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Research Article

Milk Adulteration and Its Impact on Public Health: A Study of District Layyah, Pakistan

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Abstract

Adulteration of milk is a serious problem all over the world. This issue is found in Pakistan as well. This endeavor was taken in order to evaluate the information about milk adulteration among customers in urban regions and to look at the health consciousness level about milk adulteration. This survey was done by the participation of 385 respondents from district Layyah by using simple random sampling technique. Analysis shows that milk adulteration and health awareness relationship was found. Researcher concluded that people knew that milk is adulterated by water and it has some negative consequences on the health of people but people have no Idea how to detect milk adulteration.

Key word: Milk adulteration, health awareness, fraud techniques

Introduction

Milk is a part of the diet for people since the dawn of humanity. It is very nutritional, including vital elements such as energy-giving lactose and fat, bone-forming calcium and other minerals, body-building proteins, and health-promoting vitamins, all of which are necessary for the growth of people of all ages (Hoppe et al., 2006).

Cow's milk should be offered to kids after a particular age, such as before age of 12 months in the United Kingdom and the United States, progressively from the age of 9 months in Canada and Denmark, as well as from the age of 10 months in Sweden. In the nutrition of babies, milk and milk formula play a significant role as a source of power. In underdeveloped nations, bottle-fed porridges made with cow's milk and different grains are a frequent supplementary meal.

Pakistan manufactured 42.199 million tonnes of milk in 2007-2008, with buffaloes contributing 62.17 percent, cows 34.21 percent, and sheep, goats, and camels jointly contributing 3.60 percent. Using this percentage, the per capita accessibility of milk for human usage was projected to be 182 litres per year, with 80 percent required for human intake in fluid form (market milk) or in the shape of dairy products, 15% spillage based on traditional and unsubstantiated milk managing, processing, and advertising, and 5% milked to calves (Athar et al., 2003; Anonymous, 2008).

Contrary Just after United States, Russia, and India, Pakistan is the fourth - highest milk producer (Farooq, 2011). The majority of milk is delivered raw on a traditional basis (Lateef et al., 2009). However, milk quality is rarely sustained at the customer level due to disorganised and unregulated marketing channels (Javaid et al., 2009). Tampering of milk has been identified as among the most important challenges confronting Pakistan's dairy sector today, resulting in not only significant financial damages for the processing industry but also a significant health hazard for customers.

Furthermore, some adulterants, such as soap, are utilised to improve the cosmetic quality of milk. As water is absorbed to milk, it loses its frothy look; thus, soaps are used to artificially provide milk a frothy look. Hair-removing powders and urea are used to whiten milk and give it a more natural appearance. Only a few grammes of urea are required to restore milk to its natural condition (Walker et al., 2004).

Milk production in relation to seasonal fluctuations:

Despite the fact that milk is manufactured all year, milk market forces in Pakistan are linked to seasonal variations. During the winter months of January to April, milk output is often high, but demand is lower.

Milk supply, on the other hand, is lower throughout the summertime of May through August. In Pakistan, there is also a feed scarcity at the moment. because of Extreme temperatures, milk and milk items consumption rises throughout this period. In mid-June, it is projected that the entire supply of milk would drop by half, and milk need will be at its peak for the season (Umm e Zia, 2006). To fill the gap between demand and supply, humans adulterate dairy by adding water, and then add different chemical compounds to preserve its constituent characteristics after diluting. Starch, urea, and sugar cane are examples of these compounds. Preservatives such as formalin, hydrogen peroxide, boric acid, and different antibiotics are also added to milk to extend its life span (Tipu et al., 2007).

Status of milk adulteration in some other countries:

Milk fraud is not just an issue in Pakistan; other nations also are affected by this immoral practise. Due to strong need and inadequate availability, milk merchants in China dilute milk. Then add artificial

powders to boost the protein content, inhibitors such hydrogen peroxide and gentamycin, and vegetable oils to boost the fat content. Only 20% of small-scale home farmers utilise antimicrobials preparatory to milking, resulting in significant microbial contamination of milk. Milk's shelf life is shortened as a result of this. The number of individuals with kidney stones rose as a result of the tainted milk (Gale and Hu, 2007).

