A STUDY ON DETECTION OF CHEMICAL ADULTERATION IN PACKED MILK

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ABSTRACT

Background: Milk is a valuable source of essential nutrients that fulfill the dietary requirements of the human body. However, the addition of adulterants in significant quantities is prevalent to prevent spoilage, which poses a serious health risk. The objective of this study was to analyze packed milk samples in Nangarhar, Afghanistan to assess the presence of adulterants.

Keywords: Milk, Urea, Starch, Sugar, and Adulteration.

INTRODUCTION

Milk is a highly nutritious food containing essential nutrients such as casein and lactose that are important for the body. However, milk can be adulterated with various substances like starch, urea, and cane sugar, which significantly decrease its value. Consumption of adulterated milk poses health risks and can lead to illnesses (Afzal et al., 2011). Adulteration refers to the addition of substances that render a product unsuitable for consumption. Adulterants are added to increase quantity (FAO/WHO, 2003). The addition of adulterants to milk is prevalent in developing and underdeveloped countries due to the lack of proper strategies and timely monitoring during milk processing (Xin & Stone, 2008).

For instance, urea is used to enhance the stability and whiteness of milk, but it can cause acidity, indigestion, ulcers, and even cancer in consumers. Consuming adulterated milk also negatively affects the heart, liver, and kidneys (Kandpal et al., 2012). Starch is added to milk to increase the solid-not-fat (SNF) content. Excessive consumption of starch-adulterated milk can lead to diarrhea and may prove fatal for diabetic patients (Sukumaran & Singuluri, 2014). Moreover, excessive starch intake can contribute to obesity (IMNA, 2005). Sugar is mixed into milk to enhance its solids content, excluding lipids (Reddy et al., 2017). Additionally, sugar is used to increase the carbohydrate content and thickness of milk (Sharma et al., 2012).

In Afghanistan, where agriculture and livestock play a significant role, people consume milk and meat products from various animals such as cattle, buffalo, sheep, goats, and camels. While these products alone do not meet their immediate needs, packed milk is imported from neighboring countries. Unfortunately, the milk entering the country from these neighboring sources is not subjected to any examination. Consequently, the presence of adulterants in milk has become a major issue for the dairy sector in Afghanistan, resulting in economic losses for the processing industry and potential health risks for consumers. Hence, this research aims to evaluate the adulteration levels in the well-known packed milk samples mentioned above within the Nangarhar province.

MATERIALS AND METHODS

GENERAL CONSIDERATIONS: Sixty-three samples from three kinds of packed milk (MILK PACK, TARANG, and EVERY DAY), each of 250 ml packed milk were collected which are purchasing in Jalalabad city. From each kind of them we randomly took twenty-one samples which were brought for analysis into the Dairy Test Center, Livestock Management Department, Veterinary Faculty, and Nangarhar University in Afghanistan. Each sample was observed for the detection of various adulteration. Various milk adulterants like starch, urea, and cane sugar were detected by using the following procedures.

Identifying Urea in Milk

Method: Dimethylaminobenzaldehyde & Trichloroacetic Acid are used.

Reagent: Dimethylaminobenzaldehyde (DMAB), Ethyl alcohol, Concentrated HCL, and Trichloroacetic acid (TCA)

Procedure: About 5 ml of Para Dimethylaminobenzaldehyde (16%) is added to a 5 ml sample of milk and is mixed well. If the color of the solution turns clear yellow, then it indicates that the sample of milk is

adulterated with urea. Otherwise, pale yellow is the natural color of the milk (Arvind et al., 2012).

Identifying Starch in Milk

Method: Iodine (Without a heated milk sample) is used.

Reagent: Potassium iodide and Iodine crystal

Procedure: About 3 ml of milk as a sample is taken in a test tube. After thoroughly boiling cool it down to room temperature. Then need to add 2 to 3 drops of Iodine (1%) solution. If the color of the solution appears blue, it indicates the presence of starch in milk (Singh et al. 2012; Kumar et al. 1998).

Identifying Cane Sugar in Milk

Method: Seliwanoff's Reagent is used.

Reagent: Resorcinol and Concentrated Hydrochloric Acid (HCL)

Procedure: About 5 ml of milk is taken as a sample in a test tube. Then 5 ml conc. HCL and 0.1 g resorcinol are added. After that test tube is placed in a water bath for 5 min. If it appears red color, it indicates the presence of added sugar (Kamthania et al. 2014).

RESULTS

The Milk samples from various milk shops in Jalalabad city were collected and identified the existence of adulterant additives. The result indicates that packed milk which is imported from neighboring countries, particularly from Pakistan has low quality. Generally, 44.44% of Milk samples were positive for Adulterants (urea, Starch, and Cane sugar) in packed milk (MILK PACK, TARANG, and EVERY DAY). 33.3% of Milk samples were positive for Adulterants (urea, Starch, and Cane sugar) in TARANG. 66.6% of Milk samples were positive for Adulterants (urea, Starch, and Cane sugar) in EVERY DAY. 33.3% of Milk samples were positive for Adulterants (urea, Starch, and Cane sugar) in MILK PACK. The complete result is further displayed in Table 1.

