deniz ÇARDAK, 2012. Microbiological and chemical quality of Çökelek cheese, Lor cheese and Torba (strained) yoghurt. African Journal of Microbiology Research 6(45):7278-7284.

Barbaros Ozer, Celalettin Kocak, Mehmet Guven. 2006. TRADITIONAL DAIRY PRODUCTS OF TURKEY MANUFACTURED FROM AWASSI SHEEP'S MILK. 57TH EAAP Meeting, 15-18 September, Antalya, Turkey.

Beaven. G. H. and Holiday. E. R. (1952). Advanced Protein Chemistry.

Edward R. Farnworth. 2008. Handbook of fermented functional foods. 2nd ed. CRC press. P.222.

FAO/WHO. 1991, Protein Quality Evaluation; Food and Agricultural Organization of the United Nations : Roma, Italy, p 66.
Hassan A. Al Kahtani. 1988. Processing of Different Wheat Flour – Supplemented sorghum
Flakes (Sorghum and Wheat of Saudi Arabia): Sensory, Nutritional and Microbiological Evaluation. Food Chemistry 33:133-149.
Jasim M S Al- Saadi, Azhar Mat Easa and Hilton C Deeth. (2012), Effect of lactose on cross-linking of milk proteins during heat treatment. International Journal of Dairy Technology, 66(1). doi:10.1111/j.1471-0307.2012.008780.x
Kabak, B. & Dobson, A. D. 2011. An introduction to the traditional fermented foods and beverages of Turkey. In *Crit Rev Food Sci Nutr,* 51:248-60.
Kurt A and Caglar A 1988. Peskutenin Kimyasal ve mikrobioyolojik ozellikleri uzerine bir arastirma. Gida. 13:341-347.
Maduka H.C.C., Maduka A.A., Ugwu C.E. and Mukthari I. 2013. Amino Acid Profile and Elemental Compositions of Some Commercially Produced Fermented Milk (Yoghurt) in Maiduguri Metropolis of Nigeria. British Journal of Dairy Sciences 3(2): 9-13, 2013. 2432; e-ISSN: 2044-2440.
Maryam Tajabadi Ebrahimi1, Arthur C. Ouwehand, Mohamad A. Hejazi and Parvaneh Jafari. 2011, Traditional Iranian dairy products: A source of potential probiotic lactobacilli. African Journal of Microbiology Research Vol. 5(1), pp. 20-27, 4 January, 2011.
Mevhibe Albayrak and Erdogan Gunes, 2010, Traditional foods: interaction between local and global foods in Turkey. African Journal of Business Management, 4(4): 555-561.
Mostafa Soltani, Dilek Say, Nuray Güzeler1. 2012. Production and Quality Characteristics of "Doogh". Akademik Gıda® / Academic Food Journal ISSN Print: 1304-7582, Online: 2146-9377. *http://www.academicfoodjournal.com*
Murat GULMEZ, Abamuslum GUVEN, Cigdem SEZER and Berna DUMAN. 2003, Evaluation of Microbiology and chemical Quality of Ayran samples Marketed in Kars and Ankara cities in Turkey. Kafkas Univ. Vet. Fak. Derg. 2003, 9(1): 49-52.
Robert E. C. Wildman and Denis M. Medeiros. Advanced Human Nutrition. 2000. 2nd Edition CRC press.
Tamime, A.Y. and Deeth, H.C., 1980, Yogurt: technology and biochemistry, J. Food Protect., 43, 939–977.
Tamime, A. Y., G. Davies, A. S. Chehade, and H. A. Mahdi. 1989. The production of 'labneh' by ultrafiltration: International Journal of Dairy Technology 42(22): 35-39.
Tamime, A. Y., and R. K. Robinson. 1999. Yoghurt Science and Technology. 2nd ed. CRC Press, Boca Raton, FL. C. f. E.Al-Kadamany, I. Toufeili, M. Khatter, Y. Abou–Jawdeh, S. Harakeh, and T. Hadded. Journal Dairy Science 85(5): 1023-1030.
Tarakci Z, Yurt B, Kucukoner E (2003). A study on some properties of Dumas produced in Darende and its surround. Gida. 28:421-427.
Vaitheeswaran, N.I. and Bhat, G.S., 1988, Influence of lactic cultures in denaturation of whey proteins during fermentation of milk, J. Dairy Res., 55, 443–448.

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