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BOVINE MILK;
CHEMICAL ANALYSIS OF RAW BOVINE MILK IN DISTRICT PESHAWAR

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ABSTRACT… Introduction: Milk and dairy products are consumed by the human on daily basis throughout the globe and constitute a huge business by the dairy farmers due to its high demand. The consumers of milk and milk products expect its high quality, free from the artificial preservatives and threatening agents. **Objectives:** To determine the chemical quality of raw bovine milk sold in open markets of district Peshawar. **Study Design:** Cross-sectional study. **Setting:** 4 towns, Town 1(Sikandar Town and Gul Bahar) ,2 (Shahi Bala,Methra and Pajjagi),3 (University Road and Hayatabad Area), 4 (Hazaekhawani and Badabair Area) of district Peshawar. **Period:** 6 months; from November 2016 to April 2017. **Methodology:** 158 samples were selected. All samples were analyzed for adulteration in the Public Health Laboratory phase 5 Hayatabad Peshawar. Study duration was 6 months; convenient sampling technique has been followed. **Results:** Among all 158 samples; 32.3% of the sample were adulterated with water. 8.9% of sample showed hydrogen per oxide adulteration. Starch, cane sugar and urea adulteration was in 7.6%, 2.5% and 1.9% samples respectively. Vegetable oil, formalin and synthetic milk adulteration was in 1.9%, 5.7% and 5.7% of samples respectively. We have Large Scale Vendors i.e. Rural Area 10% showing low and Urban Area 90% as high adulteration, Small Scale Vendors 30% low in rural Area and 70% high adulteration in urban area respectively. **Conclusion:** This study results provided a base line data of chemical composition of bovine milk used in Peshawar. Chemical were present and can play key role in alteration of milk which we use on daily basis. Water content was high, it means that most of the shop-keepers prefer to mix water in milk to increase the quantity of milk. Use of starch, Vegetable Oil and Formalin was minimal. Use of hydrogen peroxide, Urea and synthetic milk was very less in provided sample.

Key words: Adulteration, Chemical composition, Bovine milk, Pakistan

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Milk and its elements with high general potential, advanced supporting respects and without flourishing dangers and risks are all around requested dietary purposes.[1,2] The presence of adulterants in the raw milk can lead to an unpleasant taste and derangement of the physical properties of the milk. It not only reduces the nutritional quality of the milk but consumption of such contaminated milk threatens health of the society as well.[3,4] On an average, bovine milk is composed of 87% water, 4-5% lactose, 3% proteins, 3-4% fat, 0.8% minerals, and 0.1% vitamins with pH ranging from 6.4 to 6.8. [5] In Pakistan, the major concern is the adulteration of milk by the supplier which not only disturbs the natural taste of the milk but also compromised its nutritional quality and enhances the risk of harmful pathogens.[6] In an examination of bovine milk from Mirpurkhas Pakistan, 73% of the amassed debilitate tests were ruined with water taken after by high rate of chemicals, good 'ol fashioned sweetener, acidic pop, rice flour, skimmed deplete, hydrogen peroxide and even formalin.[7,8,9]

Milk as a raw material has a relatively short shelf life but it can be prolonged by heat treatment, which is an essential steps adopted by the dairy industry, heat treatment of milk during commercial processing not only inactivates the microorganisms but also results in a number of physio-chemical changes in the milk constituents.[10] Pasteurization is widely used to prevent infected milk from entering the food

supply. However, raw milk is not pasteurized.

Cane sugar

Sugar loosely refers to a number of carbohydrates, such as mono-saccharides, disaccharides, or oligosaccharides. Mono-saccharides are also called "simple sugars," the most important being glucose. Glucose has the molecular formula $C_6H_{12}O_6$.[11]

Pure Water is colorless, transparent, odorless liquid and is basic liquid for life. The water is icecaps and glaciers 69% and 31.1% is ground water.[12] Water is a liquid at the temperatures and pressures that are most adequate for life.[12]

Synthetic milk is the chemically produced milk that differs from the animal milk. It is manufactured by mixing the predefined and calculated amount of urea, caustic soda, refined oil and common detergents.[13]

Hydrogen peroxide is a chemical compound with the formula H_2O_2. In its pure form, it is a colorless liquid, slightly more viscous than water. Hydrogen peroxide is the simplest peroxide (a compound with an oxygen–oxygen single bond.[14]

Starch is polysaccharide carbohydrate and is rich source of energy, found in large amount in potato, wheat, maize and rice.[15]

It is a colorless, odorless solid, highly soluble in water, Urea, also known as carbide, is an organic compound with the chemical formula CO(NH2)2. This amide has two –NH2 groups joined by a carbonyl (C=O) functional group.[16]

A vegetable oil is defined to plant oil that are liquid at room temperature.[17]

Formalin is colorless solution of formaldehyde in water, used chiefly as a preservative.[18]

METHODOLOGY

Samples are selected from different town of district Peshawar. Town 1 included shops from Sikander town and Gulbahar. Town 2 included shops from Shahi Bala, Mathra and Pajjagi. Town 3 included University road and Hayatabad area. Town 4 included Hazar Khwani and Badbare area. All samples were analyzed in the Public Health Laboratory phase 5 Hayatabad Peshawar. A Cross-sectional study is carried out for estimation. Peshawar is the most populous district of Khyber Pakhtunkhwa with an estimated population of about 3,575,000 as of 2014. There are a total of four administrative towns in Peshawar. Samples were collected from four towns both from rural and urban areas located in Peshawar. This study was completed in 6 months time period. Convenient sampling technique has been followed.