One of the major issues in India is the premeditated contamination of food containing match ingredients. According to a 2011 assessment of fluid milk impurity in India, 68% of the samples examined carelessly prepared (n = 1791) were non-conforming (FSAAI, 2011). In other states, the level of disobedience remained at 100%. The study's deviance was found to be 31% in rural regions, with 81 percent of the samples being open (unpacked). In metropolitan areas, 69 percent of the testing were non-conforming (67 percent were free samples). Cleanser was found in 8% of the samples, which also included creamed milk powder (45%) and glucose (27 percent). All tests conducted in seven Indian locations were designed to be mixed. It demonstrates the extent of milk present frauds in India. The milk powder fraud has caused the most widespread epidemic of milk products fraud to date, with severe community fitness repercussions.

Milk adulteration and health of consumers:

Chemicals employed as solvents in milk have had the following impacts on customer health: Formalin induces vomiting, diarrhoea, and abdominal discomfort. Larger dosages may result in a drop in body temperature, shallow breathing, a weak irregular pulse, and unconsciousness. It also damages the visual nerve, resulting in sight. It is one of the most dangerous carcinogens (Gwin et al., 2009). Hydrogen peroxide causes stomach cell destruction, which can rise to gastritis, intestinal inflammation, and bloody diarrhoea (Murthy et al., 1981).

Because of the impact of unprocessed starch in the colon, high quantities of starch may produce diarrhoea. Its buildup in the body might be lethal for diabetic people. High levels of carbonates in the body may interfere with hormonal signals that control growth and reproduction (Rideout et al., 2008).

The current study intended to analyse customer awareness about milk adulteration in metropolitan areas, examine health consciousness levels about milk frauds, learn about the impacts of milk frauds, and recommend policy strategies to combat milk frauds.

Review of literature

This study looks at the malpractices of commercial fresh milk with water and starch in Khartoum state. Three hundred samples were gathered from Khartoum, Omdurman, and Bahri. To determine the quality of the samples, they were chemically inspected and evaluated. According to the findings, the spoilage in Khartoum state is caused by the addition of water (35.3 percent) instead of starch. The study suggested that milk marketing be regulated and governed by regulations that include the quality of the milk sold. Allocation, manufacturer and distributor endorsements, good laboratories, and skilled technicians to regulate quality and preserve customer health and economics. (Adam, 2009)

Milk is a healthy nutritious bovine product that is eaten by the most of the global population for consumption as well as via dairy products. Moreover, the process of adulterating milk always lowers its quality and may introduce dangerous chemicals into the dairy distribution chain endangering the health of consumers. Various cases of milk malpractices have been recorded across the world, with materials such as superfluous water, imported proteins, whey proteins, melamine and urea, vegetable or animal lipids, and

many minor components of milk fat being introduced as possible substances in dairy products (Poonia et al., 2017).

The use of a near infrared technique on milk products revealed that fat adulteration with as low as 3% foreign fat may be identified simply, quickly, and "nondestructively" for butter and margarine mixes. The current investigation was conducted in light of the newly increasing concern about the spoilage of natural milk with artificial milk. Manufactured milk is made by mixing vegetable oils with a suitable quantity of soap and urea. Electronic impedance spectroscopy was used to examine samples of real milk and manufactured milk. At 100 kHz and 8 °C, analysis confirmed a statistically significant variation in conductance (G). The experimental findings for a laboratory-fabricated sample are given. (Sadat, Mustajab and Khan 2006)

The Milk Technological Lab, National Agriculture Research Centre (NARC), Islamabad, Pakistan, undertook this research in 2005 to assess various buffalo milk samples from different dairy farms in Islamabad and Rawalpindi. The formation and fraud of these samples were investigated. There were no adulterants identified in these samples, according to the study. The statistical analysis revealed that the fat, protein, water, and ash compositions of these milk samples obtained from various locations differed substantially (p0.05). (Ayub et al., 2007)

