
EFFECTS OF SODIUM BENZOATE ON PHYSICOCHEMICAL AND MICROBIOLOGICAL QUALITIES OF YOGHURT IN KANO METROPOLIS

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ABSTRACT

The study was conducted to determine the physicochemical and microbiological quality of yoghurt prepared from raw milk preserved with sodium benzoate at varying levels and stored for 7 days under ambient temperature. The experiment was laid in a completely randomized design. The result of physicochemical analysis shows that the pH, protein, moisture, lactose, total solids, fat, solids-not-fat and ash were significantly ($p < 0.05$) different across all the treatment during the storage period. In addition, the result also shows that the pH, moisture and protein values decrease with increase in storage period in yoghurt. While total solids, ash, titratable acidity, lactose, solids-not-fat and density increased indicating addition of sodium benzoate in the yoghurt and reduce rate of deterioration and enhances its shelf life. The Aerobic Mesophilic Mean Bacterial Count of yoghurt prepared using milk preserved with sodium benzoate at 0, 150, 200 and 250mg/l respectively indicate that there is decrease in number of aerobic mesophilic mean bacterial with increase in sodium benzoate at day 1. Furthermore mean value of 2.61×10^{-6} to 4.0×10^{-6} cfu/ml was also recorded across the treatments at day 3, showing that presence of sodium benzoate reduces microbial count. Furthermore, only treatment 1 recorded value of 5.26×10^{-7} cfu/ml at day 7 which is an increased in microbial count indicating absent of sodium benzoate. No pathogenic microbes were detected. It is recommended that addition of sodium benzoate to yoghurt enhances the shelf life of the products as well as reducing the bacterial count at ambient temperature.

Keywords: Food preservatives, Synthetic additives, physicochemical parameters, Bacterial Count.

INTRODUCTION

Milk is a nutrient-dense food that provides energy and high-quality protein as well as a variety of vital micronutrients (particularly calcium, magnesium, zinc, and phosphorus) in an easily absorbable form (Rizzoli, 2014). Milk is used in the creation of at least 400 distinct fermented products around the world (Okeke *et al.*, 2014). Yoghurt is a semi-solid fermented milk product produced by the action of lactic acid bacteria (*Streptococcus thermophiles* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) when heat-treated milk is added (Behore *et al.*, 2016).

Chemical food preservatives are compounds that, under specific conditions, either slow the growth of microorganisms without necessarily killing them or prevent quality deterioration during manufacturing and distribution (Ruth and Cheryl, 2017). Sodium benzoate as an additive is a sodium salt, which is commonly used as a chemical preservative in foods, and it is found mainly in industrialized drinks. One of the compounds known as a preservative with a high safety profile is sodium benzoate. Sodium benzoate (according to the European nomenclature E211) is a salt of benzoic acid and is well soluble in water, tasteless, and odorless, and due to its antifungal and antibacterial properties, it is a preservative added to food in strictly defined doses. It inhibits the growth of bacteria, yeast, and mold [Davidson *et al.*, 2021]. Then, connect the information about sodium benzoate with the objective of the study. The main objective of was to examine the effects of sodium benzoate on physicochemical and microbiological qualities of yoghurt in Kano metropolis.

MATERIALS AND METHODS

The research was conducted at the Department of Animal Science laboratory, (for the Physicochemical Analysis) and Department of Microbiology laboratory (for the Microbiological Analysis) at Bayero University, Kano.

About 3litres of fresh cow milk was used for yoghurt preparation. Yoghurt samples containing Sodium benzoate at the rate of 0, 150, 200 and 250 mg/litre respectively was used which were stored at ambient temperature for 7 days. The experiment was laid in completely randomized design (CRD). The factor was Yoghurt with 4 levels of sodium benzoate as the treatment and replicated three times. Data generated on physio-chemical and microbiological properties of the experimental yoghurt samples were subjected to analysis of variance (ANOVA) using SPSS (2020). Significant differences among the treatment means were compared using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

RESULTS AND DISCUSSION

The result of effect of sodium benzoate on physiochemical qualities of yoghurt revealed that there were significant ($p < 0.05$) differences in all the parameters measured during the storage period except density. In addition, the results also showed that the pH, moisture and protein values decreases with increase in storage period in yoghurt. While total solids, ash, titratable acidity, lactose, solids-not-fat and density increased indicative that addition of sodium benzoate to milk for making yoghurt reduces rate of

Table 1: Physicochemical Composition of the Fresh Yoghurt Preserved with Sodium Benzoate

