International Scholars Journals

African Journal of Immunology Research ISSN 2756-3375 Vol. 8 (1), pp. 001-006, January, 2021. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Effect of stabilizers on the physico-chemical and sensory attributes of thermized yoghurt

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Accepted 12 September, 2020

Stabilized thermized yoghurt was produced by the addition of gelatin, carboxyl methyl cellulose (CMC) and corn starch, into yoghurt mix as stabilizers, each at 0, 0.5, 0.75 and 1.0% concentrations. The yoghurt samples produced after pasteurization of the mix, cooling, inoculation of starter culture and incubation for about 16 h were thermized at 75^{O}C for 60 s followed by immediate cooling. Results show that titratable acidity value of the control samples (0% stabilizer) was 0.92 ± 0.03. CMC, when added to yoghurt mix at levels of 0.5% and above, depressed lactic acid production (compare 0.92 ± 0.03 of the control with 0.90 ± 0.01 of samples containing 0.5 and 0.75% CMC). This observation is in contrast to effects of corn starch and gelatin which enhanced lactic acid production (at least up to 0.75% concentration). This was also mirrored (in reverse order) in the pH values; as samples with higher titratable acidity had, expectedly, lower pH values. Addition of stabilizers decreased percent protein and ash contents due to dilution effect but increased total solids and specific gravity of the thermized yoghurt samples. Sensory results showed that addition of corn starch produced the most desirable flavour and taste which differed significantly ($p < 0.05$) from flavour and taste produced by gelatin but did not differ significantly ($p \geq 0.050$) from that produced by CMC at 0.5 and 0.75% concentrations. Yoghurt containing CMC had the best mouth feel/consistency as well as appearance which did not differ significantly ($p \geq 0.05$) from the mouth feel and appearance of yoghurt containing corn starch but differed significantly from yoghurt containing gelatin. Yoghurt containing CMC at 0.75% concentration was the most generally accepted.

Key words: Stabilizers, thermized yoghurt, sensory attribute, physco-chemical.

INTRODUCTION

Yoghurt is an acidified coagulated dairy product obtained by controlled fermentation of milk by selected thermophilic lactic acid bacteria. These organisms are used as yoghurt cultures to produce a characteristic mild clean lactic flavour and typical aroma (Early, 1998). Yoghurt is a source of highly nutritive protein, energy from added cane sugar, milk fat and unfermented lactose as well as vitamins (Ihekoronye and Ngoddy, 1985).

On the basis of shelf life, yoghurt exists as fresh or thermized. Thermized yoghurt is a product which has been heat-treated after incubation in order to reduce lactic acid bacteria load and by so doing, extend the shelf-life of the product outside refrigeration. The challenge of incessant power outage in the developing countries, especially Nigeria, coupled with consumer demands and adverse marketing/distribution conditions in the developing countries have stimulated research interest in thermized yoghurt production and its quality improvement. Heat treatment of yoghurt, however, destroys most of the natural body and viscosity of the original product due to shock and thinning effect (Early, 1998).

The quality of thermized yoghurt can be enhanced by the use of stabilizers with protective colloid properties

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(Trudso, 1991). Stabilizers enhance the viscosity, influence texture, creaminess and mouth feel as well as help to prevent separation of whey from yoghurt. Sources of stabilizers are many and varied. Some are artificially (synthetically) produced e.g. carboxyl methyl cellulose, many are from plant origin of which the cheapest and most widely used is corn starch while a few, such as gelatin, are from animal origin.

Sodium carboxyl methyl cellulose, called CMC or cellulose gum, is a synthetic water soluble ether of cellulose (Klose and Glicksman, 1975). Food grade CMC is soluble in hot and cold water and viscosities of a 2% solution range from 10 -50000 cps or higher and a reversible loss of viscosity occurs on heating. It is also stable over a wide range (3 - 10) of pH (Trudso, 1991). CMC is used as a stabilizer for ice cream, sherbets, ice pops and other frozen confectioneries to prevent ice crystal growth; in salad dressings and flavour emulsions it is used as a protective colloid, thickner and emulsifier; in fruit juices it is used as a thickner and to prevent floating or settling of fruit during preparation as well as impart clearer brighter appearance, produce desirable gel texture and reduce syneresis (Klose and Glicksman, 1975); and in sour cream it is used as a thickening agent (Trudso, 1991).

