Food safety issue in various food products with reference of adulteration in Faisalabad, Pakistan

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Abstract: Concerns about food safety and regulation have ensured the development of various techniques like physical, biochemical and instrumental technique for adulterants detection in food. Both branded as well as non-branded samples were selected from different regions of Faisalabad (Satiana, Chiniot, Jhang). There were presence of different adulterants in selected foods. Scorched persimmon, powder of date seed or tamarind seeds and chicory were present 33% while cereal starch was 67% in samples of coffee. The ranges of microbial load in the coffee samples for these three regions (Satiana, Chiniot, Jhang) were $1.43x10^4$ to $1.67x10^4$, $1.65 x10^4$ to $2.09 x10^4$ and $1.39 x10^4$ to $1.63 x10^4$ respectively. Chalk powder, washing soda and sodium bicarbonate were 75% in samples of jaggery. The ranges for the regions (Satiana, Chiniot, Jhang) were $4.67x10^7$ to $5.12x10^7$, $3.92 x10^7$ to $7.85 x10^7$ and$2.74 x10^7$ to $3.01 x10^7$ the microbial load in the Jaggery samples may be due low grade handling materials. Mineral acid was present 57% in samples of soda lemonade. The ranges of microbial load in soda lemonade samples for these three regions were $4.84x10^4$ to $5.33x10^4$, $2.93 x10^4$ to $3.90 x10^4$ and $2.60 x10^4$ to $3.70 x10^4$ respectively.
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Introduction

The cases of food fraud have a long history. The food fraud is an act of increasing profit and deceiving consumer. It also include to increase the quantity or make more grow up. Food fraud consists adulteration, counterfeiting, tempering and intentional contamination at any stage occurrence related to food supply chain (Spink, 2011). Since the beginning of civilization, food adulteration is an issue not just decreases the food quality but also have numerous bad effects on health (Bensal *et al*., 2015). Food adulteration term is commonly used for intentional contamination in basic food material with low quality, non-edible, cheap or toxic substances. It consist of a large number of other practices e.g. mixing, substitution, putting up decayed foods, giving fake label or concealing the quantity (Abhirami and Radha, 2015). Adulteration of food is a major problem which occurs in food processing at every level from preparation of food till utilization of end product. The adulteration of food is utilizing of toxic artificial colors and even through harmful chemicals. They are also applying toxic chemicals even on perishable foods commodities which are mainly cause of endangering the lives (Choudhury *et al*., 2011). Contaminated foods and drinks are affecting common sources of infection. Adulterants have bad health effects of range from acute signs such as vomiting, abdominal pain, allergy, asthma and headache and even psychological retardation, cardiac seize and cancer (Alauddin, 2012). The dyes used in food are highly carcinogenic and may cause paralysis, brain and liver damage, kidney stone, glaucoma, blindness, heart attack or even sudden death if taken for long time (Mirza *et al.,* 2015). Inferior qualities and artificial substitutes are mostly used in adulteration. Natural products are converted to hazardous material due to adulterants involvements in food (Poornima, 2010). Coffee is a commonly consumed beverage containing cereal starch, scorched persimmon, powder of date seed or tamarind seeds and chicory in coffee (Faheem *et al.*, 2014, Latif et al., 2019). Soda lemonade is a commonly consumed beverage in summer season having mineral acid (FSSAI, 2012). Current food adulteration scenario required proper measures for positive change through regulatory authorities (Rahman *et al*., 2015). The lack of good agricultural, manufacturing, and hygiene practices remains a major challenge for improving food safety for the domestic and export market (Deinger and Sur, 2007). Food should be without or only with acceptable and safe levels of adulterants, contaminants or any other substances that may make food hazardous to health. Also such food can deny nutrients essential for proper body growth and development (Gahukar, 2014). Global campaign to create awareness on bacterial pathogenesis and the magnitude of food borne illness especially diarrhea, gastroenteritis and respiratory tract infection were continued to grow among children in Pakistan (Akhtar *et al*., 2014).

