ORIGINAL ARTICLE

DETERMINATION OF FOOD PRESERVATIVES (BENZOIC AND SORBIC ACIDS) IN BAKERY PRODUCTS OF DISTRICT PESHAWAR, PAKISTAN

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ABSTRACT

Objective: To determine the level of preservatives (Benzoic and Sorbic acid) in bakery products of Peshawar

Material and methods: This cross-sectional study was performed in district Peshawar from August 2019 to December 2019 by visiting four bakery stores in each union council (total of ten union councils) by collecting three samples (of biscuits, cakes and bread) from each bakery stores using multistage convenient sampling technique. Thus, a total of 120 samples were collected. Food additives in the form of Benzoic and Sorbic acid were checked in Forensic and toxicology laboratory of Khyber medical college Peshawar. Data was analyzed using SPSS 23, where frequencies and percentages were used for categorical variables and mean. Standard deviation for numerical data.

Results: In samples of cakes, concentration of benzoic acid (BA) ranged from 314 to 457 ppm (WHO permissible limit is up to 500ppm) while that of sorbic acid(SA) ranged from 597 to 859 ppm (WHO permissible limit is up to 1000ppm). Similarly, concentration of benzoic acid in biscuits samples ranged from 363 to 467 ppm and sorbic acid ranged from 649 to 895 ppm. In bread samples, BA ranged from 350 - 487 ppm and sorbic acid ranged from 619 to 944. Comparing the values with WHO standards for preservatives, the concentration of benzoic and sorbic acid is found to be within permissible limits with p value < 0.05.

Conclusion: Benzoic acid and Sorbic acid were found in permissible limits in 3 bakery products in the city of Peshawar, as set by World Health Organization.

Keywords: Bakery products, Additives, Preservatives, Bakeries

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INTRODUCTION

When we have to store food for a prolonged period, additives are added to maintain the quality and the taste. These additives stop bacteria and fungus from growing by removing additional water[1]. Preservation of food is one of the oldest methods used by people that can inhibit changes which occur due to action of microbes, enzymes and physical agents[2,3]. A preservative can be natural or synthetic, which we add to food to prevent deterioration by bacteria or atmospheric effects. Chemical preservatives such as Sulphur dioxide, sorbic acid, propionic acid and sodium benzoate are increasingly used by the baking industry mainly because of high demand for good quality, safe and fresh food[4,5]. Preservatives when added to food minimize food wastage which can be caused by microbes. In this way these can be stored in stores and homes for longer period[6].

Bakery Products have an important place in food consumption[7]. Commonly consumed bakery products are bread, biscuits and cakes which make up to 80% of the products produced in most of the countries[8]. Changing life styles and dietary habits have resulted in increased demand of ready to eat food[9]. Foods in which preservatives are used because of their antimicrobial activity are cakes, butter, pie and doughnuts[10]. Studies have proven that on an average, every individual can annually consume up to 3 to 5 kg or even higher quantity of food additives[11]. Additives are mostly added to all forms of food, ranging from the less processed to the highly processed ones[12].

The association between added chemicals and the health is not a good one. In the 1980s, food chemicals were thought to be harmful to be used by humans, which resulted in fear of using them, and some of them were excluded from list. Later, it was proven by different studies that not

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all of them were harmful, although there were doubts about the effects of these on health[13]. Like any other medicinal chemical, preservatives can initiate hazardous reactions like allergic reactions and even carcinogenesis[14]. Many studies have shown that particular levels of artificial preservatives and their long-term use can cause carcinogenicity and genotoxicity[15,16]. Recent research is encouraging the use of agents that are natural and have got antimicrobial activity to replace the commonly used synthetic preservatives thus reducing their hazardous impact over health[17]. While in Pakistan, the quality control measures are inadequate, studies to estimate the levels of food preservatives are not yet conducted at all in our province. This study will highlight the level of food preservatives that will help food control authority to regulate the quality and standards of bakery products in the district Peshawar.