Gelatin is a translucent brittle solid hydrocolloid, colourless or slightly yellow, nearly tasteless and odourless and produced by partial hydrolysis of collagen from connective tissues of such animals as the domesticated bovines, porcines and equines (Ward and Courts, 1977). It contains about 98 - 99% protein but it has less nutritional value than many other protein sources. It is high in non-essential amino acids glycine, proline, etc. while lacking in essential amino acids such as lysine, thryptophan, etc (Ward and Courts, 1977). The importance of gelatin as a stabilizer does not lie in its nutritive value but in its properties as a protective hydrocolloid used to modify physical properties of foods. Examples of foods that contain gelatin include yoghurt, ice cream, gelatin deserts, jelly, trifles and many other confectioneries. It is also used in the clarification of juices such as apple juice and vinegar (Wikipedia, 2007).

Starch is used extensively, either in form of native or modified starch, throughout the food industries as a carbohydrate source, extender, processing aid, thickner, stabilizer texture modifier, etc (Wurburg, 1975). The major factors governing its use in modification of foods is its availability and low cost. Although starch can be derived from seeds of plants (e.g. corn, wheat, sorghum, rice, etc) or roots and tubers (such as cassava, potato, etc), the major sound economical and commercial source is corn because of its abundance, high starch content, stability of the grain during storage, value of its product and ease of processing (Wurburg, 1975). If it is hydrolyzed with dilute acid it yields D-glucose. In the use of corn starch as a stabilizer, its contribution as a source of carbohydrate for energy supply is very negligible since the quantity used is very small rather, it is used for its protective colloid properties to modify physical and sensory properties of foods.

Stabilizers are also reported to exhibit many secondary functional properties (Imeson, 1999) whose effect on physico-chemical and sensory properties need to be continuously evaluated. The objectives of this work are to produce thermized yoghurt at 75^{O}C for 60 s fortified with stabilizers and to determine the effects of these stabilizers and their concentrations on the physico-chemical and sensory qualities of the final products.

MATERIALS AND METHODS

Thermized yoghurt production

Yoghurt was produced as described by Balami et al. (2004) with slight modification. In the first set of samples, powdered milk (1000 g) and granulated sugar (500 g) were weighed and made up to eight liters (8 L) with clean water and thoroughly mixed and homogenized. The mixture was divided into four equal parts of 2 L each to correspond to the following four treatment concentrations of gelatin 0, 0.5, 0.75 and 1.0% added into the yoghurt mix. Each yoghurt mix was pasteurized at 80^{O}C for 20 min, cooled to 45^{O}C, inoculated with yoghurt starter culture (containing *Streptococcus thermophilus* and *Lactobacillus bulgaricus*) and allowed to ferment for 16 h. Fermentation was stopped by lowering the temperature of the yoghurt to 10^{O}C. The products were packed in plastic bottles for thermization. Second set of similar products was produced by substituting gelatin with carboxyl methyl cellulose (CMC) while in the third set of products corn starch replaced gelatin. All products were then thermized by heating to 75^{O}C, holding at this temperature for 60 s and thereafter, cooled immediately to room temperature.

Physico-chemical analysis

The pH was determined using a digital pH meter (model 152R). Buffer solutions of pH 7 and 4 were used to standardize the pH meter and pH measurements were carried out in duplicate. Titratable acidity, specific gravity, as well as crude fat, ash and protein were determined in duplicate according to the methods of AOAC (1995).

Sensory analysis

Sensory evaluation was carried out using a 5-point hedonic scale. The scale and categories are as follows: Liked much = 1, Liked = 2, Neither liked nor disliked = 3, Disliked = 4 and Disliked much = 5. Appearance, flavour, taste, mouth feel/consistency and general acceptability were evaluated by a 10-man panel of judges made up of food science and technology professionals.

Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) using split-plot in completely randomized design according to the methods of Gomez and Gomez (1985). When results were found significant, means were separated using least significant difference (LSD) method. Correlation analyses were also applied where necessary to establish the extent of relations between variables.

Table 1. Effect of stabilizers on titratable acidity and pH of thermized yoghurt*[+].

