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Determination of Main Ingredients in Milk Using AKM-98 Milk Analyzer

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DETERMINATION OF MAIN INGREDIENTS IN MILK USING AKM-98 MILK ANALYZER

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Abstract: The aim of the research is a quick, easy, economical way to determine milk content. Nowadays, the production of cow's milk is dominant, but the original quality of non-bovine

milk, such as camel's milk, is now better described and is experiencing growing interest.Camel's milk, goat's milk, ewe's milk and buffalo's milk have received special attention becauseof their recognition as potential functional foods from a nutritional point of view. It is admitted that camel's milk presents a high nutritional quality; e.g., it has three times more vitamin C, minerals, and essential and polyunsaturated Fatty Acids than cow's milk. It is also considered as exhibiting properties to manage chronic ailments, e.g., tuberculosis, jaundice and asthma.

Cow milk contains more than 20 protein allergens that can cause allergic reactions. The main proteins are casein and whey proteins. Casein fractions (αs1-casein, αs2-casein, and β-casein) and β-lg are the main allergens in cow milk. Allergic reactions to bovine serum albumin (BSA), immunoglobulin G (IgG) heavy chain and α-lactalbumin (α-la) have also been noted. Genetic polymorphisms of milk proteins play an important role in MPA development. Goat milk with the αs2-casein genotype caused less intestinal and systemic sensitization thangoat milk with the αs1-casein genotype in guinea pigs. This is very interesting and may have great potentials in selecting goat breeds for different casein genotypes, especially for αs2-casein, which is found in less amount in cows' milk comparing to αs1-casein. Allergic responsesto lactoferrin and some cows' milk enzymes have been detected in some patients with MPA but none to mammalian lysozyme. The balance between casein and whey proteins in cow milk may determine its allergenicity. Allergenicity to goat and sheep milk caseins and cheese has been reported for some patients.

Key words: cow's milk, goat's milk, device, production, fat, protein, density.

INTRODUCTION. Organic food is consumed by many people, because consumers believe that organic food is safer, healthier and more quality than conventional products. The purpose of the production of organic products is to protect the health and quality. In animal production, utilization of hormones, antibiotic, synthetic and growth-promoting drugs have negative effectsin human health, and have been prohibited in organic animal food. There are many detailed regulations for organic milk production. Although organic animal production has increased in theworld, this increased ratio is relatively lower in Turkey [1].

World milk production largely derives from cattle, buffaloes, goats, sheep, and camels. Among these species, the cow can be considered as the most widespread for milk production. In 2018, the total cow milk production in the world was around 683 million tons with a population higher than 1.5 billion heads [3]. Buffalo milk production, customary in many countries, ranks second in the world after cow milk and represents about 13% of worldwide global milk production. In 2018, dairy ewes and dairy goats produced more than 29 million tons of milk [2].

MATERIAL AND METHODS. Milk is the whole, clean, fresh, lacteal secretion obtained by the complete milking of one or more healthy animals, excluding that obtained within 15 days before or 5 days after calving or such periods as may be necessary to render the milk practically colostrum-free, and containing the minimum prescribed percentage of milk fat and milk solid not fat. The milk of certain domesticated animals, and dairy products produced therefrom, are major components of the human diet in many parts of the world. Domesticated goats, sheep and cattle have been used for milk production since about 8000 B.C [4].

Milk and dairy products are considered as a potential resource for providing functional foods. This is related to their content of a variety of essential components such as proteins, polyunsaturated fatty acids, vitamins, minerals, and also to the simplicity of incorporating lactic acid producing bacteria (LAB) during their manufacture [15]. During the last few decades, camel milk, goat milk, ewe milk, and buffalo milk have received special attention. This is principally due to their recognition as exhibiting a higher potential for functional foods from a nutritional point of view when compared to cow milk. Compared to cow milk, buffalo milk is richer in fat, lactose, protein (especially caseins), vitamins, and minerals [2].

More precisely, concerning the lipid fraction, buffalo milk is generally associated with higher amounts of saturated fatty acids and lower amounts of unsaturated fatty acids than cow milk, which contains higher amounts of medium-chain fatty acids. Regarding the long-chain fatty acids, buffalo milk contained significantly higher contents of myristic acid and palmiticacid and lower contents of stearic acid than cow milk. Buffalo milk possesses a higher amount ofrumenic acid and total trans fatty acids than cow milk [6].

