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EVALUATION OF THE QUALITY OF RAW MILK FOR YOGURT PRODUCTION

Tatjana Kalevska[1], Daniela Nikolovska Nedelkoska[1], Viktorija Stamatovska[1], Zora Uzunoska[1], Sasko Martinovski[1], Vezirka Jankuloska[1]

[1] St.Kliment Ohridski Univeristy, Faculty of Technology and Technical science – Veles, Republic of North Macedonia

**Corresponding author: tatjana.kalevska@uklo.edu.mk*

Abstract

Yogurt is one of the most popular fermented products. From a nutritious aspect yogurt is very similar to the milk from which it was made, partly changed, with certain therapeutic effects linked with the starter cultures added in the production process.

The research includes the examination and presentation of results for the physical-chemical composition, the inhibitory substances and the hygienic quality of the raw milk for yogurt production, the technology, the physical-chemical composition and the microbiological quality of the yogurt.

According to the results obtained from the research, the milk fat content amounts to 3.78%, proteins 3.23%, lactose 4.68%, and dry matter 12.76%. The average number of somatic cells in the milk is 248.400/ml, and the total number of bacteria 199.000/ml. No antibiotics had been detected in the milk, and the content of aflatoxins is 0.010μg/kg. The average value of the acidity and pH of the milk are 6.68 and 6.79 ^{0}SH respectively. The microbiological quality of the produced yogurt is in accordance with the requirements of the Regulations for the special requirements for the microbiological criteria of food.

Key words: *quality, raw milk, yogurt*

INTRODUCTION

Fermented milk products have been consumed in Europe for perhaps 4000 years and yogurt is one of the oldest and most popular of these products worldwide (Buttriss, 1997). Fermented milk products contain all important food ingredients in such relation that a human body can optimally use them and because of that they belong to a group of very important food in human nutrition. They, as well as milk, contain all the basic ingredients needed for growth of a human body, for development, reproduction, maintenance and satisfying energy needs. These ingredients entail lactose, lactic acid, protein, milk fat, minerals and vitamins. During fermentation there is a change of some constituents of milk and with creating of new constituents, fermented products get new features compared to milk (Carić, 2000).

The fermented dairy products are traditional products that are present in milk processing facilities, markets and our table (Tamime and Robinson, 2004). One of the most consumed sour-milk products in our country is the yogurt. Yogurts are produced by a lactic acid fermentation process using thermophilic strains of bacteria. From a nutritious aspect yogurt is very similar to the milk from which it was made, partly changed, with certain therapeutic effects linked with the starter cultures added in the production process. For the production of yogurt, a good quality milk is necessary (Srbinovska, 2007). The physico-chemical quality of the milk for yogurt production is defined based on the following parameters: proteins, fats, lactose, dry matter without fat and casein, the degree of acidity of the milk (Antunac et.al., 1997). The variations in the composition of the milk affect its total quality, as well as certain technological operations in the processing of the milk, and manifest themselves on the

composition, properties and quality. Indicators of the hygienic correctness of the milk are the total number of bacteria and the number of somatic cells, which is correlated with changes in the physico-chemical composition of the milk and is used to evaluate its quality (Kalit et. al. 1998). As a determining factor in establishing the suitability of the milk for yogurt, processing is the ascertainment of the upper limit of the number of somatic cells (Katić & Stojanović, 2002). An increased number of somatic cells and enzymatic activity adversely affect the milk's processing suitability and its technological properties. The milk for yogurt must not have the presence of antibiotics and other residues that negatively affect its technological suitability and human health. Antibiotics inhibit the development of lactic acid bacteria, and can cause allergic reactions in humans or reduce the sensitivity of harmful bacteria in the human body to some antibiotics used in the treatment of certain diseases. (Presilski, 2004). Milk can also contain aflatoxins M1, which are the most toxic collection of mycotoxins that are secondary fungal metabolites. The aflatoxin present in milk over an extended period of time even in extremely small quantities poses a health hazard to humans. (Sassahara et. al., 2005).

MATERIAL AND METHODS

The samples used for this research were taken from the aggregate milk for production of yogurt, following a standard technological process in the Dairy "Bistra" Kicevo. The technology of yogurt includes the following steps:

Raw milk
↓
Filtration
↓
Pasteurization (92^0C/10 min)
↓
Cooling to 43^0C
↓
Inoculation with starter cultures YF- L812
↓
Fermentation to pH 4.6
↓
Cooling and mixing to 15^0C
↓
Packaging of the yogurt
↓
Storage of the yogurt at 4^0C

Physico-chemical composition of the milk

The analysis of the physico-chemical composition and antibiotics in the milk was done in the internal laboratory of the dairy, while the other analyses were done in the Institute of Food" at the Faculty of Veterinary Medicine in Skopje: Analysis of the physico-chemical composition (proteins, milk fat, dry matter, lactose and minerals) was performed with Lacto Scope. The active acidity of the milk was determined with the digital pH meter TESTO 720.

Microbiological analysis of the milk

Total number of bacteria (Bactocount - ISO 21187: 2004) and number of somatic cells (Fossomatic-ISO 13366). Antibiotics from the group of tetracyclines and β-lactams in the milk were determined by rapid tests with the Twin Sensor incubator. The analysis of aflatoxins in the milk was performed with (ELISA R-biopharm 1113).

Physico-chemical composition of the yogurt

Physico-chemical composition of yogurt was determined by accredited methods: fats (ISO2446:1976), dry matter (ADAC/2005/990.20), acidity of yogurt (SH^0) with titration. The pH value was determined by a pH meter.

Microbiological analysis of the yogurt

Listeria monocytogenes (ISO 11290-1), Enterobacteriaceae - (ISO 21528-2), Escherichia coli (ISO 16649-2).