Parameter	Level of Sodium Benzoate (mg/l)	Storage Duration			SEM.
		Day 1	Day 3	Day 7	
pH	0	4.50 ^a	4.20 ^a	3.50 ^b	0.216
	150	4.53	4.51	4.49	0.085
	200	4.57	4.52	4.50	0.224
	250	4.6	4.55	4.48	0.158
Protein	0	4.0	3.70	3.68	0.368
	150	4.05 ^a	3.75 ^b	3.70 ^b	0.058
	200	4.20	3.77	3.75	0.383
	250	4.25	3.79	3.78	0.220
Moisture	0	85.5 ^a	84.0 ^b	82.6 ^c	0.577
	150	85.39 ^a	83.80 ^{ab}	82.40 ^b	0.809
	200	85.12	83.50	82.28	1.798
	250	85.0	83.0	82.17	0.492
Lactose	0	6.23 ^b	7.5 ^a	7.6 ^a	0.220
	150	6.25	7.58	7.63	0.553
	200	6.32 ^b	7.59 ^a	7.65 ^a	0.407
	250	6.36 ^b	7.64 ^a	7.67 ^a	0.497
Total Solids	0	15.67	16.0	17.5	1.220
	150	14.61 ^c	16.20 ^b	17.60 ^a	0.212
	200	14.88 ^c	16.50 ^b	17.72 ^a	0.379
	250	15.0	17.0	17.83	1.491
Fat	0	3.5 ^b	3.93 ^b	5.18 ^a	0.449
	150	3.55 ^b	3.94 ^b	5.20 ^a	0.304
	200	3.54 ^b	4.20 ^{ab}	5.25 ^a	0.469
	250	3.53 ^b	4.60 ^a	5.3 ^a	0.385
Ash	0	0.73 ^b	0.87 ^{ab}	1.04 ^a	0.101
	150	0.79 ^b	0.93 ^{ab}	1.07 ^a	0.067
	200	0.82 ^b	0.94 ^b	1.07 ^a	0.050
	250	0.86 ^b	0.97 ^{ab}	1.08 ^a	0.080
Solids-not-Fat	0	11.0	12.07	12.32	1.079
	150	10.76	12.49	12.40	0.798
	200	11.34	12.30	12.47	0.970
	250	11.47 ^b	12.40 ^a	12.53 ^a	0.180
Density	0	1.05	1.06	1.07	0.024
	150	1.06	1.07	1.08	0.193
	200	1.06	1.07	1.08	0.016
	250	1.07	1.08	1.08	0.011
Titratable Acidity	0	0.90 ^c	1.14 ^b	1.50 ^a	0.048
	150	0.89	0.91	0.95	0.030
	200	0.85 ^b	0.89 ^a	0.91 ^a	0.012
	250	0.83 ^b	0.85 ^{ab}	0.87 ^a	0.014

^{abc} Means in the same rows having superscripts are significantly different, SB= Sodium Benzoate, SEM= Standard Error of Mean

deterioration and enhances its shelf life. The ranged 3.68 - 4.2, 14.61 - 17.8, 3.5 - 5.3, 10.76 - 12.53, 0.73 - 1.08 and 0.83 - 1.5 % mean for protein, total solids, fat, solids- not -fat, ash and titratable acidity

respectively is in agreement with the work of El-bakri and El-zubeir 2009; Ekram and El-zubeir (2011) but disagree with that of Karagozlu *et al.*, (2005). The range of 3.5 – 4.6 and 82.1 - 85.5% in pH and moisture agree with the work of Ashwini and Desale (2018).

While the result of aerobic mesophilic mean bacterial count of yoghurt ranges from 6.37×10^{-5} to 9.20×10^{-5} cfu/ml across the treatments at day 1, this indicated that there is decrease in number of aerobic mesophilic mean bacterial with increase in sodium benzoate at day 1, where 2.61×10^{-6} to 4.0×10^{-6} cfu/ml was also recorded across the treatments at day 3 also shows present of sodium benzoate reduces microbial count. Furthermore, only treatment 1 recorded value of 5.26×10^{-7} at day 7 which is an increased in microbial count indicating the absence of sodium benzoate. However, the 6.37×10^{-5} to 9.20×10^{-5} recorded in this research was higher than the values obtained by Omola *et al.* (2018). However, it is within the acceptable limit of Codex (2011) and no pathogenic microorganism was detected in the samples.

Table 2. Aerobic Mesophilic Mean Bacterial Count of Yoghurt Prepared using Milk Preserved with Sodium Benzoate AMBC (cfu/mL)

TREATMENTS Levels of SB (mg/L)	STORAGE DAYS		
	1	3	7
0	6.62×10^{-5}	4.00×10^{-6}	5.26×10^{-7}
150	9.20×10^{-5}	3.62×10^{-6}	ND
200	6.37×10^{-5}	2.61×10^{-6}	ND
250	4.20×10^{-5}	3.35×10^{-6}	ND

ND= not detected

Conclusion

It is concluded that addition of sodium benzoate to yoghurt enhances the shelf life of the products without affecting the physicochemical parameters as well as reducing the aerobic mesophilic mean bacterial count at ambient temperature.

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