PHYSICOCHEMICAL AND MICROBIAL QUALITIES OF SOME SELECTED BRANDS OF YOGHURT SOLD IN KATSINA STATE

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ABSTRACT
The physicochemical and microbial qualities of some selected yoghurt brands sold in Katsina State were assessed. The brands were coded as WP-Y (Wapa yoghurt), MD-Y (Mai-dabino yoghurt), HB-Y (Habib yoghurt) and RFD-Y (Rufaida yoghurt and the qualities were analysed. Microbial and physicochemical properties such as pH, total solid, total titratable acidity, total soluble sugar and viscosity were analysed. The values for pH content ranged from 4.2% in sample WP-Y to 6.1% in sample MD Y, the Total Soluble Sugar (TSS) content ranged from 0.83% in sample HB-Y to 1.075% in sample WP-Y, the Titratable Acidity content ranged from 0.97% in sample MD-Y to 1.71% in sample HB-Y while Sample HB-Y contained the highest for total solid (TS) (23.88%) and the sample MD-Y has the least TS (20.90%). Sample HB-Y had the highest viscosity (15.05%) while sample RFD-Y had least viscosity (7.97%). The Total Viable Count (TVC) values ranged from 10% in sample HB-Y to 21% in sample WP-Y while Total Lactic acid bacteria Count (TLC) values ranged from 1% in sample MD-Y to 3% in sample WP-Y and RFD-Y. The values for Total Coliform Count (TCC) content ranged from 1% in sample WP-Y and HB-Y to 3% in sample RFD-Y. Total fungal count (TFC) content ranged from 0% in the sample WP-Y and RFD-Yto1% in the sample HB-Y and MD-Y. However, apart from HB-Y, the microbial levels of the other products did not meet Codex Alimentarius standards for fermented milk products.
Key words; Yoghurt, total solid, titratable acidity, viscosity, microbial analysis.

Introduction

Yoghurt is a product of the lactic fermentation of milk by starter cultures (Mukias and Birungi, 2018). *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsp. Bulgaricu*s are the major symbiotic starter cultures used (Codex Alimentarius, 2003). Yogurt is among the most common dairy products consumed around the world and is also commonly used as a probiotic carrier. It is produced in different ways and has different names depending on the part of the world (Hussain *et al.*, 2009). Yoghurt has been considered to be one of the most consumed effective probiotics throughout the world (Kisanthini and Kavitha, 2019). Yoghurt generally is known to be a good source of proteins, calcium, potassium, phosphorus, magnesium, zinc, and some B vitamins such as riboflavin, niacin, vitamin B6 and B12 (Adolfsson *et al.*, 2004). The consumption of yoghurt with live bacteria has its beneficial effects rather than pasteurized products as it is a probiotic food. Probiotics are 'live microorganisms which when administered in adequate amounts confer a health benefit to the consumer' (FAO/WHO, 2002). There is increasing global interest in the use of probiotics owing to the range of associated health benefits. *Lactobacillus rhamnosus* is a widely studied probiotic that is beneficial in the treatment of gastrointestinal diseases (Guandalini, 2011; Horvath *et al.*, 2011). Since yoghurt involves microorganism, contamination of yoghurt by bacteria and fungi other than the species *Lactobacillus bulgaricus* and *Streptococcus thermophilus* can surface. Contamination of yoghurt occurs in various stages which include contamination during the production process or change in weather from cold to warm temperatures or duration from manufacturing to selling and insufficient refrigeration (Mukias and Birungi, 2018). The contamination of yoghurt can occurs due to unhygienic practices during the production level, unsterilized equipment, water source and weather changes (Kisanthini and Kavitha, 2019). Consumers who are not aware of the contaminated product even if the product is not expired are prone to more diseases like diarrhoea, fever and other conditions. Locally manufactured yoghurt should be given a thorough inspection by the health inspector before it comes to the market. Awareness among the people should be created about the health hazards of consuming low-quality yoghurts. The aim of this study is to assess the physicochemical and microbial quality of some brands of yoghurt sold in Katsina metropolis.

Materials and methods

Freshly prepared yoghurt samples were bought from four (4) producers within Katsina State and brought to the food science laboratory in Federal University Dutsin-Ma, Katsina State for analyses. The samples

were labelled as WP-Y (Wapa yoghurt), MD-Y (Mai dabino yoghurt), HB-Y (Habib yoghurt) and RFD-Y (Rufaida yoghurt.