Inclusion Criteria

Shops selling Open market milk in district Peshawar

Operational Definition

Large-Scale Vendor

Small-Scale

Agents in the present study handled less than 200 litres of raw milk daily, use a motorbike as transport and plastic jerry cans to hold the milk. The definition Small Scale agents include hawkers by foot. 38 Considered as unprocessed bovine milk sold in open markets of District Peshawar;

Chemical Analysis

The collected samples will be analyzed in the biochemistry laboratory to detect the presence of detergents, cane sugar, water content, synthetic milk, hydrogen peroxide, starch, urea, vegetable oil, detergent and formalin.

Rural Area

A rural area or countryside is a geographic area that is located outside towns and cities.

Urban Area

An urban area is a human settlement with high population density

DATA COLLECTION PROCEDURE

The research has been executed after approval was obtained from the relevant technical and ethical boards of the institute. Milk samples were collected from the sampled vendors. The sample collected by the researcher by presenting as a

customer to the market to avoid any conflicting situation. Purchase of minimum 500ml of milk has been carried out. The collected sample of milk were transported in the same container (polythene bag) as handed over by the milk vendor. The samples were transported in an ice box to the laboratory within 2 hours of its collection. The collected samples were then analyzed for their biochemical content.

DATA ANALYSIS PROCEDURE

The qualitative chemical analysis for adulteration of milk with respect to presence of detergents, cane sugar, water content synthetic milk, hydrogen peroxide, starch, urea, vegetable oil, and formalin was carried out. Association of location and type of Vendor [Large scale, Small scale Vendor] with the adulteration of milk has been done through chi-square test. Data was analyzed using S.P.S.S version 20 for windows. Data was quantitative so it was calculated as Mean ± S.D. For rural and urban areas comparison independent sample t-test was also applied. Total 158 samples were taken, in which 40 samples are taken from each of four town (s) in district Peshawar, which were analyzed in public health department Peshawar. Results of the analysis have been given below.

RESULTS

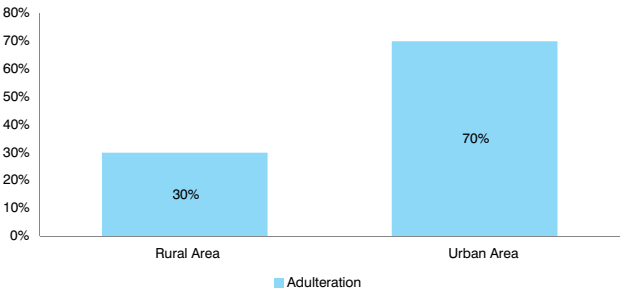
Descriptive Statistics			
	N	Mean	Std. Deviation
Cane Sugar	158	1.9747	.15758
Water Content	158	1.92132	.46903
Hydrogen Peroxide	158	1.9114	.28508
Starch	158	1.9241	.26576
Urea	158	1.8544	.35380
Vegetable Oil	158	1.9809	.13734
Formalin	158	1.9427	.23321
Synthetic Milk	158	1.9228	.21112
Valid N (listwise)	158		

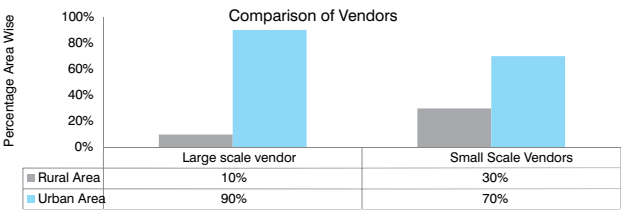
Concentration of chemical adulteration of milk in rural and urban Vendor.

In above table, milk comparison Adulteration of Milk 30% in Rural Area and 70% in urban respectively.

Concentration of chemical adulteration of milk in Large Scale & Small Scale Vendor

In above table, we have Large Scale Vendors i.e. Rural Area 10% and Urban Area 90%, Small Scale Vendors 30% in rural Area and 70% in urban area respectively.





Adulteration in Percentage

As per above table, we have 158 samples; Cane sugar adultered milk which shows the 2.5 % response of the whole sample, 97.5% shows no adulteration in remaining response. Water content shows 32.3 % of the whole sample, 67.7% shows no adulteration. Hydrogen Peroxide shows the 8.9 % adulteration, 91.1% shows no adulteration. Starch has adultered milk 7.6 % and 92.4% showed no adulteration.