There is a rapid increasing requirement for more accurate detection method adulterations in food (Zhang*et al*., 2011). Adulteration is a global issue which increasing with each day of passing. As far as Pakistan is concerned, food safety issue is very much undermined. There is an ever increasing list of food items that are adulterated on daily basis. The present research has been designed to check the adulterants in selected food items. The objectives of the study were as follow:

Objectives

- Selection of various products according to food groups from Faisalabad region.
- Safety assessment of selected food products with reference to adulteration.
- Interpretation and compilation of results for consumer awareness.

Materials and methods

Raw material

The samples of Jaggery, coffee, and soda lemonade were collected from different regions (Satiana, Chiniot, Jhang) of Faisalabad. Samples types were branded or non-branded as per availability. All chemicals and reagents of analytical grade were purchased from scientific stores.

Preparation of raw material

Grinding of coffee sample was done through grinder and mixed well to get a homogenous sample.

Adulterants in Coffee

Coffee was tested for cereal starch, corched persimmon, powder of date seed or tamarind seeds and chicory.

Cereal starch

Iodine solution was dropped on coffee samples. Appearance of developed blue color showed presence of cereal starch was done by method expressed in Faheem *et al.* (2014).

Scorched persimmon

One tea spoon of coffee powder was taken and dropped it on a moisturized blotting paper. 3 ml of 2 % aqueous solution of sodium carbonate was poured slowly and carefully on it. A red coloration indicated the presence of powder of scorched persimmon stones in the coffee powder was done by following the method of FSSAI (2012).

Powder of date seeds

Coffee floated and date seeds powder settled down in water was done by method expressed in Faheem *et al.* (2014).

Powder of tamarind seeds

Coffee floated and tamarind seeds powder settled down in water was done by following the method of Faheem *et al.* (2014).

Chicory

Coffee powder sample was gently sprinkled on the surface of water in a glass. The coffee floated over the water but chicory settled down within a few seconds. The falling chicory powder particles leave behind them a trail of color, due to large amount of caramel was done by method expressed in Faheem *et al.* (2014).

Adulterants in Jaggery

Jaggery was tested for metanil yellow color, chalk powder, washing soda and sodium bicarbonate adulterants presence or not in it.

Metanil yellow color

A small quantity of jaggery sample was taken in a test tube and few drops of HCl was added along with alcohol in it. Appearance of pink color showed presence of metanil yellow color in jaggery sample was done by following the method of Faheem *et al.* (2014).

Chalk powder

10 grams of jaggery was taken in a glass of water and allowed it to settle down. Chalk powder was settled down at the bottom was done by method expressed in FSSAI, (2012).

Washing soda

Small quantity of sugar was taken, dissolved it in water and added few drops of Hydrochloric acid. Presence of washing soda indicated gave off bubbles was done by method expressed in FSSAI, (2012).

Sodium bicarbonate

Small quantity of jaggery sample was taken in a test tube and muratic acid added in this. Presence of sodium bicarbonate produced effervescence was done by following the method of Faheem *et al.* (2014).

Adulterant in Soda lemonade

Soda Lemonade samples were tested for presence or not of mineral acid.

Mineral acid

2 drops of the lemonade soda poured on a metanil yellow paper-strip. Appearance of violet color was indicated the presence of mineral acid in aerated water. The color impression gets retained even after drying the paper (metanil yellow paper strips was prepared by soaking filter paper strips in 0.1 % aqueous solution and then drying the paper-strips) was done by following the method of FSSAI (2012).