Physicochemical properties of selected yoghurt brands

Yoghurt samples were analysed for total solid, total soluble sugar, titratable acidity, pH according to the method described by AOAC (2012).

Microbial analysis of selected yoghurt brands

The total viable count, total fungal count, total coliform count and Total lactic acid bacteria were analysed according to the method described by APHA (1976).

Viscosity of Four brands of yoghurt samples

The viscosity was determined using a Viscometer (HAAKE Viscotester VT-02). The 100 ml metal beaker of the viscometer was filled with yoghurt at 5°C and the rotor was immersed into it. The viscometer was then be switched on and the resistance of the fluid against the applied speed was measured in decipoise (dPs). A value was recorded for all the samples after 20 seconds when the dial remained at the same reading.

Results and Discussion

Physiochemical Properties of Yoghurt Brands

Table 1 shows the physicochemical properties and viscosity of yoghurt sold in Katsina metropolis. The values for pH ranged from 4.2% in sample WP-Y to 6.1% in sample MD Y. Sample MD-Y has the highest pH (6.1%) and WP-Y has the least pH (4.2). pH is an important factor in the production of yoghurt. Low pH values indicate high acidity and this prevent bacterial growth (Makanjuola and Alokun, 2019). This shows that sample WP-Y and RFD-Y had low pH which is essential to prevent bacteria spoilage. An optimum pH of 4.1 – 4.4 and minimum acidity of 0.6% is recommended for yoghurts since these levels of acidity facilitate coagulum development and also prevent growth of spoilage and pathogenic microorganisms (Codex Alimentarius, 2003). Yoghurt according to the FDA specifications should have a pH of 4.6 or lower (Olugbuyiro and Oseh 2011). The low pH may also reduce the inhibitory effect of dietary phytic acid on calcium bioavailability (Adolfsson *et al*., 2004).

Total Soluble Sugar (TSS) content ranged from 0.83% to 1.075%. Sample WP-Y contained the highest (TSS) (1.075%) while sample HB-Y has the least TSS (0.83%). Sample WP-Y, MD-Y and RFD-Y was not significantly difference $p<0.05$ from each other, likewise sample RFD-Y and HB-Y was also not significantly different. Total soluble sugar concentration is obtained by summing up all the sugar forms accumulated in the product, including sucrose, glucose, fructose and sorbitol (Quilot *et al.,* 2004).

Titratable Acidity content values ranged from 0.97% in sample MD-Y to 1.71% in sample HB-Y. Sample HB-Y has the highest TTA (1.81%) while sample MD-Y had the least TTA (0.97%). Sample HB-Y and RFD-Y was significantly different from WP-Y while sample WP-Y was significantly different $p<0.05$ from sample MD-Y. High acidity in food products is important as it helps the food store for long before deterioration starts (Makanjuola and Alokun, 2019).

Total Solid content ranged from 20.90% to 23.88% with sample HB-Y having the highest TS (23.88%) and sample MD-Y has the least TS (20.90%). Total soluble solid is mass fraction of substances remaining after the heating process; it has effect on viscosity of yoghurt (Osundahunsi *et al.,* 2007). Increasing the solid content leads to increase in viscosity of yoghurt (Abimbola *et al.,* 2022). The FDA administration 2008 standard for identity of yoghurt drinks specifies that >8.25% milk solid non-fat and fat levels to satisfy non-fat yoghurts (<0.5%), low-fat yoghurt (2%), or yoghurt (>3.25%) before the addition of other ingredients (Allgeyer *et al*.,2010).

The values for viscosity content ranged from 7.97 to 15.05 dps with sample HB-Y having the highest Viscosity. (15.05) while sample RFD-Y has least Viscosity (7.97) there was no significant difference $P< 0.05$ in sample WP-Y and all other sample. Viscosity is this work is higher than that reported by Omola *et al.,* (2014). Differences in viscosity could be due to stabilizer type used.