Milk is an essential element of the daily nutrition of both pregnant women and growing kids. Milk is extremely essential owing to its high nutritional content and vital function in animal and human health. Contamination is used to either replace cheaper materials or to persuade the consumer that the item is more precious or of higher quality. Milk samples were also obtained from the Mess and Canteen of the Girls and Boys Hostel. The findings of this study emphasise the need of implementing enhanced sanitary standards and implementing efficient oversight across the manufacturing to distribution chain. Training and instruction are also required for all those involved in dairy production, trading, and manufacturing. (Kandpal, Srivastava and Negi, 2012)

The current study aims to examine the milk quality, spoilage, and mastitis disease in milk marketed in various Dehradun zones. A total of 100 arbitrary milk samples collected were gathered from dairy proprietors in Dehradun's 30 distinct districts. 100 samples were examined for physical looks, quality, adulterants, and postpartum infection. Mastitis illness was not found in any of the samples. Substances reduce the nutritional content of milk and may potentially create significant human health issues. (Nirwal, Pant and Rai, 2013)

Milk is a very useful meal that is easily digested. It contains nutrients that the body requires for optimal growth and upkeep. Dairy products are an important element of the food, and milk and other dairy products account for a sizable portion of our food budget. Milk is delivered from the point of manufacture to customers and processing factories in Pakistan by intermediaries known as "Gawalas." They do not maintain adequate sanitary conditions throughout this travel, resulting in a rise in the total bacterial count. They additionally adulterate milk with other substances such as urea, starch, flour, cane sugar, vegetable oils, detergents, and so on to improve their profit margin. To extend the shelf life of milk, different preservatives such as formalin and antibiotics are included. The nutritional content of milk is reduced as a result of this inclusion. These substances, preservatives, and medications in milk create significant health issues. (Afzal, Mahmood , Hussain and Akhtar, 2011)

Milk is among the most nutrient-dense and complete foods; it contains a complex mixture of fat, protein, carbs, minerals, vitamins, and other components distributed in water in droplet, colloidal, and liquid forms. It is high in lean protein, which contains all required amino acids, fat, particularly important fatty acids, and the majority of minerals and vitamins. Thus, milk serves as the primary nutrient in the human diet, particularly for youngsters. Milk products, including milk, have been linked to a variety of health benefits that go beyond their nutritional worth. Some of the frauds committed in the form of liquid milk include adulteration using water, neutralizers, and preservatives, which have a negative impact on human health. With the exception of adulteration, milk safety should be maintained in terms of infestation with dangerous bacteria. Milk's food safety has now been called into question. (Ojha et al. (2018)

In 2008, China experienced a melamine-contaminated powdered milk radioactivity scandal. So far, the primary effects have been urinary stone development in kids, as well as renal impairment and higher infant mortality. Despite the passage of eight years, food safety concerns continue to plague millions of Chinese people on a daily basis. To guarantee that such food safety issues do not reoccur, monitoring is necessary. Ongoing research focuses on the early identification of food industry misconduct, the processes by which these toxic chemicals cause illness, and how sickness may be avoided and managed effectively. Melamine experience renal emission, but is metabolized gradually and excreted mainly unmoved in the urine. Bladder melamine testing may be a quick and low-cost technique to determine melamine contamination in food. Even though most sufferers with melamine-related urinary stones (MUS) responded well to conventional therapy, longer-term follow-up is required to assess long-term impacts. Melamine, in addition to MUS, is a known carcinogen that can cause urinary tract malignancies. Whereas short-term consequences of melamine-contaminated milk powder in babies have been evident throughout the crisis, very little is known regarding the long-term implications on development, adolescence, and adult health. (Wen et al., 2017)

Research Methodology

This part of research has some essential steps which are carried out by the researcher to conduct this research. This quantitative research was conducted in district layyah, Punjab Pakistan. Data was collected by the general population of district layyah who were living in rural and urban areas. Through simple random sampling researcher involved 385 participants in this research to collect required information. Before going to field researcher decided to pretest the interview schedule. For purpose of pretesting researcher took response from 10 respondents and checked the validity and reliability.

After checking validity of interview schedule, researcher decided to go to field and took his required information from male and female respondents. Researcher used IBM SPSS software for analysis and came to know about the facts and figure.

