ХИМИЧЕСКИЕ НАУКИ

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STUDY ON PHYSICOCHEMICAL AND HYGIENIC QUALITY OF URUM AND FERMENTED URUM OF MONGOLIA

The research objects in this study were 12 samples of conventional urum and fermented urum obtained from Xilin Gol, and their quality and safety were compared and evaluated using physicochemical and microbiological compositions. The average fat content of urum was 60.75±4.79 %, the average moisture content was 25.49±7.74 %, the average non-fat milk solids content was 13.76±8.71 %, and the total number of colonies and E. coli were not discovered. Fermented urum had an average fat content of 44.21±0.98 %, an average acidity content of 202.67±33.16 °T, an average moisture content of 36.4±6.36 %, an average nonfat milk solids content of 19.38±5.69 %, and an average total bacterial colony concentration of lg7.31±0.99 CFU/g.

The average mold level was lg2.1±1.16 CFU/g, while E. coli was not found. The examination and comparison of the physicochemical properties and microbiological composition of traditional Mongolian high fat urum and fermented urum revealed that the two dairy products had a high fat content. Furthermore, the fermented urum had higher acidity, moisture, and nonfat milk solids than the urum. The presence of mold in fermented urum may pose a concern to hygienic quality. The average number of bacterial colonies in fermented urum is lg7.31±0.99 CFU/g, indicating that it is rich in microbial resources and has enormous possibilities for microbial resource development and commercialization.

Key words: *Urum; fermented urum; physicochemical detection; microbial detection; security.*

Introduction

Traditional high-fat dairy products are natural products with rich milk flavor and distinct flavor that are essential components of the Mongolian diet. Traditional high-fat dairy products have a high nutritional value and a large amount of protein, fatty acids, vitamins, calcium, phosphorus, and trace elements, as well as a balanced amino acid ratio, high essential amino acid content, similar digestibility, and a high fatty acid content, particularly a high unsaturated fatty acid content [1]. As a result, high-fat traditional dairy products are an excellent source of calcium, phosphorus, and zinc for the elderly and children. As a result, traditional Mongolian dairy products may provide a variety of necessary nutrients to the human body and have become one of the Mongolian people's main diets.

Due to considerable regional disparities in the production process, diverse sources of samples, and variable detection indices, recent analysis studies of the nutritional components of high-fat dairy products such as urum and fermented urum lack impartiality and integrity. The samples gathered in this study are all made using traditional artisanal dairy skills in the Xilin Gol region, and the collection kinds are all complete. Fat, moisture, acidity, nonfat milk solids, coliform, the total number of bacteria, mold, and lactic acid bacteria were found to have physicochemical components. It can perform physicochemical analysis on high-fat dairy product samples in a systematic manner, providing a foundation for subsequent study and comparison of product quality and health safety [2; 3; 4; 5; 6].

Materials and methods

Samples

Six samples of butter, zuukhii, urum, fermented urum, and tude were obtained from herdsmen's residences in Xilin Gol and Qixian County and transferred to the laboratory for testing under low-temperature preservation conditions.

Medium

Nutrient AGAR medium, crystal violet neutral red bile salt AGAR and PDA medium were purchased from Beijing Road and Bridge Technology Co., LTD. Sodium hydroxide, sodium chloride, phenolphthalein and other pure analytical reagents were purchased from Sinopsin Chemical Reagent Co., LTD.

Equipment

Shanghai Bingyue Electronic Instrument Co., LTD, fat analyzer (BYSXT-02/2 series). Tianjin Teste Instrument Co., LTD electric thermostatic drying box (202-3A) and Tianjin Teste Instrument Co., LTD electric thermostatic incubator (WPL-230BE) were employed in this study.

Methods

We utilized method GB 5009.3-2016 to determine moisture content. The fat content was determined using GB 5009.6-2016; the acidity was determined using GB5009.239-2016; and the nonfat milk solids were determined using GB5413.39-2010 respectively. The total number of colonies relates to GB4789.2-2022 for counts of microbiological viable bacteria in the sample; coliform was determined according to GB4789.3-2016; and mold was determined according to GB4789.15-2016 [7; 8; 9; 10; 11; 12; 13].