Results and discussion

Adulterants in Coffee

Five different types of adulterants named cereal starch, scorched persimmon, powder of date seed, tamarind seeds powder and chicory were analyzed in coffee samples collected from different regions of Faisalabad. The results given in table 1 showed significant regarding adulteration of coffee depicted that 33% coffee samples were adulterated with scorched persimmon, powder of date seed, tamarind

seeds powder and chicory while 67% samples were adulterated with cereal starch. Coffee is adulterated from many ways. Coffee powder is adulterated with powder obtained from tamarind seed (Nagvanshi, 2015**).** The scorched persimmon, powder of date seed, tamarind seeds powder and chicory are adulterants used in coffee due to the consumption of these types of adulterants can cause problems of diarrhea, giddiness and joint pains in humans (Faheem *et al.,* 2014). Bansal *et al*. (2015) studied commonly used adulterants like chicory, tamarind seeds and date seed powder in coffee samples. Srivastava, (2015) studied that chicory and tamarind seed powder used as an adulterants in coffee samples. The result for the presence or absence of adulterants was found significant ($p< 0.05$). Powder of scorched and cereal starch are those types of adulterants also used to increase weight of coffee these adulterants caused serious problems of the stomach disturbances (Faheem *et al* 2014). Abhirami and Radha (2015) noted that there were presence of chicory in coffee which cause diarrhea. But starch was not found in samples of coffee. Waghray *et al*. (2011) study showed that there were 28 percent presence of adulterants in coffee samples. (Awasthi *et al*., 2014) studied that fifty percent of coffee samples were contained adulterants. Srivastava (2015) detailed that date and tamarind seeds powder were utilized in coffee samples causing diarrhea.

The coffee samples were collected from three regions of Faisalabad (Satiana, Chiniot, Jhang). Statistical results of total plate count (TPC) illustrated non-significant variation in total plate count (Table 6). The mean values of TPC (Table 7) from three regions of coffee samples were 15500±1200, 18700 ±2200 and 15100±1200 respectively. Results demonstrated that it ranged from$1.43x10^4$ to $1.67x10^4$, $1.65\ x10^4$ to $2.09\ x10^4$ and $1.39\ x10^4$ to $1.63\ x10^4$. The microbial load in the coffee samples may be due to low level of quality control in supply chain. Highest value of TPC was $2.09\ x10^4$ cfu in region 2 and lowest value $1.39\ x10^4$ in region 3 as can be seen from figure 6. The microbial load in the coffee samples may be due to poor quality handling, storage and stock of market conditions.

Table No. 1. Adulterants in Coffee

Coffee		Adulterants				
		Cereal starch	Scorched persimmon	Powder of date seed	Tamarind seeds powder	Chicory
Absent	No. of Samples	3	6	6	6	6
	%	33	67	67	67	67
Present	No. of Samples	6	3	3	3	3
	%	67	33	33	33	33
Total	No. of Samples	9	9	9	9	9
	%	100	100	100	100	100
X^2		9.00*	9.00*	9.00*	9.00*	9.00*
p		<0.05	<0.05	<0.05	<0.05	<0.05

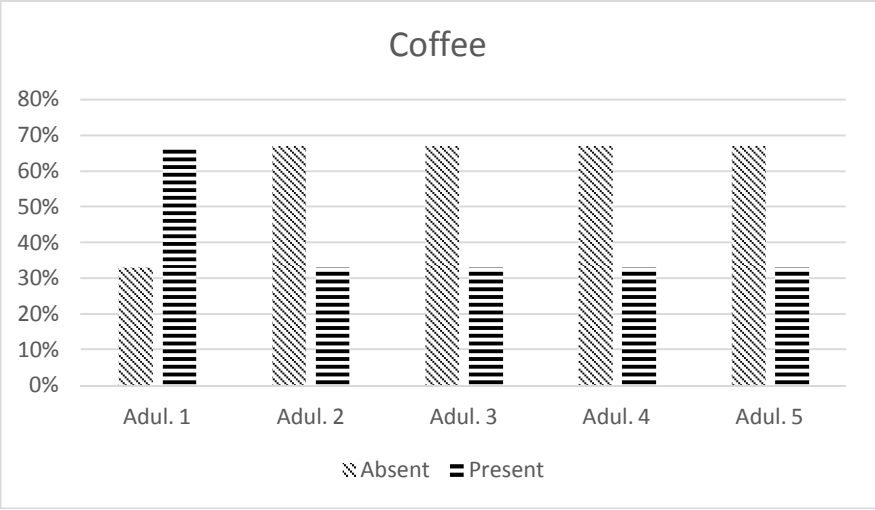

Figure No. 1. Adulterants in Coffee

Adul. 1= Cereal starch**, Adul.2**= Scorched persimmon**, Adul.3**= Powder of date seed, **Adul.4**= Powder of tamarind seeds, and **Adul.5= C**hicory