RESULTS AND DISCUSSION

Table No: 1 Demographic profile

Variables	***Categories***	***F (P %)***
Gender	Male	238 (61.8)
	Female	147(38.2)
Family Type	Nuclear	227(59)
	Joint	158(41)

Residential area	Rural	29(7.5)
	Urban	356(92.5)
Educational status	Illiterate	100(26)
	Literate	285(74)
Milk buying place	From Gawala	306(79.5)
	From chiller	79(20.5)
Employment status	Govt. job	120(31.2)
	Own business	199(51.6)
	Unemployed	38(9.9)
	Others	28(7.3)

NOTE: *%age in the bracket*, N=385

The table consists of the responses of respondents in different strata's of life that are discussed with different categories. The first one is the gender of respondents. According to data collected, 61.8% respondents were male while 38.2% of the respondents selected were females. Second one is Family Type. According to the survey data 41% respondent were living in joint families while majority 59% of the respondents preferred nuclear families. Third one is residential area, according to the data collected from the respondents it shows that 7.5% were living in rural areas while 92.5% were living in urban areas. Fourth one is educational status; according to survey data 26% of the respondents were illiterate while other 74% of the respondents were literate. Fifth one is milk buying place, according to survey data 79.5% of the participators purchase milk from gawala whereas other 20.5% of the contributors buy milk from chiller. Last one is employment status, according facts 51.6% of the contributors have their personal business, 31.2% contributors have government employment, and 9.9% of the participants were those who were jobless while other 7.3% of participants were working in other than mentioned places.

Table No.02

Descriptive statistics

Table 2 is about descriptive statistics of knowledge about milk adulteration. This table depicts different questions regarding knowledge of milk adulteration and their response in return of these queries.

Statement	***Yes***	***No***
Adulteration of milk by eliminating fat/cream	333(86.5%)	52(13.5%)
Adulteration of milk by water	347(90.1%)	48(9.9%)
Adulteration of milk by adding urea	181(47%)	204(53%)
Adulteration of milk by adding caustic soda	147(38.2%)	238(61.8%)
Adulteration of milk by adding formalin	86(22.3%)	299(77.7%)
Adulteration of milk by adding ice	240(62.3%)	145(37.7%)
Adulteration of milk through detergents	92(23.9%)	293(76.1%)
Adulteration of milk by adding skim milk powder	259(67.3%)	126(32.7%)

Discussion

Above table shows the knowledge of respondents about milk adulteration. The first row shows that 86.5 percent of participants believe milk may be contaminated by removing fat/cream, whereas 13.5 percent believe milk cannot be corrupted by removing fat/cream (Nedeljkovic, Tomasevic, Miocinovic and Pudia, 2017). The second graph shows that 90.1 percent of participants believe milk may be contaminated by water, whereas 9.9 percent believe milk cannot be contaminated by water. The third one shows that 47 percent of participants believe milk may be tainted by injecting urea, whereas the remaining 53 percent believe milk cannot be tainted by injecting urea. Fourth, 38.2 percent of participants believed milk may be contaminated by putting caustic soda, whereas the remaining 61.8 percent stated milk cannot be defiled by putting caustic soda. Fifth, 22.3 percent of participants claimed that milk may be contaminated by putting formalin, while the remaining 77.7 percent said that milk cannot be contaminated by adding formalin. When it comes to the sixth row, we discovered that 62.3 percent of participants believed that milk might be tainted by adding ice, while the remaining 37.7 percent believed that milk could not be tainted by adding ice. In terms of the seventh row, poll data reveals that 23.9 percent of participants believe milk may be contaminated using detergents, whereas the remaining 76.1 percent believe milk cannot be contaminated through lubricants. The last row shows that 67.3 percent of participants believe milk may be tainted by putting skim milk powder, while 32.7 percent believe milk cannot be tainted by putting skim milk powder. (Gheisari, Mazkour, Shekarforoush & Keshavarzi, 2018)

Table No.03

Descriptive statistics

Table 3 is about descriptive statistics of milk adulteration and health awareness. This table depicts different statements regarding health awareness and milk adulteration and their response.

