



Detection of Counterfeit Milk by Modern Methods

Iroda Salimova*¹ and Noila Salimova²

¹Researcher Institute of Veterinary Medicine of Samarkand Uzbekistan

²Student Institute of Veterinary Medicine of Samarkand Uzbekistan

*Corresponding author: Iroda Salimova, Researcher Institute of Veterinary Medicine of Samarkand Uzbekistan

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Annotation

In recent years, the range and production of milk and milk drinks in Uzbekistan has increased significantly. On the market for milk and dairy products, which are in stable demand, there are hundreds of its names, and many of them are actively advertised. The methods of milk falsification have practically not changed over the past 2-3 years. However, new methods have emerged to identify counterfeit products. This should assist the manufacturer in identifying low-quality raw materials. Manufacturers must also clearly understand what operations will put them on the line of counterfeiters. Today, problems with a comprehensive examination of the authenticity of all types of milk and milk drinks are very urgent. Preventing counterfeiting of dairy products is one of the most pressing problems of our time, which worries governments of different countries, producers, sellers, public organizations and, of course, consumers. The purchase of counterfeit dairy products is associated for consumers with a certain risk to their life and health. In modern market conditions, both strict production control carried out by the manufacturer and state supervision must be carried out using modern highly sensitive methods of analysis, which make it possible to detect not only contaminants, but also possible falsification of dairy products. Over the past 15 years in the Republic of Uzbekistan, a modern system of analytical research methods has been developed to ensure control over both safety indicators and quality indicators of dairy products, which are based on modern analytical technologies. The use of innovative methods for detecting milk falsification is focused on the stable development of production, solving the problem of food security, obtaining high quality food products.

Keywords: Milk; Falsification; Milk Pasteurization; Whey Proteins; Casein; Products; Stabilizing Additives; Milk Fat

Introduction

The methods of milk falsification have practically not changed over the past 2-3 years. However, new methods have emerged to identify counterfeit products. This should help the manufacturer identify low-quality raw materials. Manufacturers should also clearly understand what operations will put them in a number of counterfeits [1]. At the moment, two large groups of falsification can be distinguished - falsification of the composition (mainly - falsification of raw materials) and quality falsifications. Among the latter, there may be an attempt to hide quality defects, including production problems, the absence of a "cold chain". These groups are joined by a group that unites the falsification of product properties, which, in fact, is close to falsification of the composition. For example, cottage cheese is produced that has a low protein content and an increased moisture content, for binding of which and giving the cottage cheese a characteristic consistency, moisture-binding additives are used. Falsification of the composition is largely caused by the need to reduce costs. This applies equally to both products and raw materials. For the falsification of raw materials, dry dairy products are often used - dry cheese and even curd whey. The prime cost of whey is low, so it is an ideal means of reducing the price.

Counterfeiting of products is the use of certain stabilizing additives, for example, in the production of fermented milk products [2].

To ensure the stable sale of products, it is necessary to comply with three indicators: the products must be tasty, high-quality and natural. Therefore, the identification of counterfeits is a top priority. The falsification of quality also includes various methods of deoxidizing raw milk. For deoxidizing raw milk, soda, ammonia are used less and less often, the addition of stabilizing salts, which are also used in the production of sterilized products and processed cheeses, is much more often used. Moreover, falsification of raw milk is possible by adding reconstituted milk, replacing milk fat on vegetable fat. When falsifying with reconstituted milk and replacing fat with vegetable, mechanized methods of recovery are used, for example, homogenization or dispersion [3]. Undoubtedly, the use of reconstituted milk is regulated by economic expediency - the cost of reconstituted milk should not exceed the cost of raw milk. All of these counterfeits are present to varying degrees, and they are all currently being recognized. There are also more harmless ways of falsifying raw milk. The use of soy isolate is difficult to prove, but it is not economically justified, since it has

a cost higher than the cost of casein. The addition of soy flour, as a rule, is carried out when falsifying milk powder by dry mixing. With such falsification, equipment malfunctions begin - heat exchangers, separators, etc. become clogged. The introduction of foreign proteins is a gross falsification and is easily recognized. Soy flour in milk forms a sedimentation unstable suspension compared to the casein-calcium-phosphate complex of natural milk. In a milk sample with such falsification, a sediment immediately forms during centrifugation with a sufficiently high load. Sludge volume exceeding 0.8% indicates falsification [4,5].

For the purpose of counterfeiting, demineralized whey that has undergone electro dialysis treatment is used. Whey proteins, which are in excess in relation to the casein fraction (the natural ratio is 1: 3), are unstable to heat [4]. So, when trying to pasteurize milk falsified with whey, coagulation and coagulation of whey proteins occurs. So, the alcohol test when using a mixture of 15% demineralized curd whey cannot be "pulled" even by 72. Therefore, curd whey is not widely used for these purposes. Cheese whey is used much more often, especially in the production of sweetened condensed milk. It is known that for everyone region, the content of macro- and microelements and their the ratio in raw milk is constant. If they are violated, it is necessary to determine whether raw materials from another region are used or whether falsification has been carried out. However, the parameters of naturalness are the same for all regions of the world, regardless of the breed of cows, feed, etc. The protein content of milk is a key parameter. On the one hand, the protein content is a parameter that determines the cost of milk, on the other hand, it is an object of falsification. That is why the Technical Regulations specify the minimum protein content for each dairy product and raw milk. Therefore, for example, COM with a protein content of 29% may indicate a possible falsification. Whey may be a counterfeit additive or very rarely, flour or chalk powder. Determination of total protein by the Kjeldahl method or the Dumas method allows you to quickly determine naturalness product in terms of protein content [4]. The Dumas method makes it possible to measure the nitrogen content directly. In practice, chromatography takes place. The method is used for total control or when a quick analysis is required, for example, when normalizing milk mixtures for the production of yoghurts. At the same time, the analysis dairy products of any consistency can be exposed: liquid, pasty, solid, etc.