Stabilizer	Concentration (%)	Titratable acidity	pH
CMC	0.50	0.90±0.01[b]	4.53±0.02[a]
	0.75	0.90±0.00[b]	4.51±0.01[abc]
	1.00	0.91±0.00[b]	4.51±0.02[abc]
Gelatin	0.50	0.98±0.08[ab]	4.49±0.04[c]
	0.75	1.05±0.06[a]	4.45±0.04[d]
	1.00	1.05±0.05[a]	4.46±0.06[d]
Corn Starch	0.50	1.09±0.04[a]	4.42±0.02[e]
	0.75	1.04±0.08[a]	4.46±0.04[d]
	1.00	0.91±0.02[b]	4.52±0.02[ab]
Control (No stabilizer)	0.00	0.92±0.03[b]	4.50±0.03[bc]

*Values are in mean ± standard deviation.
+ Values in the same column carrying different superscripts are significantly different ($p < 0.05$).

RESULTS AND DISCUSSION

Effect of stabilizers on titratable acidity and pH of thermized yoghurt

Table 1 shows that the titratable acidity values of the freshly thermized yoghurt samples without any stabilizer were found to be 0.92 ± 0.03. The results show that there were no significant differences in titratable acidity between stabilizers ($p > 0.05$) and no significant differences were also observed between concentrations used ($p > 0.05$). However, interaction between stabilizers and their concentrations were found to be significant ($p < 0.05$) suggesting that the effects caused by concentrations used were different for different stabilizers.

As shown in Table 1, on addition of 0.5, 0.75 and 1.0% CMC, the titratable acidity values were respectively 0.90 ± 0.01, 0.90 ± 0.00 and 0.91 ± 0.00. Thus, compared to samples without stabilizer, it is seen that the presence of CMC (at the levels used) depressed the production of lactic acid. CMC is a stabilizer which functions as a thickener and has optimum pH range of 3 - 10 (Trudso, 1991) and therefore could not have affected the chemical equilibrium of the system or become affected chemically; it appears to be compatible with the acidic range of milk and milk products such as yoghurt. It has been noted that CMC is used commercially at a range of 0.2 - 0.3% in sour milk products and its solution viscosity is known to be high (Trudso, 1991). Therefore, the low acid production could be attributed to its formation of highly viscous systems which caused diffusion resistance that reduced mobility of reactants; and the consequence was reduction of the rate at which the reacting species (yoghurt culture organisms and lactose) came together for fermentation to take place. The similar amounts of titratable acidity produced yoghurts with 0.5 - 1.0% CMC concentrations point to the direction that the concentration of CMC that would favour production of higher amounts of organic acids was exceeded by using concentrations in excess of 0.3% in the experiment. Preliminary investigation, during this study, revealed that use of concentrations of 0.3% and below produced yoghurt, with high amount of acidity, but which on thermization thinned so much that there was whey separation. Furthermore, use of concentrations of 0.5 - 1.0% would make comparism with corn starch and gelatin easier.

In contrast to CMC, addition of gelatin did not impede the production of titratable acidity. Gelatin is a stabilizer which functions as a gelling agent in milk products; its solution viscosity is known to be very low and is used commercially at 0.3 - 1.0% (Trudso, 1991). Thus, the same effects of diffusion resistance, which influence the mobility of reactants and rate of reactions, could be used to explain the differences between effects of CMC and gelatin (at similar concentrations) as well as the differences between the effects of various concentrations of gelatin. The low viscosity effect of gelatin presumably allowed greater freedom of mobility of reactants which enabled the reacting species (yoghurt culture organisms and lactose) to come together for fermentation to take place; with the concentrations tested not being impedement to mobility of reactants. The results also show that the use of gelatin at concentrations beyond 0.75% is wastage since maximum titratable acidity was produced at a level of 0.75% concentration (unless a thicker product with less organic acid production is required as is the case with CMC above).

As shown in Table 1, the titratable acidity of yoghurt treated with corn starch at levels of 0.5, 0.75 and 1.0% concentrations were respectively 1.09 ± 0.04, 1.04 ± 0.8 and 0.91 ± 0.02. Thus, at the levels used, corn starch had less inhibitory effect on the production of titratable acidity compared to gelatin and CMC at similar levels or concentrations. It is seen that maximum titratable acidity

Table 2. Effect of stabilizers on the solids and specific gravity of thermized yoghurt*$^{+}$.