Table 1: Physicochemical Properties and Viscosity of Yoghurt Brand

SAMPLE	pH	TSS	TTA	TS	VISCOSITY

WP-Y	4.2 ± 0.14^{c}	1.075 ± 0.064^{a}	1.17 ± 0.40^{c}	22.25 ± 1.34^{b}	14.42 ± 0.021^{ab}
MD-Y	6.1 ± 0.35^{a}	1.03 ± 0.085^{a}	0.97 ± 0.11^{d}	20.90 ± 0.31^{c}	11.37 ± 5.049^{b}
HB-Y	4.6 ± 0.14^{bc}	0.83 ± 0.071^{b}	1.71 ± 1.00^{ab}	23.88 ± 0.01^{a}	15.05 ± 0.537^{a}
RFD-Y	4.4 ± 0.14^{bc}	0.97 ± 0.205^{ab}	1.38 ± 0.84^{b}	22.35 ± 0.40^{b}	7.97 ± 0.502^{c}

Values are expressed as means (±SD) of three different determinations. Means with different superscripts in the same column indicate significant differences ($P< 0.05$). WP-Y=Wapa yoghurt; MD-Y=Mai-dabino yoghurt; HB-Y=Habib yoghurt**;** RFD-Y=Rufaida yoghurt

Microbial Analysis of Yoghurt Brands

The microbial analysis of yoghurt sold in Katsina metropolis is presented in Table 2. TVC content ranged from 10 to 21% with Sample WP-Y as the highest (21%) while sample HB-Y has the least TVC (10%). Sample RFD-Y was significant different ($p< 0.05$) from samples MD-Y and HB-Y while MD-Y and HB-Y was significantly different ($p< 0.05$) from WP-Y. This gives idea of the presence of microorganism in the yoghurt sample. Yoghurts are said to contain live cultures and these cultures could be starter or probiotic. Although yoghurts contain these live cultures at the time of manufacture, some yoghurt are heat treated and this causes some of the live bacteria present to die (Diez-Gonzalez, 2014). The international standard for yoghurt requires a minimum total viable microorganism of 10^{7}cfuml^{-1} in the finished product (Bakri and Ibtisam, 2009).

The TLC content ranged from 1% in sample MD-Y to 3% in sample WP-Y and RFD-Y. Sample WP-Y and RFD-Y contained the highest TLC (3%) and sample MD-Y has the least TLC (1%). Sample MD-Y was significantly different ($p<0.05$) from sample HB-Y and RFD-Y while HB-Y and RFD-Y was significantly different ($p < 0.05$) from WP-Y. The finished yoghurt product is to meet the National Yoghurt Association (for USA) Criteria for 'live and active culture yoghurt', it must contain live lactic acid bacteria in amounts 10^{8} organisms/g at the time of manufacture and the cultures must remain active at the end of the stated shelf life (Adolfsson *et al.*, 2004).

The TCC content ranged from 1 to 3% in sample RFD-Y. Sample RFD-Y has the highest TCC (3%) WP-Y and HB-Y has the least TCC (1%). Sample WP-Y and HB-Y are significantly different ($p< 0.05$) from MD-Y and RFD-Y. Coliforms are indicator organism that indicates faecal contamination. In this study the coliform count was below 5cfu/ml, which is the standard for pasteurized milk (Omola *et al.,* 2014).

The TFC content ranged from 0 to1%. Sample HB-Y and MD-Y contained TFC (1%). This shows that only sample HB-Y and MD-Y had fungal contamination. The presence of organism as contaminant in food is used as an indices of sanitary conditions. In order to achieve safety, the mould count should not exceed 1cfu/ml (Omola *et al*., 2014)

Table 2: Microbial Analysis of Yoghurt Brands

Sample	TVC	TLC	TCC	TFC
WP-Y	21.00 ± 0.01^{c}	3.00 ± 0.20^{c}	1.00 ± 0.60^{a}	0.00 ± 0.02^{a}
MD-Y	15.00 ± 0.50^{b}	1.00 ± 0.50^{a}	2.00 ± 0.02^{b}	1.00 ± 0.00^{a}
HB-Y	12.00 ± 0.20^{b}	3.00 ± 0.20^{b}	1.00 ± 0.20^{a}	1.00 ± 0.20^{a}
RFD-Y	10.00 ± 0.20^{a}	2.00 ± 0.02^{b}	2.00 ± 0.20^{b}	0.00 ± 0.50^{a}

Values are expressed as means (±SD) of three different determinations. Means with different superscripts in the same column indicate significant differences ($P< 0.05$). WP-Y=Wapa yoghurt; MD-Y=Mai-dabino yoghurt; HB-Y=Habib yoghurt**;** RFD-Y=Rufaida yoghurt

Conclusion

The physicochemical and microbial properties of the yoghurt samples were studied and it was discovered that the physicochemical properties of the yoghurt samples analyzed was good, although there is need for improvement since this involves health. The pH and microbial properties of the yoghurt should be improved to achieve a wholesome and safe product.

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