Results and discussion

Results of physicochemical composition and microbial composition of the urum

Table 1 shows the findings of detecting and analyzing the physicochemical composition of fat, moisture, nonfat milk solids, and protein in urum samples.

Table 1

Physicochemical compositions of the urum

Sample number	Fat	Moisture	Non-fat milk solids	Total colony count	*E. coli*
	g/100g	g/100g	g/100g	lg CFU/g	lg CFU/g
WR01	62.56	31.41	6.03	ND	ND
WR02	69.40	22.71	7.89	ND	ND
WR03	60.67	23.97	15.36	ND	ND
WR04	57.75	12.01	30.23	ND	ND
WR05	57.17	30.44	12.39	ND	ND
WR06	56.93	32.41	10.66	ND	ND
Average value	60.75	25.49	13.76	–	–
Standard deviation	4.79	7.74	8.71	–	–

According to Table 1, the average fat percentage of urum is 60.754.79 %, with the highest fat level being 69.40 %. The average moisture content was 25.497 %, while the average nonfat milk solids percentage was 13.768.71 %. Because urum is prepared by separating and extracting the fat from raw milk, its fat level is relatively high. The fat percentage in traditional urum is 57.05 %, according to Xiao Fang et al., however, the fat concentration in this study was greater [14]. The total number of colonies in the urum and the microbiological composition of *E.coli* were not discovered, indicating that no microorganisms were present, and that the hygienic quality met the requirements for consumption. It is due to the boiling at higher temperatures during the manufacturing operations. It demonstrates that urum, as a high-fat dairy product, is abundant in fatty acids and an excellent source of essential fatty acids and phospholipids.

Results of physicochemical composition and microbial analysis of the fermented urum

The physicochemical composition of fat, acidity, moisture, and nonfat milk solids in fermented urum samples was investigated, as well as the total number of bacteria, mold, and *E.coli* in the samples. Table 2 shows the results.

Table 2

Pphysicochemical compositions and microbial analysis of the fermented urum

Sample	Fat	Acidity	Moisture	Non-fat milk solids	Total bacterial count	mold	*E. coli*
	g/100g	°T	g/100g	g/100g	lg CFU/g	lg CFU/g	lg CFU/g
FV01	22.00	178.00	48.00	29.40	8.45	3.51	ND
FV02	50.50	244.00	34.50	14.70	7.28	1.00	ND
FV03	46.80	224.00	39.40	13.70	5.79	1.00	ND
FV04	47.90	157.00	31.40	20.40	6.80	2.45	ND
FV05	47.70	224.00	32.90	20.80	7.26	1.30	ND

Ending of table 1

Sample	Fat	Acidity	Moisture	Non-fat milk solids	Total bacterial count	mold	*E. coli*
	g/100g	°T	g/100g	g/100g	lg CFU/g	lg CFU/g	lg CFU/g
FV06	50.30	189.00	32.20	17.30	8.30	3.34	ND
Average value	44.20	202.67	36.40	19.38	7.31	2.10	ND
Standard deviation	10.98	33.16	6.36	5.69	0.99	1.16	ND

Table 2 demonstrates that the fermented urum has an average fat content, acidity content, moisture content, and nonfat milk solids content of 44.210.98 %, 202.6733.16°T, 36.46.36 %, and 19.385.69 %, respectively. The average bacterial colony content was lg7.310.99 CFU/g, the average mold content was lg2.11.16 CFU/g, and E. coli was not found. Mongolian traditional hand-fermented urum is a high-nutritional, fat-rich dairy product. Gao Wenting et al. discovered that fermented urum had a high fat content, with the average water and crude fat content being 38.704.67% and 49.835.13%, respectively [15]. This corresponds to the fat and water data measured in this investigation, which is consistent with relevant findings. The fermented urum included a total of bacterial colonies and mold, and the mold concentration was relatively high, with an average value of lg2.11.16 CFU/g. Mold is a type of fungus that exists in abundance in nature, with a vast range of species. It has the ability to release mycotoxin, a low molecular mass secondary metabolite with carcinogenic, toxigenic, and teratogenic properties. The fermented urum obtained in this study may have hidden dangers in the cecum or rumen, and extended fermentation throughout the production process leads in mold developing in the completed product, posing possible safety and health quality problems.

