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Short Communication

Detection of adulterants and evaluate the quality of selected commercial pickles and chutneys collected from various local markets in Jashore, Bangladesh

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Abstract: In Bangladesh, pickles and chutneys are very popular appetizers that give main dishes more taste. In this present study quality of selected commercial pickles and chutneys were evaluated by conducting physicochemical parameters and analyzing the adulterant. A total 19 samples were used for this experiment. The pickle and chutney samples were evaluated for physicochemical parameters including moisture content, acidity as citric acid, sodium benzoate, and arsenic in laboratory. The results suggested that, highest concentration of moisture content (49.80±0.21%), acidity (1.85±0.02 mg/Kg) and sodium benzoate (363.30±0.26 mg/Kg) were found in Tamarind chutney (C-1), Jujube chutney (B-3) and Mixed chutney (E-1) respectively. However, all of the samples estimated arsenic (As) levels remained within the corresponding guideline limit. It is concluded that samples of moisture content (57.89%), acidity (68.42%) and sodium benzoate (15.79%) were higher than BSTI standard which is not suitable for food safety. However, pickles and chutneys are available in both good and bad quality in the market.

Keywords: adulteration; quality; pickles; chutney; heavy metal

1. Introduction

Pickle and chutney are very popular as food or appetizer in Bangladesh. One of the oldest and most effective ways of food preservation is pickling, known to humans. Pickles are fermented foods that include a variety of vegetables, fruits, meat and spices while additives are added for the taste improvement. Fresh, pure ingredients and salt are the only ingredients in salt pickle, which is preserved with 12-15% acidity. In general, lactic acid bacteria are used for the transformation of sugar into acid (Nurul and Asmah, 2012; Rahman *et al*., 2014). According to Pal *et al*. (2018), pickles contain acetic acid, which acts as a preservative to extend the shelf life of the product. A wide variety of spicy dishes and condiments are referred to as chutney. Chutney is made in a similar manner like jam, with the addition of salt, vinegar, and spices (Pervin *et al.*, 2021).

In pickle industry, adulteration has found a unique way. For picking type of alum used is commonly known as potassium alum. By strengthening the cell walls of fruits and vegetables, aluminium makes pickles crisper and firmer. Commonly used adulterants such as chalk powder, white sand, washing soda, plastic crystals, and urea. Due to alum consumption, the most serious side effect of is lung damage. Effects of washing soda are all side such as diarrhea, nausea, and vomiting (Rahman *et al*., 2014).

The adulteration in pickle and chutney seems to be a major concern for the better and healthy living of life. For assuring food safety, increasing agro-industrial market liberalization and globalization the widespread integration of food supply chains necessitates the development of new methodologies and systems. The customer's health may be put in danger by the unfair market practice and unawareness among general public. Considering above mentioned concerns this study was conducted to detect and determine adulterants, assess quality, and identify potentially harmful Arsenic concentration in commercial pickles and chutney collected from various local markets in Jashore.

2. Materials and Methods

2.1. Study location and periods

In order to conduct a laboratory examination, commercial pickles and chutney samples were collected from 10 to 25th November at the Jashore city local market. The research was conducted at the laboratory of Department of Agro Product Processing Technology, Jashore University of Science and Technology and the Arsenic concentration was examined in Asia Arsenic Network laboratory, Jashore, Bangladesh (Figure 1).