MATERIAL AND METHODS

This cross-sectional study was performed in the district Peshawar from August 2019 to December 2019 by visiting four bakery stores in each union council, in a total of ten union councils by collecting three samples of (biscuits, cakes and bread) from each bakery store using multistage convenient sampling technique. Thus, a total of 120 samples were collected. Sample size was calculated using WHO sample size calculator, using Prevalence of 93% of benzoic acid found in bakery products in study conducted in Iran[18]. After collection of samples, the analysis was done by High Performance Liquid Chromatography in Forensic and toxicology laboratory of Khyber Medical College Peshawar.

RESULTS

In samples of cakes, concentration of benzoic acid (BA) ranged from 314 to 457 ppm (WHO permissible limit is up to 500ppm) while that of sorbic acid(SA) ranged from 597 to 859 ppm (WHO permissible limit is up to 1000ppm). Similarly, concentration of benzoic acid in biscuits samples ranged from 363 to 467 ppm and sorbic acid ranged from 649 to 895 ppm. In bread samples, BA ranged from 350 - 487 ppm and sorbic acid ranged from 619 to 944. Comparing the values with WHO standards for preservatives, the concentration of benzoic and sorbic acid is found to be within permissible limits with p value < 0.05. See table 1-6 for details. Fig-1 shows level of benzoic and Sorbic acids in three food products.

DISCUSSION

The results of this study revealed that preservatives are present in all bakery products and they are found to be

Table 1: Frequency of different types of bakery products

Types of bakery product	Product No	Percentage
Bread	40	33.3%
Biscuit	40	33.3%
Cake/Pastery	40	33.3%
Total	120	100.0%

Table 2: Comparison of Food preservatives (BA & SA) in Cakes in Different Union Councils

UCs	Benzoic acid: Mean & (S D)	Sorbic acid: Mean (SD)
UC 1	449.25(8.18)	836.75(45.828)
UC 2	455.00(8.446)	859.50(55.842)
UC 3	451.50(22.487)	789.50(173.09)
UC 4	454.50(25.736)	811.25(50.566)
UC 5	419.75(49.149)	852.00(141.393)
UC 6	457.75(75.522)	663.25(59.011)
UC 7	389.50(74.942)	597.00(141.353)
UC 8	374.25(67.342)	759.75(74.437)
UC 9	390.75(76.443)	728.25(186.382)
UC 10	314.00(60.619)	612.25(33.180)

Table 3: Comparison of Food Preservatives (SA&BA) in Bread in different Union Councils

UCs	Benzoic acid mean & (SD)	Sorbic acid mean & (SD)
UC 1	487.75(29.159)	812.00(59.121)
UC 2	472.00(26.633)	813.50(47.007)
UC 3	461.00(40.042)	825.50(110.147)
UC 4	409.50(60.341)	944.25(34.121)
UC 5	400.25(15.064)	807.25(116.554)
UC 6	376.75(107.398)	697.00(146.592)
UC 7	350.00(87.939)	827.75(69.687)
UC 8	380.75(105.844)	619.50(114.684)
UC 9	404.25(92.330)	727.00(171.587)
UC 10	373.50(101.773)	872.50(94.296)

Table 4: Comparison of Preservatives (BA &SA) in Biscuits in different Union councils

UCs	Benzoic acid mean & (SD)	Sorbic acid mean & (SD)
UC 1	458.75(45.683)	886.00(25.073)
UC 2	460.75(13.276)	889.50(90.780)
UC 3	467.25(24.245)	753.00(42.591)
UC 4	450.25(51.803)	721.50(183.945)
UC 5	436.50(48.446)	841.50(116.119)
UC 6	364.00(93.192)	701.50(72.247)
UC 7	376.50(32.808)	895.75(93.870
UC 8	403.50(32.563)	829.25(93.870)
UC 9	394.75(128.181)	649.75(150.050)
UC 10	363.75(68.070)	815.00(179.907)

Table 5: Comparison of Benzoic acid with FDA criteria applying (one sample T test)

Level of BA in biscuits	Test value	T test	DF	sig	Mean Difference	95% C.I	
						Lower	Upper
	500	-21.600	39	0.001	-260.40	-284.78	-236.01
Level of BA in cake	1000	-75.24	39	.0001	-683.87	-702.25	-665.49
Level of BA in bread	500	14.59	39	.0001	294.62	253.79	335.45