Comparison of physicochemical composition and microbial results of the urum and the fermented urum

Table 3 indicates that the average fat content of urum and fermented urum is 60.75 % and 44.20 %, respectively, indicating that the two dairy products are high-fat dairy products with excellent nutritional value. The comparative study of the moisture and non-fat milk solids content showed that the content of fermented urum was higher than the urum, which was caused by the fermented urum's specific production procedure. The fermented urum had to go through a protracted fermentation process in the rumen or cecum, so its water content was higher than the urum. At the same time, the microorganisms in the production process continue to ferment naturally for a long time, resulting in a high acidity index.

Table 3

Comparison of physicochemical composition of the urum and the fermented urum

Sample name	Fat	Moisture	Acidity	Non-fat milk solids
	g/100g	°T	g/100g	g/100g
Urum	60.75±4.79	25.49±7.74	–	13.76±8.71
Fermented urum	44.20±10.98	36.40±6.36	202.67±33.16	19.38±5.69

Comparative analysis of microbial results of the urum and the fermented urum

The total counts of colonies in the fermented urum were approximately 7.31±0.99CFU/g, as shown in Table 4, however colonies were not found in the urum. The reason for this is that the manufacturing processes of the two dairy products are distinct. The average mold content in fermented urum was approximately 2.10±1.16 % CFU/g, although mold was not found in the urum. The fermented urum is obtained from long-term

natural fermentation of the urum in the cecum or rumen, therefore the presence of mold may be attributed to the destruction of the sealing state during fermentation, or to storage and transportation.

Table 4

Comparative analysis of microbial composition of the urum and the fermented urum

Sample name	Total colony count	mold	E. coli
	lg CFU/g	lg CFU/g	lg CFU/g
Urum	ND	ND	ND
Fermented urum	7.31±0.99	2.10±1.16	ND

Conclusion

In this study, the physicochemical composition and microbial composition of traditional Mongolian high-fat fermented urum and urum were analyzed and compared. The results showed that both the urum and the fermented urum belong to high-fat dairy products and contain high nutritional value. The average content of mold in the fermented urum was lg 2.10±1.16 CFU/g, which could lead to health quality risk. Through the study of evaluation and analysis of the quality and safety of the fermented urum and the urum, the results show that the safety risks do not exist in the urum. Hence, it can be used as the basis for the research and development of the production process of fermented urum and the research of safe and reliable storage and transportation. Fermented urum has an average of lg7.31±0.99 CFU/g of bacterial colonies, indicating an abundance of microbial resources and considerable potential for the research and commercial production of microbial resources.

