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Chemical Composition of Yoghurt Enriched with Arabic Gum (AG)

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Abstract

The main objective of this study was to evaluate the effect of Arabic Gum (AG) on chemical composition of yoghurt. Cow's milk was collected from Khartoum University Farm in clean and sterilized ice containers, filtered, pasteurized at 85^{o}C for 30 sec and then cooled to 42^{o}C. Yoghurt samples were formulated with 0%, 0.1%, 0.3% and 0.5% Arabic Gum. Starter culture MIX505LYODCU (*Streptococcus thermophilus* and *Lactobacillus bulgaricus* SSP.). Danisco, France was added at the level of 3% then, samples were incubated at 42^{o}C for four hours. After setting, yoghurt samples were then kept refrigerated at 4^{o}C for 24hrs. Chemical composition, interval 4 days up to 12 days was determined using the standard analytical procedures. Statistically, Completely Randomized Design (CRD) in 2x2x3 factorial arrangement was used. The data collected were subjected to (ANOVA) using SAS software. The results revealed that, concentration of gum had significant (P≤0.05) influence on the moisture content of yoghurt. The highest moisture content was reported for control sample 84.88%, while, the lowest moisture content was 82.71%, which was reported for the sample treated with 0.5%. Arabic Gum (AG) had significant (P≤0.05) influence on the Total Solids (T.S) content of yoghurt. T.S content of yoghurt samples decreased as the gum level increased. Untreated yoghurt reported the lowest T.S 15.11%, while, yoghurt sample treated with 0.5% reported the highest T.S 17.02%. Protein content was significant (P≤0.05) influence with gum level. The highest protein content was 3.77%, reported for sample stabilized with 0.5% Arabic gum, while, the lowest protein content was reported for control sample 3.49%. As gum level increased, fat content of the sample increased significantly. As Arabic Gum level increased, lactose content of yoghurt decreased. Arabic Gum level increased, ash of yoghurt increased. Acidity content of the samples significantly (P≤0.05) influenced by gum concentration. Regarding storage period, moisture content, T.S, protein and ash content significantly (P≤0.05) deceased as storage period increased. In contrast, lactose and acidity significantly (P≤0.05) increased as storage period increased. Generally, it

is recommended that enriched yoghurt with AG could enhance and develop the chemical composition.

Key: Yoghurt, Arabic Gum (AG), chemical composition, protein, lactose

Introduction

Livestock is the main agricultural resource in Sudan. It's population is 105 million heads, distributed throughout the country according to the climatic conditions (MLFR, 2015). The available estimate of milk production in the Sudan varies widely and no accurate statistics are kept. An estimate of annual milk production of 20249.91 million tons obtained from cow, goat, sheep and camel (A.O.A.D, 2002). Milk is considered as a nearly complete food since it is a good source for protein, fat and major minerals (Sarkar, 2010). Milk required for yoghurt manufacture should be standardized in order to ensure consistency of the end product. It is usual in commercial practice to fortify milk for yoghurt production with dried skim milk or by adding calcium gluconate. This results in improved culture growth, a more homogenous coagulum, and improved nutritional and organoleptic qualities (Elhassan, 2017). Fermented milk products are known for their taste, nutritive value and therapeutic properties (Kroger *et. al.,* 1989). Yogurt is fermented dairy product, it contains significant amount of proteins having high biological value, traces of mono- and disaccharides and appreciable quantities of minerals such as sodium, potassium, calcium and magnesium etc. Besides, it also possesses considerable quantities of several other health promoting substances such as vitamin A, biotin, thiamine, riboflavin, folic acid, nicotinic acid, pantothenic acid and ascorbic acid. Additionally, yogurt also has several therapeutic impacts such as enhancing the digestion and immune functionality and reducing the serum cholesterol level (Guinard *et al.,* 1997). The most commonly used methods include an increase of total solids in the milk and the addition of gums as stabilizers (Clark, 2017). The factors known to improve consistency and develop the chemical composition are increasing total solids, manipulation of processing variables, and characteristics of starter culture, (Omer, 2003). One approach to improve the yoghurt quality uses of stabilizer such as gums (Hussein, 2006). Gum Arabic is a dried exudation obtained from the stems of a *Acacia senegal L.* and well-related species. It consists mainly of salts of acidic arabinogalacton protein complex which on hydrolysis yields glucose, arabinose rhamnose and glucuronic acid (Glicksman, 1982). The gums have two major properties gelling and thickening, all gums by definition have a thickening effect. This property is the basis for their use as bodying, stabling and emulsifying agents in many foods such as: yoghurt, chocolate, milk drink, pudding, cottage cheeses, cream cheese, cheese spread (Omer, 2003).