P value = 0.0001

Table 6: Comparison of Sorbic acid levels with FDA criteria (one sample t-test)

SA in biscuits	Test value	T test	DF	sig	Mean Difference	95% C.I	
						Lower	Upper
	500	9.73	39	0.0001	-201.72	-243.6	-159.7
SA in cake	1000	-58.5	39	0.0001	-124.05	-129.2	-1205.8
SA in bread	500	14.59	39	0.0001	294.62	253.79	335.45

P value = 0.0001

CI is also significant

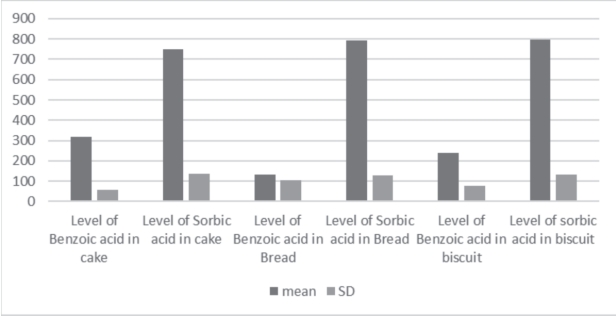

Fig 1: Comparison of Benzoic and Sorbic Acid in three food products

within permissible limits set by WHO. Intake of food exceeding the minimum permissible carries a definite health risk, but at the same time these risks carry a strong association with level of consumption and accurate calculation of these additives. Studies have shown that safe food practices result in healthy population which improves the economic growth of those countries. WHO has set certain standards for food additives so that they cause less toxicity because it is proven that food additives cause genetic mutations if consumed in large amounts[19]. Different countries either use the WHO criteria for preservative addition or set their own standards which is consistent the findings of this study where in Pakistan WHO set standards are followed[20]. The addition of natural ingredients to bakery products in our study is consistent with the practice in developed countries where demand for "clean label" is being introduced and people of the bakery industry are deviating from using chemicals as food additives[21]. Studies carried out in most of the countries show that Benzoic acid and Sorbic acid are frequently used preservatives either alone or together. In our study, sorbic acid and benzoic acid levels in cake samples are found mixed together within the range of 595-859 ppm and 314-457 ppm respectively. A study conducted in Egypt by Mahmoud Gamal reported that the levels of Sorbic acid in cake were 288-659 ppm while benzoic acid was not detected. These findings are not consistent with our study which shows that both the preservatives are present together[22]. A study in Iran reported the levels of benzoic acid were from 350 to 1520 ppm while sorbic acid was found to be from 850 to 2300 ppm in bread samples. The results showed that benzoic acid and sorbic acid widely occur in food products in Iran. This study results also show that great variation is found in preservative added to food from country to country & region to region, so the associated health risks also differ[23]. Samples in case of Iran show no benzoic acid at all. Another finding which was not consistent with the results of our study was detection of both these additives in bread sample. Again, the levels were lower in samples of Iran and benzoic acid was not detected in their samples. This also shows that different countries use their own criteria at times[24].

The results of our study show that level of benzoic acid and Sorbic acid in cake differ from cake samples checked in Yemen and Iran where the study showed that the levels of these preservatives was found to be lower, while samples in case of Iran show no benzoic acid at all. Another finding which was not consistent with the results of our study was detection of both these additives in bread sample [25].

This study has limitations in many respects, the samples are taken from one city where public health regulations are adopted stringently. Sample collection from areas out of main cities might show variations in preservatives use. Another limitation of this study is the fact that we selected only three bakery products.

CONCLUSION

Benzoic acid & Sorbic acid were found in permissible limits in these bakery products, as set by World Health Organization. Large sample size including multiple products

and venues in far flung areas are needed to estimate the true magnitude of preservatives addition in food products.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Mustafa A:	Helped in literature review, data analysis and writeup.
Ayub R:	Conceived study, collected data and did literature review and data analysis.
Irfan S:	literature review and Writeup.
Iftikhar B:	Data analysis, critical review, overall supervision
Inamullah M:	Bibilography

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.