Stabilize	Concentration [%]	Total solids [%]	Protein [%]	Fat [%]	Ash [%]	Specific gravity
CMC	0.50	18.78±0.00^{e}	3.75±0.15^{bc}	2.10±0.15^{a}	0.57±0.03^{a}	1.068±0.000^{e}
	0.75	19.31±1.00^{e}	3.42±0.01^{de}	2.12±0.12^{a}	0.65±0.06^{a}	1.070±0.000^{e}
	1.00	24.53±0.25^{ab}	3.71±0.01^{c}	2.10±0.22^{a}	0.72±0.15^{a}	1.092±0.001^{b}
Gelatin	0.50	18.91±0.25^{e}	3.71±0.18^{c}	2.00±0.40^{a}	0.50±0.10^{a}	1.069±0.001^{e}
	0.75	21.28±1.00^{d}	3.90±0.15^{a}	2.10±0.08^{a}	0.55±0.19^{a}	1.078±0.004^{d}
	1.00	23.90±0.50^{b}	3.51±0.21^{d}	2.20±0.05^{a}	0.57±0.13^{a}	1.098±0.002^{a}
CornStarch	0.50	22.40±0.50^{c}	3.71±0.16^{c}	2.20±0.10^{ab}	0.48±0.07^{a}	1.084±0.004^{c}
	0.75	22.53±0.25^{c}	3.32±0.11^{e}	2.10±0.15^{a}	0.47±0.08^{a}	1.085±0.003^{c}
	1.00	25.40±0.75^{a}	3.12±0.14^{f}	2.40±0.15^{a}	0.56±0.08^{a}	1.090±0.003^{b}
Control (No Stabilizer)	0.00	21.28±1.00^{d}	3.82±0.10^{ab}	2.10±0.05^{a}	0.59±0.04^{a}	1.069±0.001^{e}

*Values are in mean ± standard deviation.
+ Values in the same column carrying different superscripts are significantly different ($p < 0.05$).

was produced at 0.5% concentration. It is also evident from Table 1 that increase beyond 0.5% concentration reduced the production of titratable acidity presumably because concentrations beyond 0.5% produced thicker systems that increased diffusion resistance which consequently reduced reactants mobility and rate/extent of fermentation. As noted by Wursburg (1975), the higher the concentration of starch, the higher the viscosity and the tendency to thicken or gel on cooling.

Table 1 contains data on the pH of the thermized yoghurt samples. The results show that the differences between effects of stabilizers were not found significant ($p > 0.05$) but the differences caused by concentrations used as well as differences produced by interaction between stabilizers and concentrations were all found to be significant ($p < 0.05$). This means that the pH generally decreased with increase in concentration of the stabilizers but the nature of the decrease was significantly ($p < 0.05$) different for different stabilizers. The pH of thermized yoghurt without any stabilizer (control) was 4.5 and this did not differ significantly from those of CMC but differed significantly ($p < 0.05$) from those of gelatin and corn starch. Furthermore, whereas the highest pH was produced at 0.5% concentration by CMC and gelatin, corn starch had the highest pH at 1.0% concentration. Not unexpectedly, the pH of the samples followed a reverse trend with titratable acidity. It is seen that samples with higher titratable acidity also had correspondingly lower pH values ($r = -0.964$), confirming that level of pH depended on the amount of acid in the yoghurt systems; if there is no buffering activity in the system.

Effect of stabilizers on solids and specific gravity of thermized yoghurt

The data in Table 2 contain the percent total solids content of the yoghurt samples. The results show that the differences in totals solids between stabilizers were significant and yoghurt containing corn starch significantly ($p < 0.05$) possessed the highest quantities followed by gelatin while CMC was the least. Not unexpectedly, the total solids contents of samples significantly ($p < 0.05$) increased with increase in concentration of the stabilizers because the stabilizers are solids themselves. Thus, the lowest percent total solids were recorded at 0% (control) while the highest values were at the 1.0% concentration ($p < 0.05$). These results are in agreement with the findings of Mekana and Mehanna (1990) and Monay (1987) who reported that addition of stabilizers increases the solid contents of yoghurt. The significant ($p < 0.05$) interaction between stabilizers and concentrations suggests that the differences caused by the stabilizers were magnified by concentrations used.

The results of the protein content of the thermized yoghurt samples containing various stabilizers in Table 2 show that the differences in protein contents between stabilizers were not significant ($p \geq 0.05$). This may be related to the small proportions of the stabilizers used and the fact that CMC and corn starch have little protein contents. Protein contents significantly ($p < 0.05$) decreased with increase in concentration of stabilizers probably due to dilution effect. Corn starch, followed by CMC, caused the greatest dilution probably due to their little or no protein contents. The less dilution effect due to gelatin could be attributed to its being a nitrogen source of animal origin (Imeson, 1999). Also the significant interaction between stabilizers and concentrations show that the effects of the concentrations were different for different stabilizers. Milk and its fermented derivative, yoghurt, are known sources of high quality dietary proteins with high biological value. Therefore, the dilution effects caused by higher concentrations of stabilizers

Table 3. Effect of stabilizers on the sensory attributes of thermized yoghurt.