Urea shows 1.9 % of adulteration, 97.5% response showed no adulteration. Vegetable Oil shows the 1.9 % of adulteration while 97.5% shows no adulteration response of the whole sample for vegetable Oil. Formalin Showing 5.7 % adulteration in milk 93.7% showed no adulteration. Synthetic milk shows 5.7 % adulteration and 93.7% showed no adulteration. Adulteration of Milk 30% in Rural Area is low and 70% in urban is high respectively. Large Scale Vendors i.e. Rural Area 10% showing low adulteration and Urban Area 90% showing high adulteration, Small Scale Vendors 30% showing low adulteration in rural Area and 70% showing high adulteration in urban

area respectively.

Chemical Wise Adulteration in Percentages		
Chemicals	**Showing effect of Adulteration %**	**No effect of Adulteration %**
Cane Sugar	2.5	97.5
Water content	32.3	67.7
Hydrogen peroxide	8.9	91.1
Starch	7.6	92.4
Urea	1.9	98.1
Vegetable Oil	1.9	98.1
Formalin	5.7	93.7
Synthetic Milk	5.7	93.7
Area Wise Adulteration in Percentages		
Rural Area - Adulteration	30	
Urban Area- Adulteration	70	
Large Scale Vendors-Rural	10%	
Large Scale Vendors-Urban	90%	
Small Scale Vendors-Rural	30%	
Small Scale Vendors-Urban	70%	
N=158		

DISCUSSION

This study was carried out to find the adulteration of raw bovine milk with cane sugar, hydrogen peroxide, starch, urea, formalin and synthetic milk at district Peshawar. In this study district Peshawar was divided into 4 main towns. Total sample size was 158, 40 samples have been taken from each town, 20 from Large scale and 20 from small scale vendors. In these 158 samples overall 79 samples are taken from large scale vendors and 79 have been taken from small vendors. These samples were chemically analyzed in public health lab. Mean concentration of cane sugar 7.48%, hydrogen peroxide 11.42%, starch 9.45%, urea 6.47%, formalin 4.2%, synthetic milk 5.44% and water content 9.41%. A study has been carried out in Kenya with collaboration of department of microbiological Swedish University of Agricultural Sciences which shows30% of adulteration of milk sample. Preservatives and extra adulterated water was detected in this study. This kind of adulteration is done for earning more money in developing countries. Lack of hygiene and carelessness in storing, transporting and processing of milk also causes adulteration of milk in underdeveloped countries.

32.3% of the milk samples were adultered with water, thus showing water as most common adulterant in milk in order to increase quantity. Although natural milk 87% of water but still milk with added water is very major and common issue in Pakistan. Addition of water is a cheap way of adulteration in milk.

The second most common adulterant is hydrogen peroxide 8.9% of the samples were adultered with hydrogen peroxide. It is used as preservative in order to increase the shelf life of the milk.

Starch is also used as adulterant. 7.6% of samples were adultered with starch. On adding water in order to compensate the density and cohere and to make it more acceptable by consumer additional chemical were added in which starch is used.

Moreover consumer buys and uses open market raw bovine milk with chemical preservatives and added water which affect the nutritional value of milk and ultimately effect the health of consumer; reduces immune system of their body as well as increases the risk of diseases. Finally, addition of such kind of elements is highly un-acceptable, illegal and condemnable and should be banned with immediate effect. Govt. and legal authorities should take serious actions against such kind of activities. The potential health risk is associated with the production of natural milk in shops. Present transporting system and methods used by these shop keepers and milk dealers/sellers are not suitable as per the standard. Milk Farmers are not using suitable machinery, safe transport and new technology of preserving milk.

LIMITATIONS

Due to financial and time limitation it was not possible to collect maximum number of samples as sample; therefore we have only 158 from the sample location of the study. Certain other dangerous chemicals can be used but we have

used only these chemicals due to financial constraints.

Shop keepers as samples were reluctant to share information about adulteration of milk, due to legal obligations.

CONCLUSION

This study provided a base line data of chemical composition of bovine milk used in Peshawar.

Water content were highly present, it means that most of the shop-keepers prefer to mix water in milk to increase the quantity of milk.

Use of starch, Vegetable Oil and Formalin was shown on very minimal basis.

Use of hydrogen peroxide, Urea and synthetic milk was absolutely very less in provided sample.

Concentration of these chemicals varies according to shop owner, location of the shop and buyers of the milk respectively.

RECOMMENDATIONS

Further studies should be done in this regard with bigger sample size.
All other chemical which can cause effect in adulteration of milk can be studied in detail.

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If you believe the doubts in your mind
you won't achieve the dreams in your heart.

– Marinela Relia –

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Shafqat Ullah	Designed study, collect data, analysed data, edit all drafts of paper.	
2	Dr. Naheed Mahsood	Helping in generation of idea, developed methodology for datacollection and analysis.	
3	Dr. Ayesha Imtiaz	Edited all drafts.	
4	Dr. Amir Hamza	Edited all drafts including final draft.	