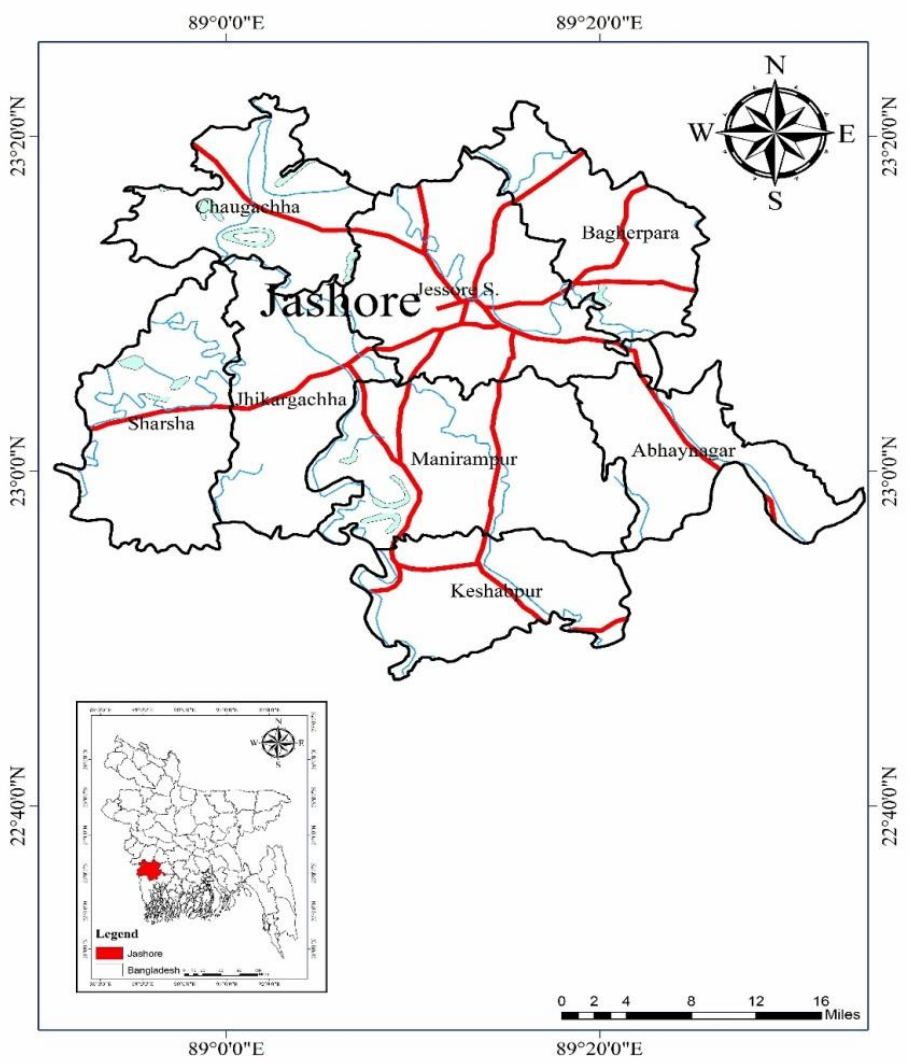

Figure 1. Study area map of Jashore district.

2.2. Sampling

Total nineteen (19) pickle and chutney samples were collected from eight local markets (Arabpur, Churamonkati, Chanchra, Doratana, Dhormotola, Pulerhat, Monihar and New Market) from Jashore municipality. To avoid bias, samples were coded with letters A, B, C, D, E, P, and M for tamarind chutney-1, jujube chutney, tamarind chutney-2, olive chutney, mixed chutney, olive pickles and mango pickles respectively.

2.3. Determination of moisture content

The amount of moisture in the sample was determined using the AOAC (2000) method and calculation was done following equation,

$$\% \text{ moisture} = \frac{\text{Initial weight(w1)} - \text{Final weight(w2)}}{\text{Weight of sample(w)}} \times 100$$

2.4. Determination of acidity as citric acid

Titratable acidity was determined following AOAC method (2000). The titratable acidity or acidity was expressed as mg citric acid/Kg, determined using formula,

$$\text{Acidity} = \frac{Titre\ value \times N \times M}{Weight\ of\ sample} \times 100$$

Here, N is the normality of NaOH and M is the molecular weight of citric acid =0.06404.

2.5. Determination of sodium benzoate

Sodium benzoate was determined following the method described by Rahman *et al*. (2014). The calculation was conducted using following formula,

$$\text{Concentration of Benzoic acid (mg/kg)} = \frac{61000000 \times NV}{V1 \times W}$$

Here, N, V, V_1 and W denote normality of the standard sodium hydroxide solution, volume of standard sodium hydroxide solution, volume of filtrate taken and mass in g of the material respectively.