Statement	***Strongly disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly agree***
The removal of several essential components from milk is hazardous to one's health.	43(11.2)	45(11.7)	49(12.7)	105(27.3)	143(37.1)
Mixing of formalin causes vomiting and diarrhea	26(6.8)	31(8.1)	114(29.6)	159(41.3)	55(14.3)
The stomach is harmed when milk is adulterated with hydrogen peroxide.	25(6.5)	46(11.9)	169(43.9)	99(25.3)	46(11.9)
Addition of urea in milk is the origin of uneven heart beat	25(6.5)	32(8.3)	103(26.8)	143(37.1)	82(21.3)
Milk is a chemically unique combination of fat, protein, carbohydrates, minerals, and nutrients.	22(5.7)	33(8.6)	36(9.4)	151(39.2)	143(37.1)
Diabetic individuals may be endangered by milk adulteration.	26(6.8)	61(15.8)	60(15.6)	169(43.9)	69(17.9)
Caustic soda mixed with milk lead to damaging on the lips and mouth.	32(8.3)	56(14.5)	125(32.5)	85(22.1)	87(22.6)

Discussion

Table no 3 illustrates the milk adulteration and health awareness. According to facts and figures large number of 37.1% respondents has full belief that the removal of several essential components from milk is hazardous to one's health. Many 41.3% of the respondents think that addition of formalin is source of diarrhea and vomiting. Majority of participants 43.9% have no idea that the stomach is harmed when milk is adulterated with hydrogen peroxide. Majority 37.1% participants were agreed that addition of urea in milk originate uneven heartbeat. Most of the people 39.2% were agreed that Milk is a chemically complex blend of fat, protein, carbs, minerals, and vitamins. Most 43.9% of the participants were agreed that Diabetic individuals may be endangered by milk adulteration. Most 32.5% of the respondents have no idea that caustic soda mixed with milk lead to damaging on the lips and mouth.

Assessment of milk adulteration effects

Table No.04

Descriptive statistics

Table 3 is about descriptive statistics of overall assessment of milk adulteration effects. This table depicts different statements regarding health overall assessment of milk adulteration effects and their response.

Variables	***Categories***	***F (P %)***
Has anyone in your family become ill as a result of drinking milk?	Yes	240(62.3)
	No	145(37.7)
Has anyone in your family had an allergic response to milk?	Yes	112(29.1)
	No	273(70.9)
Has anyone in your family had diarrhea as a result of consuming milk?	Yes	248(64.4)
	No	137(35.6)
Has someone in your family had gastro-intestinal problems as a result of consuming milk?	Yes	133(34.5)
	No	252(65.5)
Has anyone in your family had indigestion as a result of drinking milk?	Yes	235(61)
	No	150(39)
Has someone in your family experienced acidity as a result of consuming milk?	Yes	203(52.7)
	No	182(47.3)
Did somebody in your family have hypertension after drinking milk	Yes	175(45.5)
	No	210(54.5)

Table no 4 shows the assessment of milk adulteration effects. According to survey data, the majority of respondents (62.3 percent) or their members of the family had experienced food sickness after drinking milk. It reveals that the vast majority of people (70.9 percent) have never had allergic reactions after consuming milk. According to this data, the most of responders (64.4 percent) experienced diarrhoea after drinking milk. According to the table, the vast majority of respondents (65.5%) have never had gastro-intestinal problems as a result of consuming milk. It states that the majority of participants (61%) had indigestion after drinking milk. It reveals that the majority of participants (52.7%) had experienced acidity after drinking milk. The majority of individuals (54.5%) had no problems with their blood pressure after consuming milk.

Hypothesis testing

Hypothesis 1

There is a substantial positive link between milk adulteration information, health awareness, consequences of milk adulteration, and milk adulteration treatments.