Goat milk is generally presented as containing high levels of vitamin A, thiamine, and niacin and structural differences in α-lactalbumin and β-lactoglobulin, which are major whey proteins found in cow milk. The difference in tolerance has also been linked to differences in digestibility rates, aligned with the smaller fat globule distribution of cow milk. This property is related to the amount of and the structural differences in α-lactalbumin and β-lactoglobulin and to the small-diameter fat globules that allow for higher digestibility compared with cow milk. Furthermore, goat milk can be considered as a natural source of lactose-derived oligosaccharides. It presents a healthier lipid composition with increased conjugated-linoleic acidand short FA content and higher vitamins (A and B complex) and Ca2+ contents [7], which means that it may provide a health benefit compared to cow milk. However, goat milk also has a high content of saturated fatty acids and a low content of polyunsaturated fatty acids, often linked to the development of cardiovascular diseases. Due to its richness in minerals, higher protein, beneficial fat, and functional bioactive peptides, the demand for ewe milk is increasingin the global market. It is characterized by the presence of small fat globules with an easily oxidizable membrane. Lipolysis in ewe milk cheeses is fatty acids than in cow milk cheeses, contributing to an important and typical flavor development due to a higher content of short- chain fatty acids. Ewe milk contains higher protein and fat levels than cow milk. Compositional differences between ewe milk and cow milk, mainly in proteins and fats, account for thedifferent technological and sensorial characteristics of cheeses [2].

Cow's milk

Cow milk has long been considered a highly nutritious and valuable human food and it is consumed by millions daily in a variety of different products. Raw milk of good hygienic quality meets the nutritional needs of body better than any single food as it contains essential food constituents such as fat, proteins, carbohydrates, minerals and vitamins. As a result of thepresence of these nutritional components, milk is an excellent culture medium for many microorganisms, especially bacterial pathogens. Milk is often prone to early contamination and spoilage if not handled properly [8].

Goat's milk

Goat milk and its products of yoghurt, cheese and powder have three-fold significance in human nutrition: feeding more starving and malnourished people in the developing world than from cow milk; treating people afflicted with cow milk allergies and gastro-intestinal disorders,

which is a significant goat milk in many populations of developed countries and filling the gastronomic needs of connoisseur consumers, which is a growing market share in many developed countries [4]. Concerning, very much improvement in milk yield and lactation length of dairy goats, especially in developing countries must be accomplished through better education/extension, feeding and genetics. Concerning, little unbiased medical research to provide evidence and promotional facts has been conducted [2], but is very much needed to reduce discrimination against goats and substantiate the many anecdotal experiences about the medical benefits from goat milk consumption, which abound in trade publications and thepopular press. Goats have many unique differences in anatomy, physiology and product biochemistry from sheep and cattle, which supports the contention of many unique qualities of dairy goat products for human nutrition [5].

Sheep's milk

The sheep milk, which is the secretion of the mammary glands, is the only food of the lambs during the initial period of their life. The milk constituents provide both energy and the building materials necessary for its growth [14]. Milk also contains antibodies that protect the lambs against infection. The milking of sheep dates back to the domestication of animals. As with other milk, variations in composition with breed, stage of lactation, diet, season, milking times, and procedure have been recorded. The fat and total solids content tends to increase with the length of lactation leading to about 10% (w/v) fat content at the end of lactation. The average contents of protein (5.6%) and fat (6.4%) in sheep milk are high; only buffalo milk contains more fat on an average when milk from major dairy species is considered (Table 2). Sheep milk also contains more lactose than human, cow, buffalo, and goat milk. The higher lactose contentis compensated for by lower sodium and potassium levels, although most of the other minerals are present in higher amounts in sheep milk, in line with the higher ash content [12-13]. The average fat globule size is reported to be even smaller in sheep milk than in goat milk, which makes the milk naturally homogenized [9].

We have already mentioned the different types of milk. However, the population of Uzbekistan mainly consumes cow's milk, and in our country dairy products are made almost entirely from cow's milk. With this in mind, we determined the composition of cow's milk and the substances necessary for the good development of the human body using the AKM-98 milk analyzer.