Table 1: shows the exact result of Adulterants (urea, Starch, and Cane sugar) in packed milk

Numbers	Milk	N. samples	Adulterants (urea, Starch, and Cane sugar)	Percentages of the positive samples
1	TARANG	21	+	33.3%
2	EVERY DAY	21	+	66.6%

3	MILK PACK	21	+	33.3%
4	Total	63	+	44.44%

Identifying chemical adulterants into 3 kinds of packed milk samples revealed that cane sugar was present in EVERY DAY and TARANG milk samples respectively 100% and 100% while urea was present in MILK PACK and EVERY DAY milk samples respectively 100% and 100%. In this research, we have not seen a positive sample for starch (Table 2).

Table 2: Identifying various chemical admixtures in packed milk

Numbers	Milk	N. samples	Urea	Percentages of the positive samples	Starch	Percentages of the positive samples	Cane sugar	Percentages of the positive samples
1	TARANG	21	-	0%	-	0%	+	100%
2	EVERY DAY	21	+	100%	-	0%	+	100%
3	MILK PACK	21	+	100%	-	0%	+	0%

Table 3 demonstrates the percentage of adulterants in the packed milk samples that were collected from Jalalabad city. Urea and cane sugar were found in packed milk samples at 66% and 66%, respectively. There was no recognized sample for starch adulteration.

Table 3: Identified Adulteration in packed milk, collected from Jalalabad city

Number	Adulteration	Percentages of the positive samples
1	Urea	66.66%
2	Starch	0%
3	Cane sugar	66.66%

DISCUSSION

In the present study, a total of 63 samples of packaged milk were examined for the presence of urea. The findings indicated that 66.66% of the samples tested positive for urea, which contrasts with the results reported by Sukumaran & Singuluri (2014), Rai et al. (2020), Makadiya & Pandey (2015), and Swetha et al. (2014). These studies reported positivity rates of 60%, 71%, 100%, and 1.08% respectively. Roy et al. (2017) also conducted a study on packed milk samples and found the presence of urea. Similarly, Yang et al. (2020) and Sinha (2012) obtained similar results in their respective studies.

However, in this current study involving MILK PACK, TARANG, and EVERY DAY milk, positive samples for urea were observed. Awan et al. (2014) completed a research study and identified the presence of cane sugar in their examined packed milk samples. This finding was also supported by Yang et al. (2020), whereas Makadiya & Pandey (2015) reported a moderate percentage (50%) of cane sugar adulteration in packed milk. Our study results also showed the presence of cane sugar adulteration (66.66%). However, the presence of cane sugar in packed milk was not identified by Swetha et al. (2014).

Furthermore, our current research demonstrated that all the identified packed milk samples were free from starch adulteration, aligning with the findings of Swetha et al. (2014), Awan et al. (2014), and Makadiya & Pandey (2015). However, the presence of starch in packed milk samples was recognized by Yang et al. (2020).

In this context, Barham et al. (2014) conducted a study where they identified various substances in milk samples, including water, detergent, cane sugar, caustic soda, rice flour, sodium chloride, skimmed milk powder, hydrogen peroxide, starch, formalin, urea, vegetable oil, boric acid, ammonium sulfate, glucose, sorbitol, and arrowroot. The percentages of these adulterants were as follows: water (73%), detergent (32%), cane sugar (22%), caustic soda (20%), rice flour (17%), sodium chloride (15%), skimmed milk powder (15%), hydrogen peroxide (13%), starch (12%), formalin (11%), urea (10%), vegetable oil (10%), boric acid (8%), ammonium sulfate (6%), glucose (5%), sorbitol (4%), and arrowroot (1%) (Barham et al., 2014).

However, contrary to the findings of Barham et al. (2014), our study observed a higher percentage of positive samples for both urea and cane sugar, with 66.66% positive for each. Additionally, our study did not identify the presence of starch. Another study conducted by Weqar et al. (2021) in Jalalabad, Afghanistan, found additional adulterants in EVERY DAY, TARANG, and MILK PACK packed milk samples. Our study results align with theirs, showing the presence of adulterants such as urea and cane sugar in EVERY DAY, TARANG, and MILK PACK-packed milk samples.

CONCLUSION

Some milk-producing companies add chemical elements to packed milk in order to prevent spoilage and increase the volume, despite the harmful effects on the human body. Typically, water is used to increase the volume of milk, thereby reducing its quality. To counteract this, various chemicals such as urea, sugars, starch, and formalin are added to artificially increase the density of the milk. This research analyzed the findings of

packed milk samples in Jalalabad, Afghanistan. The scientific study revealed that approximately 44.44% of the tested packed milk samples were found to be adulterated with one or more of the investigated adulterants. Adulteration was more prevalent in EVERY DAY packed milk samples compared to TARANG and MILK PACK. Urea and cane sugar adulteration were observed to be higher than starch adulteration in all three types of packed milk samples. Conducting a qualitative study could help determine the concentration of these adulterants and differentiate the milk quality among the different brands. The presence of numerous adulterants decreases the value and quality of milk, which can have severe negative effects on human health. Implementing a regular monitoring system is crucial for ensuring milk quality control. Therefore, the government must take effective measures to combat this malpractice.

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