Objectives:

1- To evaluate the chemical composition of yoghurt enriched with Arabic Gum (AG)

2- To evaluate the effect of storage period on chemical composition of yoghurt enriched with Arabic Gum (AG)

2. MATERIALS AND METHODS

2.1 Materials

Fresh cow's milk sample were obtained from Khartoum university farm and transferred immediately in sterilized container in an ice box to the Animal Products Department laboratory, National Food Research Center (NFRC), Shambatt. Starter culture MIX505LYODCU, freeze- dried form, Danisco France was obtained from a domestic dairy factory at Khartoum State. Arabic Gum (AG) was purchased from Arabic Gum Company. Chemicals and reagents used were obtained from the Lab line company-Khartoum. All the chemical and reagents were of analytical grades.

2.2 Methods

2.2.1 Preparation method

2.2.1.1 Arabic Gum preparation

Gum Arabic, provided by Arabic Gum Company. Gum samples were dried at room temperature and cleaned by hand to remove foreign particles and adhering bark. The samples were then ground using a mortar and piston, sieved through sieve No. 4 and kept in glass containers.

2.2.1.2 Yoghurt manufacture

Fresh milk was filtered through a sterilized cloth sheet, then it was analyzed for moisture, total solids, protein, fat, lactose, ash, pH and acidity. Samples were pasteurized at 85˚C for 30 seconds and left to cool down to 42^{o}C. The different treatment was added. Starter culture Yo-MIX505LYODCU was added at the level of 3% (w/v) containing a mixture of (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*) at ratio of 1:1, then samples were incubated at 42^{o}C for about four hours. Samples were then kept refrigerated at 4^{o}C until needed.

2.2.2 Analytical method

2.2.2.1 Chemical composition

The chemical composition carried out according to A.O.A.C (2005).

2.2.2.2 Statistical analysis

The data collected from the different treatments were subjected to Completely Randomize Design (CRD) in 2×2×3 factorial arrangement using analysis of variance (ANOVA) and

Duncan's Multiple Range test was employed (Steel and Torrie, 1980). The SAS program (SAS, 2002), was used.

3-RESULTS AND DESCUTION

3.1 Effect of Arabic Gum and storage period on moisture content of yoghurt

Table 1, shows the effect of Arabic Gum on the moisture content of yoghurt during the storage period. Concentration of gum had significant (P≤0.05) influence on the moisture content of yoghurt. The highest moisture content was reported for control sample 84.88%, while, the lowest moisture content was 82.71%, which was reported for the sample treated with 0.5%. This could be attributed to the fact that, Arabic Gums contain solids substance and have a water holding capacity as stated by Elhassan (2017). Glicksman (1962) reported that, the hydrophilic plant gums in yoghurt reduce a mount mix of free water and give stability to the finished product. Omer (2018) found that, moisture content of yoghurt was increased with gum level increased. Online, Mekana and Mehana (1990) who reported that addition of stabilizers decrease the moisture content of yoghurt.