LIST OF REFERENCES

1. Ya Mei, Hasqimg, Chen Yongfu, et al. Research report on Development status of traditional dairy industry in Inner Mongolia // Chinese Dairy Industry. – 2016. – № 44 (7). – P. 28–30.
2. Dong Jie, Zhang Heping. Analysis on the development of Chinese traditional fermented dairy products // China Dairy Industry. – 2014. – № 42 (11). – P. 26–30 (in Chinese).
3. Zhao Hongxia. Study on Processing Technology and Storage Characteristics of Mongolian Milk husk and Milk Curd. – Shihezi University, 2008.
4. Guo L., Ya M. Guo Y.S., et al. Study of bacterial and fungal community structures in traditional koumiss from Inner Mongolia // Journal of Dairy Science. – 2019. – № 102 (3). – P. 1972–1984.
5. DBS15/001.2–2017 Local standard for food safety Traditional Mongolian dairy products. – Part 3: Milk skin.
6. DB15/T 1989–2020 Production process Specification of Mongolian traditional milk products Wulu Mu (milk skin).
7. National Health and Family Planning Commission of the People's Republic of China, State Food and Drug Administration. GB/T 5009.6-2016, Determination of fat in food of National Standard for Food Safety. – Beijing: Standards Press of China, 2016.
8. National Health and Family Planning Commission of the People's Republic of China, State Food and Drug Administration. GB/T 5009.239-2016, Determination of acidity in food of National Standard for Food Safety. – Beijing: Standards Press of China, 2016.
9. National Health and Family Planning Commission of the People's Republic of China, State Food and Drug Administration. GB/T 4789.3-2016, National Standard for Food Safety, Food microbiology test coliform count. – Beijing: Standards Press of China, 2016.
10. National Health Commission of the People's Republic of China, GB 4789.2-2022, National Standard for Food safety: Determination of total bacterial colonies for microbiology inspection of food. – Beijing: Standards Press of China, 2022.
11. Ministry of Health of the People's Republic of China, GB 5413.39-2010, Food Safety National Standard milk and dairy products – determination of non-fat milk solids. – Beijing: Standards Press of China, 2010.
12. National Health and Family Planning Commission of the People's Republic of China, State Food and Drug Administration. GB/T 5009.3-2016, National Standard for Food Safety – Determination of moisture in food. – Beijing: Standards Press of China, 2016.

13. National Health and Family Planning Commission of the People's Republic of China, State Food and Drug Administration. GB4789.15-2016, Determination of mold in food of National Standard for Food Safet. – Beijing: Standards Press of China, 2016.
14. Xiao F. Nutritional analysis of traditional milk skin and milk tofu in Ximeng area of Inner Mongolia // China Dairy Industry. – 2013. – № 41 (11). – P. 27–28, 37 (in Chinese with English abstract).
15. Gao W.T. Study on nutrition, quality and bacteriostatic characteristics of traditional fermented milk bark and isolation of lactic acid bacteria / Tutor: Shuang Quan. – Inner Mongolia Agricultural University, 2018.

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ИССЛЕДОВАНИЕ ФИЗИКО-ХИМИЧЕСКИХ И ГИГИЕНИЧЕСКИХ КАЧЕСТВ ТВЕРДЫХ СОРТОВ И ФЕРМЕНТИРОВАННОГО УРУМА ИЗ МОНГОЛИИ

Объектами исследования в данном исследовании были 12 образцов обычного урума и ферментированного урума, полученных из Ксилин-Гола, а их качество и безопасность сравнивались и оценивались на предмет физико-химических и микробиологических составов. Средняя жирность урума составила 60,75±4,79 %, средняя влажность 25,49±7,74 %, среднее содержание сухих веществ обезжиренного молока 13,76±8,71 %, общее количество колоний и кишечной палочки не обнаружено. Ферментированный урум имел среднее содержание жира 44,21±0,98 %, среднюю кислотность 202,67±33,16 °T, среднее содержание влаги 36,4±6,36 %, среднее содержание сухих веществ в обезжиренном молоке 19,38±5,69 % и среднее общее содержание концентрации бактериальных колоний lg7,31±0,99 КОЕ/г. Средний уровень плесени составил lg2,1±1,16 КОЕ/г, при этом E.coli не была обнаружена. Исследование и сравнение физико-химических свойств и микробиологического состава традиционного монгольского урума с высоким содержанием жира и ферментированного урума выявило, что оба молочных продукта имеют высокое содержание жира. Кроме того, ферментированный урум имел более высокую кислотность, влажность и обезжиренные сухие вещества молока, чем урум. Наличие плесени в ферментированном уруме может ухудшить его гигиеническое качество. Среднее количество бактериальных колоний в ферментированном уруме составляет lg7,31±0,99 КОЕ/г, что указывает на то, что он богат микробными ресурсами и имеет огромные возможности для разработки и коммерциализации микробных ресурсов.

Ключевые слова: *урум; ферментированный урум; физико-химическое выявление; выявление микробов; безопасность.*