The analysis time is 5 minutes, and calibration is required. The ratio of casein to the amount of whey proteins in raw milk (75: 25) and in heat-treated milk is different. The ratio of coagulating proteins minus the total of whey proteins to the total of proteins at pH 4.9 is called the thermal class of the product. When raw milk is falsified with milk powder or a product that has undergone heat treatment, in which part of the whey proteins is denatured, the heat class indicator increases to 80-85 and even to 90. The following conclusions can be drawn: milk was either reconstituted or pasteurized. Sterilized milk has an indicator thermal class more than 92, pasteurized milk - 82-86. Thus, a tool for differentiating the product by the level of heat treatment appears. The thermal class can also be used to differentiate hard, semi-hard, soft cheeses.

Determining the presence of reconstituted milk comes down to determining the thermal class of a particular product. In practice, it is determined protein content in whey and total protein in the product, and then the calculation is carried out according to the formula, in the numerator of which is "Total protein content" minus "Whey protein content", in the denominator - "Total protein content". Establishment of the fact that the thermal class of the product does not match requires further analysis of the product for falsifications.

The analysis of the composition of whey proteins is not an integral method, but an individual one, which makes it possible to judge the nature of falsification. This method is gel permeation chromatography. When proving falsification, it is necessary to use several methods to eliminate errors. In the process of drying milk (when exposed to a temperature of about 190°C and the moisture content of the product reaches less than 40%), unique markers appear - proteins that are formed only during drying. Determination of their presence is confirmation of the fact of product falsification with milk powder. This method will soon be patented, but has not yet been tested and registered, therefore it is working method of internal control. Sample preparation is simple, the speed is high. The disadvantage is the high cost of chromatographic columns. The method is quite simple, convenient and recommended for use at large enterprises. The anionic composition of milk is rich primarily in phosphates and chlorides. The deviation of the level of their content from the norm also indicates falsification. The degree to which serum tampering is determined depends on the level of demineralization. With a demineralization level of 90%, the cost of whey is so high that the question arises whether it is advisable to use it. Determination of falsification with serum at a demineralization level of 50% is not difficult. It is known that the chloride content in milk is 500-700 mg / l, therefore, with a chloride content of 0.3-0.4%, falsification is obvious, which will lead to disruption of technological processes. In milk, there is an ionic process of interaction of a colloidal solution (casein-calcium-phosphate complex) with a true solution (salt solutions), and if the concentration of the true solution is higher than normal, this leads to irreversible changes in the casein-calcium-phosphate complex. Lactates are present in all fermented milk products. A high level of lactate content (500 mg / l at a rate of up to 100 mg / l) also indicates milk falsification. In raw milk, a high lactate content leads to the formation of "cereals" (large protein aggregates) during fermentation.

Today, it is not uncommon for the production of dairy products to replace milk fat with vegetable fat. The production of such products is regulated by law, and special terminology is used to name them. However, there are facts of falsification of the fatty acid composition of milk. Gas chromatographs of both foreign and domestic production are used for the determination. Modern substitutes for milk fat are of high quality, characterized by the presence of both hydrogenated and non-hydrogenated fats, and a low level of trans isomers. They can be detected on a gas chromatograph, but they can be proved presence is difficult. However, the content of some fatty acids can be indicative of the presence of vegetable fat. Gas

chromatography-mass spectra are used for their identification [5]. The analysis time is about 1.5–2 hours. A simple and quick method is required to receive milk. This method is spectral analysis of the fat fraction solution in the UV range. The basis of the method is the specific absorption of the phospholipid membranes of the fat globules of milk and its absence in the case of vegetable fat. Determination of the naturalness of milk is carried out using the method of spectral analysis. Milk with a volume of 2 ml is introduced into a centrifuge tube and added with hexane to 50 ml, shaking vigorously. The mixture is centrifuged at 8000 rpm for 10 minutes. The resulting mixture is poured into a quartz cuvette and the spectrum is recorded on a spectrophotometer (SCAN program) in the range from 200 to 400 nm. Natural milk should have a certain kind of spectral curve. The method is simple, quick and reliable as a “first step of defense” against counterfeiting with vegetable fats. Thus, the risks posed by food counterfeiting are currently a particular problem. An example of this is the use of melamine in the production of dairy products in order to hide the lack of protein in the product, which can have a direct negative impact on the health

of the population. The falsifications associated with the substitution of some types of dairy products for others that are less valuable from both food and financial points of view also cause significant concern. This requires further government efforts to develop new methods for the identification of food products.

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