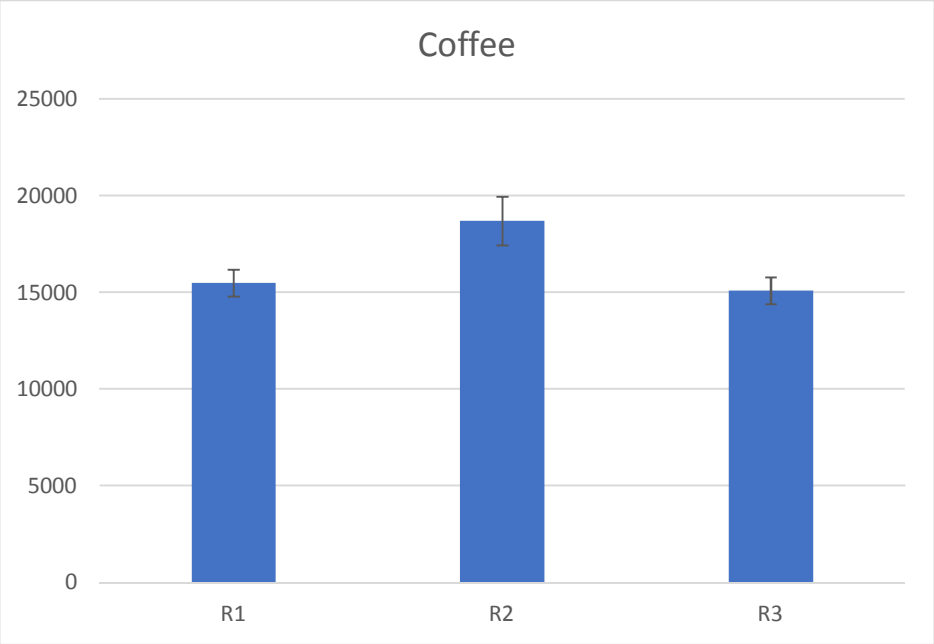

Figure No. 6. Total Plate Count of Coffee samples

Table 6 Analysis of Variance for Microbial Count of Coffee samples

S.O.V	DF	SS	MS
Region	2	2.336E+07	1.168E+07^{ns}
Error	6	1.544E+07	2573333^{ns}
Total	8	3.880E+07	

Table 7 Mean Values of Coffee samples

Region	Coffee
R1	15500±1200
R2	18700±2200
R3	15100±1200

Adulterants in Jaggery

Adulterants named metanil yellow color, chalk powder, washing soda and sodium bicorbonate were analyzed in samples collected from different regions of Faisalabad. The results from Table 2 showed significant ($p< 0.01$) difference regarding adulteration of jaggery. These results depicted that 75% jaggery samples were adulterated with chalk powder, washing soda and sodium bicarbonate while 25% samples were adulterated with metanil yellow color.

In general adulteration or contamination in food either for economic achieve or due to negligence and be short of accurate sanitized conditions of processing, storing, transportation and marketing. The results for the presence or absence of adulterants in Jaggery were found highly significant ($p<0.01$).

Total Plate Count of Jaggery

The jaggery samples were collected from three regions Faisalabad. Statistical results of total plate count (TPC) illustrated non-significant variation in total plate count (Table 10). The mean values of TPC (Table 11) from three regions of Faisalabad of jaggery samples were 48950000±2250000, 54166667±2126513 and 28700000 ± 1350000 respectively. Results showed that it ranged from $4.67x10^7$ to $5.12x10^7$, $3.92 x10^7$ to $7.85 x10^7$ and$2.74 x10^7$ to $3.01 x10^7$ the microbial load in the jaggery samples may be due low grade handling materials. Highest value of TPC was $7.85 x10^7$ cfu in region 2 and lowest value $2.74 x10^7$ in region 3 as can be seen from figure 9. The ranges for the regions were microbial analysis is essential part of food safety. Confidence in the safety and integrity of the food supply is an important requirement for consumers. There was a work done on jaggery samples and studied that the bacterial microflora were isolated on plate count agar from four jaggery samples collected at various stage of jaggery stored. So this study showed a range from $0.2x10^{-5}$ to $8.5x10^{-6}$ cfu g^{-1} (Singh *et al*., 2009).