Table 1: Effect of Arabic Gum (AG) and storage period on moisture content of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	83.99^{g} (±0.02)	84.79^{l} (±0.02)	85.10^{n} (±0.12)	85.65^{o} (±0.22)	84.88^{A}
0.1% (AG)	83.30^{c} (±0.06)	83.84^{g} (±0.05)	84.44^{j} (±0.02)	84.97^{n} (±0.05)	84.11^{B}
0.3% (AG)	82.83^{b} (±0.01)	83.72^{e} (±0.04)	84.37^{i} (±0.02)	84.78^{l} (±0.18)	83.92^{C}
0.5% (AG)	82.43^{a} (±0.05)	82.56^{d} (±0.01)	82.29^{h} (±0.01)	83.58^{i} (±0.02)	82.71^{D}
Overall	83.13^{D}	83.72^{C}	84.05^{B}	84.74^{A}	
$Lsd_{0.05}$	0.07056^{**}				

Moisture contents of samples reduced significantly (P≤0.05) as storage period continued. The highest moisture content was reported at zero time 83.13%, whereas, the lowest moisture content was 84.74%, reported after twelve day of the experiment. This could be attributed to the reduction in total solids by the microbial action throughout the storage period. The results of this study were actually contradictory to those reported by Abdelgadir (2018), Bajwa *et al.*, (2003) and Murtaza *et al.*, (2004) who found that there was a gradual increase in moisture content during storage of yoghurt.

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.2 Total solids (T.S)

Table 2, revealed that, Arabic Gum (AG) had significant (P≤0.05) influence on the T.S content of yoghurt. Obviously, T.S content of yoghurt samples decreased as the gum level increased. Untreated yoghurt reported the lowest T.S 15.11%, while, yoghurt sample treated with 0.5% reported the highest T.S 17.02%. Abdelgadir (2018) found that, yoghurt samples treated with 0.1% and 0.3% AG had T.S of 14.24% and 15.10%, respectively. Hamad *et al.*, (2016) found that, T.S of fermented milk (Rob) increased when treated with Arabic gum. Similar result was found by Abdel Razig *et al.*, (2015).

It worth mentioning that, the addition of (AG) for yoghurt formulation leads to set yoghurt with high quality characteristics. In recent study Niamah *et al.*, (2016), reported that the increase of the concentration of Arabic Gum (AG) which was added to yoghurt increased solid components in produced yoghurt.

Obviously, T.S significantly (P≤0.05) reduced during storage period. At initial time T.S was 16.86%, while, at the end of storage period was 15.22%. Recent study showed similar trend of decreasing in total solids, Macit and Bakirci (2017). Abdel-Salam *et al.*, (1996) found that, the total solids content decreased during storage period, a decrease in all samples due to lactose fermentation, protein and fat hydrolysis with formation of volatile substances. It is clear that, even though, there is an obvious gradual decrease of total solids during storage period.

Table 2: Effect of Arabic Gum and storage period on Total Solids (T.S) of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	16.01^{g} (±0.01)	15.21^{l} (±0.01)	14.90^{n} (±0.02)	14.35^{o} (±0.04)	15.11^{D}
0.1% (AG)	16.70^{c} (±0.02)	16.16^{f} (±0.02)	15.56^{j} (±0.02)	15.03^{m} (±0.02)	15.86^{C}
0.3% (AG)	17.17^{b} (±0.01)	16.28^{e} (±0.04)	15.63^{i} (±0.02)	15.22^{l} (±0.02)	16.07^{B}
0.5% (AG)	17.57^{a} (±0.05)	17.40^{d} (±0.01)	16.71^{h} (±0.01)	16.42^{k} (±0.02)	17.02^{A}
Overall	16.86^{A}	16.26^{B}	15.70^{C}	15.22^{D}	
$Lsd_{0.05}$	0.05257^{**}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.3 Protein

Table 3, shows that, the changes in protein content of yoghurt as affected by gum Arabic addition throughout storage period. The highest protein content was 3.77%, reported for sample stabilized with 0.5% Arabic gum, while, the lowest protein content was reported for control sample 3.49%. This could attribute to the fact that, Arabic gum contains glycoprotein. The findings of this study were in concordance with the results of earlier workers, Bajwa *et al*., (2003) and Murtaza *et al*., (2004) who found that, as gum level increased, protein content of yoghurt also increased. Hamed *et al.,* (2016) found that, protein content of fermented milk (rob) increased as gum level increased.