Correlations

		knowledge	Awareness	Milk adulteration effects	Remedies
Knowledge	Pearson Correlation	1	.178**	.479**	.458**
	Sig. (2-tailed)		.000	.000	.000
	N	385	385	385	373
Awareness	Pearson Correlation	.178**	1	.192**	.345**
	Sig. (2-tailed)	.000		.000	.000
	N	385	385	385	373
Milk adulteration effects	Pearson Correlation	.479**	.192**	1	.551**
	Sig. (2-tailed)	.000	.000		.000
	N	385	385	385	373
Remedies	Pearson Correlation	.458**	.345**	.551**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	373	373	373	373

Discussion:

In the first hypothesis, the researcher investigates the links between information, awareness, the consequences of milk adulteration, and treatments. Correlations were employed by the researcher for this aim. As per the alternative theory, there is a strong link between information, awareness, the consequences of milk adulteration, and treatments. Furthermore, the null hypothesis indicated that there is no link between information, awareness, the consequences of milk adulteration, and treatments. The significance level is set at.000. Which supported the alternative theory; there is a link between information, awareness, the consequences of milk adulteration, and treatments. The correlation test results demonstrate that there is a strong link between information, awareness, the impacts of milk adulteration, and the actions taken to avoid milk adulteration. It refers to individuals who are more knowledgeable about milk adulteration; they are more health-conscious, have a better understanding of the repercussions of milk adulteration, and take more preventive measures to avoid milk adulteration. (Nasreen and Ahmed, 2014)

Hypothesis 2

There is a difference of knowledge about milk adulteration on the basis of gender.

Hypothesis 3

Gender differences in health awareness regarding milk adulteration exist.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean	T value	Df	Sig. (2-tailed)
Knowledge	Male	238	7.34	1.794	.116	-4.152	383	
	Female	147	8.16	2.058	.170			.000
Health awareness	Male	238	34.42	10.034	.650	-3.799	383	.000
	Female	147	37.77	4.718	.389			

Discussion

In hypothesis 2, the researcher investigates whether there are any differences in awareness regarding milk adulteration based on gender. According to the table, the level of significance is 0.000. It was discovered that there is a significant variation in awareness regarding milk adulteration based on gender. Females (M=8.16, SD=2.058) were shown to be more knowledgeable regarding milk adulteration than men (M=7.34, SD=1.794) (Bukuku, 2013).

In hypothesis 3, researchers look to see if there are any differences in health knowledge concerning milk adulteration based on gender. The significance level is set at 0.000. It was shown that there is a statistically significant variation in health knowledge concerning milk adulteration based on gender. Females (M=37.77, SD=4.718) were shown to be more health conscious regarding milk adulteration than men (M=34.42, SD=10.034) (Hoque, Alam and Nahid, 2018)

Conclusion

This survey was conducted to understand more about milk adulteration and its effect on the health. This analysis serves as a guide for the following objectives. The first objective is to examine people's understanding of milk adulteration. 385 people were polled in order to better grasp their awareness of milk adulteration. Participants have idea that milk adulteration can be done by eliminating fat/cream and adding water in the milk. Large number of participants knew that adulteration of milk can be done by adding ice in it and as well as by adding skim milk powder. Many of the participant have no idea how to identify the deception of milk adulteration. ((Barham, shah, khaskheli and Magsi 2020)

Second objective of the research was to examine the health awareness level regarding milk adulteration. As well as this objective concerned people have perception that the elimination of several essential components from milk is hazardous to one's health and Mixing of formalin causes vomiting and diarrhea. People believed that combining urea with milk caused abnormal heartbeats and that milk adulteration posed a concern to diabetes patients. (Hetzel et al., 2004).

Third objective of the research was to know about effects of milk adulteration. Some of the respondents countenance food poisoning and diarrhea following drinking milk, many of the participants said that they faced indigestion and acidity by drinking milk (Hetzel et al., 2004).

Suggestion

Researchers have given some recommendations for public, policy makers and further researchers.

Suggestion for public

- According to the researchers, each milk user should have a milk testing equipment at home
- Avoid purchasing branded packaged milk since it is kept with formalin; instead, attempt to have a milking animal.
- Do not utilize the milk unless it has been boiled.

Suggestion for policy makers

- Each city and town should have milk testing facilities where individuals may analyze the milk on a regular basis.
- The authorities should develop SOPS at both the large and local levels to prevent milk adulteration.
- Because fines alone are insufficient to regulate milk adulteration, a rigorous strategy on milk adulteration should be implemented.

Suggestion for researcher

- Researcher should conduct research on detection of milk adulteration techniques.
- Researcher should conduct research on effects of milk adulteration on growth of children.

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