Table No. 1. Adulterants present in Honey

Honey		Adulterants		
		Invert sugar or Jaggery	Metanil yellow color	Sugar solution
Absent	No. of Samples	6	6	6
	%	67	67	67
Present	No. of Samples	3	3	3
	%	33	33	33
Total	No. of Samples	9	9	9
	%	100	100	100
X^2		9.00*	9.00*	9.00*
P		<0.05	<0.05	<0.05

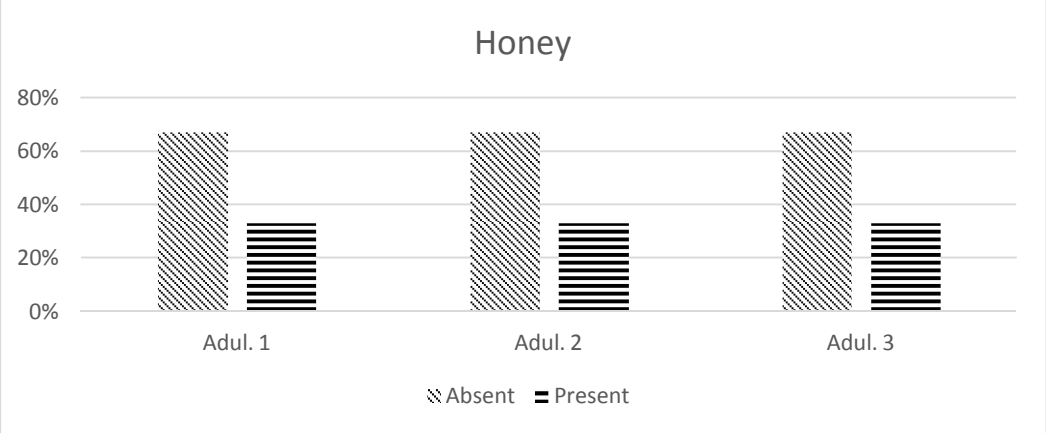

Figure No. 1. Adulterants present in Honey

Adul. 1= Invert sugar or Jaggery**, Adul.2** = Metanil yellow color **and Adul.3**= Sugar solutions or water

Table No. 2. Adulterants in Jaggery

Jaggery		Adulterants			
		Metanil yellow color	Chalk powder	Washing soda	Sodium bicorbonate
Absent	No. of Samples	9	3	3	3
	%	75	25	25	25
Present	No. of Samples	3	9	9	9
	%	25	75	75	75
Total	No. of Samples	12	12	12	12
	%	100	100	100	100
X^2		12.00**	12.00**	12.00**	12.00**
P		<0.01	<0.01	<0.01	<0.01