2.6. Determination of arsenic content

Pickles and chutney sample was digested by USEPA method (2016) which was dried in electric oven (DO-81, Hanyangs Scientific Equipment Co. Ltd, Made in Korea) at 105°C for 72 hours. Five gram of dried pickle and chutney sample was taken into a 250 ml Pyrex beaker. Arsenic concentration using flame Atomic Absorption Spectrometer (iCE 3000 Series, Thermo Scientific, USA). Three duplicates were taken for each sample, and the mean values were calculated using the three replicates. The metal analysis laboratory quality control standard, spike, blank, and duplicate sample were assessed 10 times after the sample was examined.

2.7. Statistical analysis

Utilizing statistical analysis tools, the data were analyzed using Statistical Tool for Agricultural Research (STAR) software at a 5% level of significance.

3. Results and Discussion

3.1. Moisture content of chutney and pickles

Maximum concentration of moisture contents was detected 49.80±0.02% in Tamarind chutney (C-1). Minimum concentration of moisture contents was found 19.55±0.01% in Olive chutney (D-2) which was matching with BSTI standard for consumer's products in Bangladesh. It is concluded that 57.89% samples moisture contents value was higher than BSTI standard for consumer's item which is not suitable for food safety. Moisture is common physical parameter for pickles and chutney which is depended on preservation process. Das *et al*. (2021) emphasized, moisture content may be impacted by temperature, time, and storage. Higher fluid content also has the effect of speeding up rancidity and causing the formation of off flavors. Similar findings were reported by Rahman *et al*. (2014), when they studied quality standards of commercial pickles and chutneys. Rahman *et al.* (2019) also reported, with an increase in storage time, fish pickles' moisture content dropped when they were kept stored in refrigeration and frozen temperature. Concentration of moisture contents should be maintained within 33.33% for consumer's products which is recommended by Bangladesh standard testing institute (BSTI) for consumer's products.

3.2. Total Acidity in chutney and pickle samples

Concentration of total acidity should be maintained 1.20 mg/Kg for consumer's products which is recommended by Bangladesh standard testing institute (maintained with BSTI standard guideline) for consumer's products in Bangladesh. Maximum concentration of total acidity was detected 1.85±0.02mg/Kg in Jujube chutney (B-3). Minimum concentration of total acidity was found 1.13±0.01 mg/Kg in Olive pickle (P-2) which is similar to BSTI standard for consumer's products in Bangladesh. Concentration of total acidity was higher in chutney than pickles which may be influenced by citric acid and adulating materials (Table 1). It is observed that 68.42% samples acidity value was not maintained for consumer's standard which can be harmful for human health. Pickle and chutney samples reduce acidity as storage time increases. With declining acidity, processed pickles

and chutneys also had less moisture, ash, and vitamin-C content similar results described by Rahman *et al*. (2014). Acidity of plum chutney decreased significantly during storage similar findings also reported by Parvin *et al.* (2021).

Table 1. Physicochemical parameters of commercial of pickle and chutney samples.