Stabilizer	Concentration [%]	Appearance	Flavour	Taste	Consistency/ mouth feel	General acceptability
CMC	0.50	2.4 ± 1.28^{cd}	2.1 ± 1.04^{c}	2.0 ± 0.89^{d}	2.1 ± 1.10^{bc}	2.5 ± 1.36^{cde}
	0.75	1.4 ± 0.66^{e}	2.0 ± 1.34^{c}	2.3 ± 1.42^{d}	1.5 ± 0.67^{c}	2.0 ± 1.27^{e}
	1.00	1.3 ± 0.46^{e}	3.0 ± 1.10^{ab}	3.3 ± 1.19^{b}	2.1 ± 1.38^{bc}	2.9 ± 1.22^{cd}
Gelatin	0.50	4.3 ± 0.78^{a}	3.1 ± 1.30^{ab}	3.2 ± 1.40^{bc}	4.2 ± 0.87^{a}	3.8 ± 1.40^{ab}
	0.75	2.5 ± 0.92^{c}	2.6 ± 1.02^{abc}	2.4 ± 1.11^{cd}	2.9 ± 0.83^{b}	2.9 ± 1.30^{cd}
	1.00	3.5 ± 1.43^{b}	2.3 ± 0.90^{bc}	2.4 ± 1.11^{cd}	2.9 ± 1.30^{b}	3.3 ± 1.01^{bc}
Corn Starch	0.50	1.7 ± 0.46^{de}	1.9 ± 0.94^{c}	1.9 ± 0.94^{d}	2.7 ± 1.27^{b}	2.2 ± 1.08^{de}
	0.75	1.9 ± 0.83^{cde}	1.9 ± 0.83^{c}	1.6 ± 0.49^{d}	2.2 ± 1.07^{bc}	2.1 ± 0.83^{de}
	1.00	2.4 ± 1.11^{cd}	2.1 ± 1.22^{c}	1.9 ± 0.70^{d}	2.4 ± 1.11^{bc}	2.5 ± 1.03^{cde}
Control [no stabilizer]	0.00	4.3 ± 0.90^{a}	3.2 ± 1.08^{a}	4.3 ± 0.90^{a}	4.5 ± 0.67^{a}	4.5 ± 0.50^{a}

*Values are in mean ± standard deviation.
+Values in the same column carrying similar superscript are not significantly different ($p > 0.05$).

suggest that the nutritional quality can be reduced – the extent of dilution [or reduction in protein nutrient] depending on the quantity of stabilizer used.

The fat content of the thermized stabilized yoghurt samples are shown in Table 2. The results show that addition of different stabilizers and different concentrations did not lead to any significant differences among the stabilizers or among the concentrations ($p \geq 0.05$). Also, interaction effects between stabilizers and concentrations were not found significant ($p > 0.05$). However, gelatin and corn starch recorded marginal increases with increase in concentrations presumably due to residual oil in corn starch and gelatin.

The ash content of thermized yoghurt (Table 2) to which different stabilizers were added showed that addition of CMC, gelatin and corn starch, each at levels of 0, 0.5, 0.75 and 1.0% did not cause significant differences ($p \geq 0.05$) between and within stabilizers. Interaction effects between stabilizers and concentrations were not found significant ($p > 0.05$). Similar to protein contents, the percent ash content generally decreased with increase in concentration of the stabilizers although this decrease was not found significant. Compared to gelatin and corn starch, CMC recorded the highest percent ash content presumably due to the sodium component of CMC.

Table 2 shows the results of the specific gravity of the thermized yoghurt samples which were stabilized with 0, 0.5, 0.75 and 1.0% concentrations of CMC, gelatin and corn starch. Significant differences were found between the different stabilizers ($p < 0.05$). Specific gravity increased significantly ($p < 0.05$) with increase in the concentration of each stabilizer. As shown, CMC increased from 1.069 ± 0.001 at 0% concentration to 1.092 ± 0.001 at 1.0% concentration, gelatin increased from 1.069 ± 0.00 to 1.098 ± 0.002 and corn starch increased from 1.069 ± 0.001 to 1.090 ± 0.003. The increases have been attributed to increases in total solids and similar to the effects of stabilizers and their concentrations on total solids, corn starch significantly had the greatest specific gravity compared to other stabilizers while 1.0% concentration recorded the highest specific gravity compared to other concentrations.