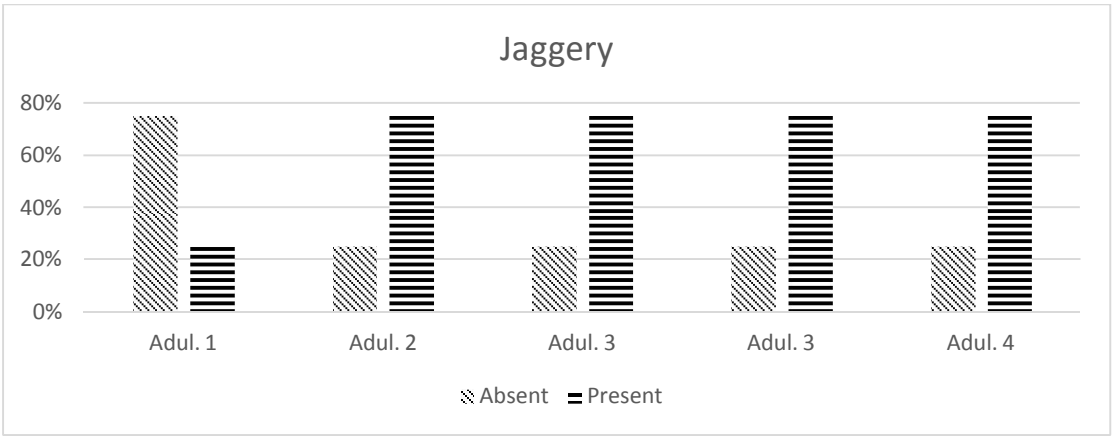

Figure No. 2. Adulterants in Jaggery

Adul. 1= Metanil yellow color**, Adul.2**= Chalk powder**, Adul.3**= Washing soda and **Adul.4**= Sodium bicarbonate

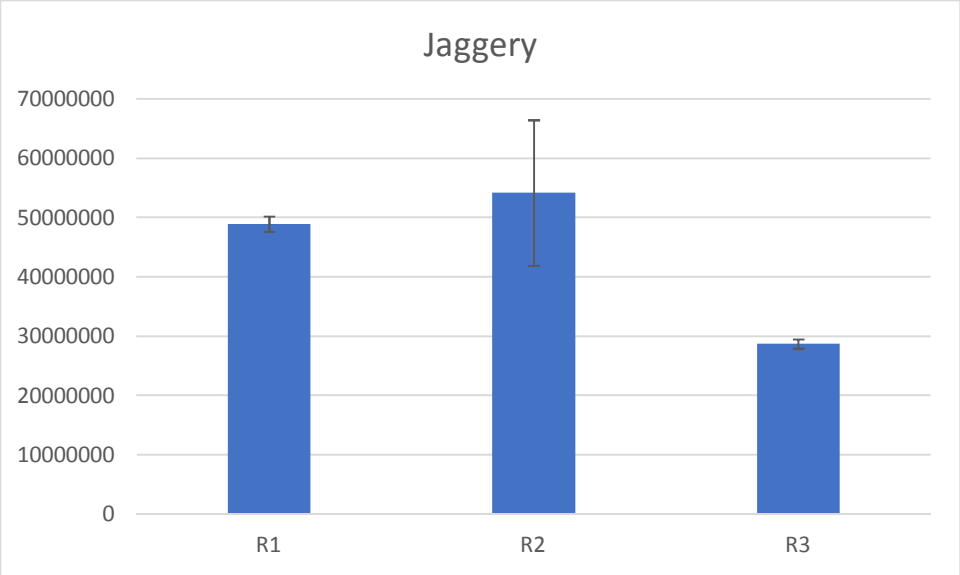

Figure No. 9. Total Plate Count of Jaggery samples

Table 10 Analysis of Variance for Microbial Count for Jaggery

S.O.V	DF	SS	MS
Region	2	1.085E+15	5.427E+14^{ns}
Error	6	9.158E+14	1.526E+14^{ns}
Total	8	2.001E+15	

Table 11 Mean Values of Jaggery samples

Region	Jaggery
R1	48950000±2250000
R2	54166667±2126513
R3	28700000±1350000

Adulterant in Soda lemonade

Soda lemonade samples collected from different regions of Faisalabad were tested for adulterant like mineral acid. Significant ($p< 0.01$) difference was observed regarding presence or absence of adulterant (Table 3) demonstrated that 43% samples of soda lemonade were free from mineral acid. Bhatt *et al*. (2012) noted that in terms of adulteration all the stores have adulterated food on the other hand branded items contains a lesser amount of percentage of adulterants other than the locally available items. (Faheem *et al*., 2014) detected mineral acid addition in soda lemonade loose motion cause to human being.