Sample ID.	Sample source/Local name	Tested parameters			
		Moisture contents (%)	Total acidity (mg/Kg)	Sodium Benzoate (mg/Kg)	Conc. of arsenic (mg/kg)
A-1	Tamarind Chutney-1	30.00±0.50	1.61±0.02	126.33±2.51	BDL*
A-2	Tamarind Chutney-1	20.00±0.50	1.50±0.03	110.66±2.51	BDL*
A-3	Tamarind Chutney-1	49.74±0.30	1.65±0.03	136.30±0.43	BDL*
B-1	Jujube Chutney	29.90±0.36	1.81±0.03	82.40±0.36	BDL*
B-2	Jujube Chutney	39.87±0.41	1.20±0.04	176.20±0.20	BDL*
B-3	Jujube Chutney	29.81±0.23	1.85±0.02	36.03±0.05	BDL*
C-1	Tamarind Chutney-2	49.80±0.21	1.46±0.04	36.26±0.37	BDL*
C-2	Tamarind Chutney-2	39.68±0.38	1.69±0.02	72.23±0.32	BDL*
C-3	Tamarind Chutney-2	29.64±0.39	1.51±0.02	90.20±0.20	BDL*
D-1	Olive Chutney	34.70±0.44	1.14±0.02	90.26±0.25	BDL*
D-2	Olive Chutney	19.55±0.39	1.15±0.01	104.16±0.20	BDL*
D-3	Olive Chutney	24.71±0.26	1.83±0.03	115.26±0.30	BDL*
E-1	Mixed Chutney	34.76±0.22	1.34±0.04	363.30±0.26	BDL*
E-2	Mixed Chutney	39.74±0.24	1.55±0.04	360.20±0.26	BDL*
E-3	Mixed Chutney	29.65±0.46	1.14±0.01	342.16±0.20	BDL*
P-1	Olive Pickle	49.72±0.25	1.15±0.03	136.46±0.30	BDL*
P-2	Olive Pickle	44.77±0.32	1.13±0.01	61.40±0.26	BDL*
M-1	Mango Pickle	39.83±0.21	1.24±0.03	21.43±0.15	BDL*
M-2	Mango Pickle	39.77±0.23	1.23±0.03	68.16±0.20	BDL*
Maximum		49.80±0.21	1.85±0.02	363.30±0.26	-
Minimum		19.55±0.39	1.13±0.01	21.43±0.15	-
Reference (BSTI) Standard		33.30	1.20	250.00	1.00

Note: BDL*= below detection level

3.3. Sodium Benzoate contents in chutney and pickles

Concentration of sodium benzoate should be maintained 250.00 mg/Kg for consumer's products which is recommended by Bangladesh standard testing institute (BSTI). Maximum concentration of sodium benzoate was detected 363.30±0.26 mg/Kg in mixed chutney (E-1). Minimum concentration of sodium benzoate was found 21.43±0.15 mg/Kg in mango pickles (M-1) which was same with BSTI standard for consumer's products in Bangladesh (Table 1). Concentration of sodium benzoate was higher in chutney than pickles which may be influenced by adulating materials. It is observed that, concentration of sodium benzoate of 15.79% sample were not maintained as consumer's standards which can be harmful for human health. The sodium benzoate preservative effect is reduced at low acidity. Similar findings were reported by Rahman *et al*. (2014), when they screened quality standards of commercial pickles and chutneys. Delavar *et al.* (2012) also reported similar result, when they investigated sodium benzoate level in cucumbers pickle.

3.4. Arsenic content in chutney and pickle samples

Arsenic (As) remained within the Corresponding guideline limit (Table 1). All of the different types of tested foodstuffs had different levels of heavy metal concentrations, which may have been caused by the different levels of heavy metal absorption and accumulation. Similar findings were reported by Hassan and Sarfraz (2018), when they investigated heavy metals content in home-made mixed vegetable pickles. Some health experts are concerned that individual heavy metal intake could have a little to significant negative influence on consumers' health.

4. Conclusions

Most of the samples were maintained the BSTI standards and few samples exceed the rules of BSTI standards. Since the adulterants make the food unhealthy. In order to ensure the physicochemical and microbiological

quality of processed foods, it is suggested that government-authorized agencies such as the BCSIR and the Bangladesh Standard and Testing Institute (BSTI) take control and conduct regular monitoring. Finally, to prevent adulteration and improve the quality of commercial fruit goods, implementing the law and imposing punishment, social incentive of food processors, adoption of BSTI standards, social motivation of food consumers, and enhancing legal authority supervision all are important.

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Data availability
The data of this research will be available upon valid request by authority from the corresponding author.

Conflict of interest
None to declare.

Authors' contributions
S M Shamiul Alam primarily planned and conceived the work. Asraful Alam, Md Akhtaruzzaman, Razmin Sultana and Maria Afrin helped in the data collection and data analysis process. S M Shamiul Alam reviewed, edited and updated the whole manuscript. All authors have read and agreed the final manuscript.

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