The AKM-98 analyzer is the most economical analyzer for milk quality and various dairy products. It is a "mobile" device, which can be carried manually from place to place. It was designed and is in full operation to calculate the mass fractions of fat, protein, and skimmed milk powder in the samples. Samples should be prepared only from uncollected and, not unimportant, concentrated milk (condensed without added sugar). It is also possible to take samples from cream, dried milk, for temperature and freezing point, density (at 20 degrees Celsius). The device allows you to measure the acidity of the samples (pH), as well as indexing the electrolyticconductivity of the samples. The milk analyzer can help calculate the mass fraction of lactose and added water in our samples.

The economy model is the most economical version of the ultrasonic milk quality analyzer among its peers. In 1 minute the device measures 5 milk parameters – protein, fat, skimmed milk powder, density, added water, temperature. The analyzer is used for indices

express determination of milk and (or) its products on farms, milk receiving points, food industry plants, veterinary laboratories, as well as in scientific research. This model is made in a plastic case, which we can see in the photo (Fig.1).

Fig.1. Appearance of AKM-98 milk analyzer

The following components are included: a peristaltic pump; a washing alarm, software for work with a personal computer; a thermal printer; a cable. The analyzer AKM-98 can work inthree modes (raw cow's or sheep's milk, or pasteurized milk), it's also possible to calibrate to any kind of milk (cow's, goat's, camel's milk, as well as cream, whey, ice-cream, recovered or homogenized milk). If you have a printer, you can print out the results of samples.

RESULTS AND DISCUSSION.

Based on the above information, we were able to determine the chemical composition of 3 types of cow's milk (Lactel, Sele green milk, Latte Act Brista Milk) using the AKM-98 milk analyzer. The results are shown in Table 1 below.

Table 1.

Milk Type	Fat%	Protein %	Skimmed milk powder %	Density%	Added water %	Temperature %
Lactel	0.76	1.78	8.69	31.3	6.05	21.6
Sele green milk	2.47	2.4	7.9	26.9	5.85	20.8
Latte Act Brista Sut	4.06	3.14	7.74	25.1	5.44	22.01

Chemical composition (g 100 g^{-1}) of different milk

It is known from the table, Latte Act Brista Dairy has more fat and protein than others, followed by Sele green milk because it has a good amount of fat and protein, which is the main ingredient.

1 2 3

1- Sele green milk, 2- Latte Act Brista Sut, 3-Lactel

Fig.2. Cow's milk from different countries.

Now let's talk a little bit about fat, protein, skimmed milk powder, density, added water and temperature, which are the components of milk.

Fat. Fat content is essential in cheese and it is varies based on the milk content and the process involved in the production of cheese. The fats contribute flavor and texture to the cheese and the types of fats involved in cheese are of triglycerides, saturated fatty acids and unsaturated fatty acids including mono and poly unsaturated fatty acids. The fatty acids contents of milk vary with the species of animals [10].

Protein. Protein is an essential nutrient your body needs to take in every day to work properly and is found throughout your body. Protein helps re-build, maintain and repair body tissues, such as muscle and nervous tissue. Your body also uses it to make new cells and to create specialized proteins, such as hemoglobin, which helps carry oxygen to your body and support a healthy immune system [10].

Density. Density is the amount of sustance in a unit, per volume of substance. Below you can see the density equiation and the table with Milk Density values, inluding those for whole, semi-skimmed, and skimmed milk, depending on temperature. What makes the question of density per unit of weight tricky, is the fact density changes depending on the temperature and pressure [11].

Skim Milk Powder. Skim Milk Powder (SMP) is the product resulting from the partial removal of fat and water from pasteurized milk.

CONCLUSION. From this article, it was concluded that we were able to quickly determine the content of 3 different types of milk using the AKM-98 milk analyzer. In doing so, we have achieved time, energy savings, no need for other redundant equipment and other conveniences. Firstly, the main purpose of determining the content of such milk is that in order

to make quality cheese, we need to have a good milk content and high in protein, low in water. Secondly, dairy companies determine the fat content of milk and the amount of water in it and set the price accordingly, while this device is more convenient and economical than others.

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