The soda lemonade samples were collected from three regions of Faisalabad. Statistical results of total plate count (TPC) illustrated significant variation in total plate count (Table 10). The mean values of TPC (Table 11) from three regions of Faisalabad of soda lemonade samples were 50850±2450, 33650±4926.713 and 32300±5671.86 respectively. Results demonstrated that it ranged from $4.84x10^4$ to $5.33x10^4$, $2.93 x10^4$ to $3.90 x10^4$ and $2.60 x10^4$ to $3.70 x10^4$. The microbial load in the soda lemonade samples may be due to low level of quality control in supply chain. Highest value of TPC was $5.33 x10^4$ cfu in region 1 and lowest value $2.60 x10^4$ in region 3 as can be seen from figure 8. The microbial load in the soda lemonade samples may be due to poor quality handling, storage and stock of market conditions. Results indicated that all the commercial samples were below the detection limit for the viable microorganisms. Results of analysis of those home-made tiger-nut samples revealed that 67% (16 samples) total plate counts while the rest of samples were free from these microorganisms. Results reflected that there exists a rather high contamination level in home-made tiger-nut beverages. There were 16 samples total plate counts ranged from 3.65-6.47 log cfu ml^{-1}. The rest of the examined samples (eight samples) were free of viable bacteria ($8x10^3$ cfu ml^{-1}) (Onovo and Ogaraku, 2007).

Table No. 3. Adulterant in Soda Lemonade

Soda lemonade		Adulterant
		Mineral acid
Absent	No. of Samples	9
	%	43
Present	No. of Samples	12
	%	57
Total	No. of Samples	21
	%	100
X^2		21.00**
p		<0.01