RESULTS AND DISCUSSION

The parameters for the quality of raw milk (physical chemical composition and hygienic quality) used for the production of yogurt are shown in Table 1.

Table 1. Physico-chemical analysis and hygienic quality of milk for yogurt.

Parameters	$\bar{x}$	S_d	Cv (%)	min	max
Proteins	3.23	0.04	1.59	3.19	3.31
Milk fat	3.78	0.06	1.68	3.68	3.89
Lactose	4.68	0.05	1.18	4.61	4.79
Dry matter	12.76	0.16	1.32	12.64	13.16
^{0}SH	6.79	0.07	1.11	6.67	6.88
pH	6.68	0.06	1.04	6.58	6.78
*TCSC/ml	248.400	18.260	7.35	220.000	277.200
*TCB/ml	199.000	17.336	8.71	176.000	228.000

*TCSC/ml (Total count of somatic cells)

*TCB/ml (Total count of bacteria)

The average content of fat in the milk is 3.78 %, proteins 3.23%, dry matter 12.76%, and lactose 4.68%. The average value of the active acidity of the milk is 6.68 and 6.79 ^{0}SH respectively. The average values of all the parameters of the physico-chemical composition are within the value limit prescribed by the Macedonian regulations on requirements for the quality of raw milk and are in accordance with the results of other authors (Srbinovska, 2007), (Dimitrovska et al., 2016). According to (Heeschen, 1987), the quality of milk, in addition to the composition, is also determined by the parameters for hygienic correctness. The number of somatic cells in the milk is in accordance with the regulations, while the total number of bacteria in the milk notes certain deviations from the permissible limit according to the regulations. A correctly performed pasteurization is expected to destroy the microorganisms present in the milk. Similar results were obtained in the research of (Dimitrovska et al., 2016), while deviating results were determined by (Srbinovska, 2007). An increased number of somatic cells in milk indicates poor hygienic quality and is a basic indicator of hygiene conditions for milk production (Srbinovska, 2007), (Kirin, 2001).

Table 2. Residues and contaminants in the milk.

Cow's milk	**Results**
Aflatoxin	<0,010 mg/kg
Antibiotics	not found

The presence of antibiotics was not established in the milk samples. The content of aflatoxins in the examined milk samples for the production of yogurt is within the limits of the permitted quantities according to the food safety regulations in relation to the max levels of certain contaminants.

Physico - chemical characteristics of the yogurt after the production are shown in table 3.

Table 3. Physico-chemical analysis of yogurt.

Parameters	(%)
dry matter	9.65
fats	3.30
^{0}SH	38
pH	4.45

From Table 3 it can be concluded that the average content of dry matter in yogurt is 9.65% and fat is 3.30%. Similar results about the physico chemical composition of yogurt were obtained in the research of (Dozet et al., 1979). The pH value of yogurt after the completed fermentation is 4.45, while the titration acidity is 38^0SH. These results are in accordance with previous researches (Milanović et al., 2013).

The results of the microbiological analysis of the yogurt are presented in Table 4.

Table 4. Microbiological analysis of the yogurt.

Parameters	CFU/ml
L. monocytogenes	not found in 25ml
Enterobacteriaceae	0
E. coli	0

From the presented results of the microbiological analysis of the yogurt, it can be concluded that the presence of L. Monocytogenes, Enterobacteriaceae and E. Coli cfu/ml, was not established. From the results of the microbiological analysis it can be noted that it complies with the regulations on special demands for microbiological criteria for food.

CONCLUDING REMARKS

Based on the performed tests and the results obtained for the physico-chemical composition, the hygienic quality and the presence of residues and contaminants in the milk, it can be concluded that the milk for the production of yogurt is of good quality and is technologically suitable for the production of fermented products, which is confirmed by the quality of yogurt produced.

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ОЦЕНУВАЊЕ НА КВАЛИТЕТОТ НА СУРОВО МЛЕКО ЗА ПРОИЗВОДСТВО НА ЈОГУРТ

Татјана Калевска[1], Даниела Николовска Неделкоска[1], Викторија Стаматовска[1], Зора Узуноска[1], Сашко Мартиновски[1], Везирка Јанкулоска[1]

[1]Универзитет Св. Климент Охридски, Технолошко технички факултет – Велес, Република Северна Македонија

**Контакт автор: tatjana.kalevska@uklo.edu.mk*

Резиме

Еден од најпопуларните ферментирани производи е јогуртот. Од нутритивен аспект Еден од најпопуларните ферментирани производи е јогуртот. Од нутритивен аспект јогуртот е многу сличен на млекото од кое е произведен, делумно променет и со одредени терапевтски ефекти поврзани со стартер културите додадени во неговото производство.

Истражувањето вклучува испитување и презентирање на резултати за физичко-хемискиот состав, хигиенскиот квалитет на суровото млеко за производство на јогурт, технологијата, физичко-хемискиот состав и микробиолошкиот квалитет на јогуртот.

Според добиените резултати од истражувањето, содржината на масти изнесува 3,78%, протеини 3,23%, лактоза 4,68% и сува материја 12,76%. Просечниот број на соматски клетки во млекото изнесува 248,400/ml, а вкупниот број на бактерии 199.000/ml. Во млекото не се утврдени антибиотици, а содржината на афлатоксини изнесува 0,010 μg/kg. Просечната вредност на киселост и pH на млекото изнесуваат 6,68 и 6,79^{0}SH соодветно. Микробиолошкиот квалитет на произведениот јогурт одговара на условите од Правилникот за посебните барања на микробиолошките критериуми на храната.

Клучни зборови: *квалитет, сурово млеко, јогурт.*