Effect of stabilizers on organoleptic characteristics

Sensory results (Table 3) show that the flavour and taste of thermized yoghurt containing 0% stabilizer (control) were the least desirable being ‘neither liked nor disliked’ and ‘disliked’ respectively (sensory scores = 3.2 ± 1.077 for flavour and 4.3 ± 0.9 for taste). However, the addition of corn starch produced the most desirable flavour and taste. These differed significantly ($p < 0.05$) from the flavour and taste produced by the control (0% stabilizer) and gelatin (at 0.5% concentration) but did not differ significantly ($p \geq 0.05$) from the flavour produced by 0.5 and 0.75% CMC which also caused production of desirable flavour and taste. Generally, the desirability of flavour and taste of yoghurt containing CMC and corn starch, reached maximum value at 0.75% concentration before decline commenced. On the other hand, the flavour and taste of yoghurt containing gelatin seemed to improve with increase in concentration. The differences between the stabilizers could be attributed to the acidity level developed during fermentation. Yoghurt is enjoyed because of its tart acidic taste and flavour and corn starch which allowed greater development of acidic flavour become more desirable. The effect of acidity on starch may not be ruled out in explaining why yoghurt containing corn starch had the best flavour and taste. According to Wurzburg (1975), in the presence of dilute acid, starch can be hydrolyzed to D-glucose which has sweetening property and the heat applied during thermization may as well accelerate the hydrolysis.

The results also show that thermized yoghurt containing 0% stabilizer (control) and gelatin had the least desirable appearance and consistency/mouth feel which were respectively ‘disliked’ and ‘disliked much’ (sensory scores = 4.3 ± 0.90 and 4.5 ± 0.67 respectively). The addition of 0.5 - 0.75% CMC caused the production of the most desirable appearance and consistency/mouth feel that differed significantly ($p < 0.05$) from control and that containing gelatin but did not differ significantly ($p \geq 0.05$) from that containing corn starch. It is probable that the thickness of the product influenced eye appeal. In many food products, colour/appearance or eye appeal is the first indicator of quality and may contribute significantly to the decision of the consumer to accept or reject the product. The tendency of CMC to impart good body as well as smooth and glossy appearance in some foods (Klose and Glicksman, 1975) may not be ruled out in explaining why CMC containing yoghurt had the best appearance and this increased with increase in concentration. In this study also, addition of 0.75% CMC in yoghurt seem to cause the production of thermized yoghurt with most desirable mouth feel that was ‘liked’ (1.5 ± 0.67), although this was similar to yoghurt containing 0.5% (2.1 ± 1.10) and 1.0% (2.1 ± 1.38) CMC. Early (1998) observed that in the UK, regular natural yoghurt has viscosity that is just pourable but that thick yoghurts have also found a place in the market generally with higher fat content and representing the luxury of quality end of the yoghurt market. The results in this study also indicate that Nigerian consumers would prefer thicker thermized yoghurt. And thus, the ability of CMC to produce highly viscous system can be taken to advantage in producing desirable thermized yoghurt without increasing fat content.

From the foregoing, it was not unexpected that thermized yoghurt produced without any stabilizer (control) had significantly ($p < 0.05$) the least overall acceptability rating (Table 3) as it was ‘disliked much’ (4.5 ± 0.50) but the addition of 0.75% CMC produced thermized yoghurt that was significantly ($p < 0.05$) ‘liked’ (2.0 ± 1.27) more than others. This supports the views of Bassett (1983) and Leder and Thomason (1973) who reported that the addition of the right type and required amount of stabilizer(s) improves the viscosity of yoghurt and prevents whey separation. According to Fellows (1997), the main quality factors for yoghurt are the colour (appearance), taste and texture (mouth feel) and thermized yoghurt stabilized with 0.75% CMC which had these in abundance has been rated as the most desirable.

Conclusion

The results of this study show that addition of stabilizers improves the physico-chemical and sensory properties of thermized yoghurt. Also yoghurt produced by addition of 0.75% CMC has the most overall sensory characteristics followed by those stabilized with 0.75 and 0.5% corn starch.

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