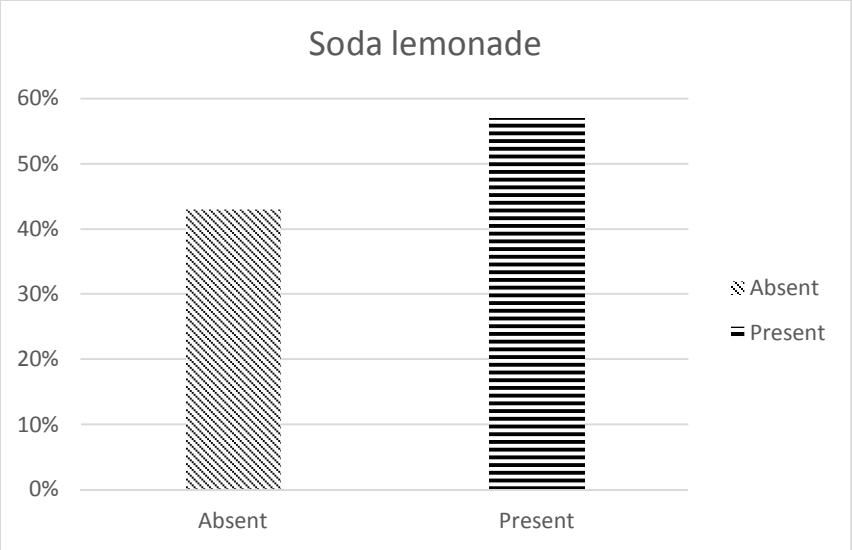

Figure No. 3. Adulterant in Soda Lemonade
Adul. 1= mineral acid

Total Plate Count of Soda lemonade

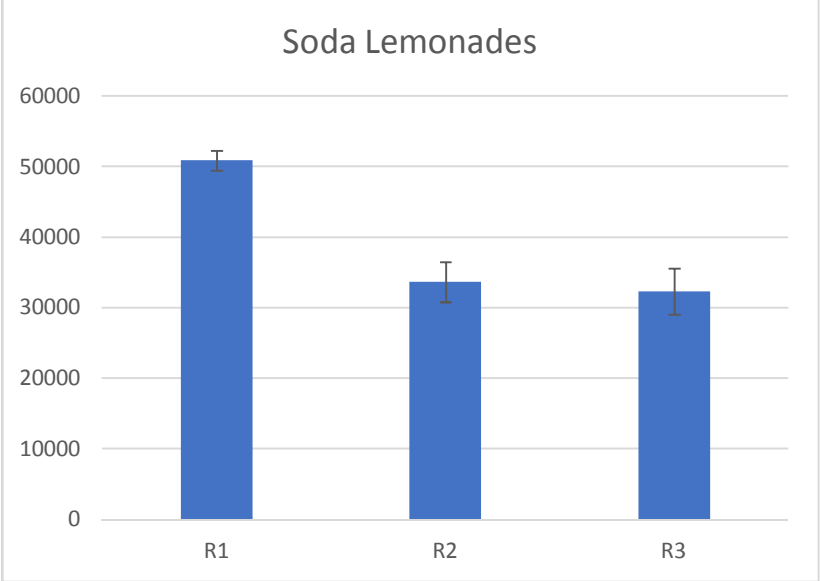

Figure No. 8. Total Plate Count of Soda lemonade samples

Table 10 Analysis of Variance for Microbial Count of Soda Lemonade samples

S.O.V	DF	SS	MS
Region	2	6.424E+08	3.212E+08*
Error	6	1.247E+08	2.080E+07*
Total	8	7.672E+08	

Table 11 Mean Values of Soda Lemonade

Region	Soda Lemonade
R1	50850±2450[a]
R2	33650±4926.713[b]
R3	32300±5671.86[b]

References

1. Abhirami, S. and R. Radha. 2015. Detection of food adulteration in selected food items procured by homemaker. International Journal of Recent Scientific Research. 6:5938-5943.
2. Akhtar, S., M. Randhawa, M. Riaz, A. Hameed, T. Ismail, A. Ismail and Z. Ali. 2014. Food safety conundrum: a Pakistan's scenario. Quality Assurance and Safety of Crops and Foods. 7:559-567.
3. Alauddin, S. 2012. Food adulteration and society. Global Research Analysis. 1: 3-5.
4. Bansal, S., A. Singh, M. Mangal, A.K. Mangal and S. Kumar. 2015. Food Adulteration: Sources, Health Risks and Detection Methods. Critical Reviews in Food Science and Nutrition.56:1-80.
5. Chowdhury, M.F.I. 2014. Evaluating position of Bangladesh to combat adulterated food crisis in light of human rights. Journal of Human and Social Science Research. 19:45-54.
6. Deininger, D.U and M. Sur. 2007. Food safety in a globalizing world: opportunities and challenges for India. Agricultural Economics. 37:135-147.
7. M. Fahad Latif, S. M. Taqi Naqvi, Neelum Shahzadi, Talha Riaz, Asad Sohai. Effect of defatted wheat germ supplemented cookies on the protein quality parameters of rats. Nat Sci 2019;17(8):110-116.
8. FSSAI. 2012. Manual of methods of analysis of foods (beverages, sugar and sugar products and confectionary products). Food Safety and Standards Authority of India.
9. Gahukar, R. 2014. Food adulteration and contamination in India: occurrence, implication and safety measures. International Journal of Basic and Applied Sciences. 3:47-54.
10. Mirza, S.K., S.U. Asema and S.S. Kasim. 2015. Chemical analysis of adulterants in common food items and there hazardous effect on health. The International Journal of Science and Technoledge. 3:140.
11. Poornima, B. 2010. Adulteration and substitution in herbal drugs a critical analysis. International Journal of Research in Ayurveda and Pharmacy. 1:8-12.
12. Rahman, M.A., M.Z. Sultan, M.S. Rahman and M.A. Rashid. 2015. Food Adulteration: a serious public health concern in Bangladesh. Bangladesh Pharmaceutical Journal. 18:1-7.
13. Spink, J. and D.C. Moyer. 2011. Defining the public health threat of food fraud. Journal of Food Science. 76:157-162.
14. Zhang, J. X, Zhang. L, Dediu, C, Victor. 2011. Review of the current application of fingerprinting allowing detection of food adulteration and fraud in China. Food Control. 22: 1126-1135.

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