Generally, there was no significant (P≥0.05) reduction in protein content during storage period. Protein content of yoghurt at zero time was 3.78%, then, it reduced to reach 3.58 % at the fifth of the storage and continued reduction to reach 3.48% after twelvth day of the storage. The microorganisms present (lactic acid bacteria) in yoghurt may hydrolyze the protein to amino acids and peptides and utilize them as nutrients. Similar reduction in protein content was study in yoghurt was reported by Abdelgadir (2018); Bajwa *et al.,* (2003) and Murtaza *et al.,* (2004).

Furthermore, Proteins are important in food processing and food product development because they possess desirable functional properties that influence the consumer acceptability of food products Ogunbusola *et al.,* (2013). These properties include both physicochemical and nutritional properties. Protein solubility, water and oil absorption capacities, viscosity and gelation potentials are some of the functional properties that influence protein quality. Amino acid composition and the ease with which digestive enzymes hydrolyze a food protein are major determinants of food quality Sze-Tao and Sathe (2000).

Table 3: Effect of Arabic Gum (AG) and storage period on Protein of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	3.67^{g} (±0.01)	3.57^{k} (±0.00)	3.44^{o} (±0.02)	3.30^{p} (±0.01)	3.49^{C}
0.1% (AG)	3.77^{d} (±0.04)	3.66^{i} (±0.03)	3.54^{l} (±0.01)	3.46^{n} (±0.01)	3.60^{B}

0.3% (AG)	3.81^{c} (±0.02)	3.71^{f} (±0.01)	3.63^{j} (±0.01)	3.52^{m} (±0.01)	3.67^{AB}
0.5% (AG)	3.89^{a} (±0.03)	3.81^{b} (±0.01)	3.73^{e} (±0.01)	3.66^{h} (±0.01)	3.77^{A}
Overall	3.78^{A}	3.69^{AB}	3.58^{B}	3.48^{BC}	
$Lsd_{0.05}$	0.0005259^{**}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.4 Fat

Table 4, shows that, fat content of yoghurt significantly (P≤0.05) affected by the addition of Gum Arabic. Obviously, as gum level increased, fat content of the sample increased also. Control sample had reported the lowest fat content 3.09%, among the different gum concentrations. While, the samples stabilized with 0.1%, 0.3% and 0.5% had fat content with a mean of 3.20%, 3.30% and 3.45%, respectively. Similar results were reported by Abdelgadir (2018) who found that, sample treated with 0.1% and 0.3% had fat content of 3.41% and 3.51%, respectively. This could be attributed to the presence of fat in Arabic Gum. Similar behavior was noticed by Hamad *et al.*, (2016).

Generally, significant (P≤0.05) reduction in fat content of the yoghurt samples during the storage period was observed. At zero time fat content of yoghurt was 3.37%, then, reduced to 3.14% at twelvth day of storage. Similar results were noticed by Hamad *et al.*, (2016); Omer (2018); Ismaeil (2018). These results were in agreement with those reported by Abdel Razig *et al.*, (2015) and Macit and Bakirci (2017). This decrease could be as a result of the lipolytic activities of yoghurt bacteria during storage period. The fluctuation in fat content during storage period might be due to fat hydrolysis and liberation of free fatty acids that cause deterioration as mentioned by Tamime and Deeth, (1980), Abdelsalam *et al.*, (1996). Most samples were falling in the acceptable level determined by SSMO (2008) which recommended that, set yoghurt fat must be <3.25%. In addition, fat content has positive influence on the physical and sensory characteristics and negative impact on the shelf stability of yoghurt Saint-Eve *et al.*, (2008).

Table 4: Effect of Arabic Gum (AG) and storage period on Fat (%) of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	3.20^{e} (±0.00)	3.10^{f} (±0.00)	3.10^{f} (±0.00)	2.97^{g} (±0.06)	3.09^{C}
0.1% (AG)	3.30^{d} (±0.00)	3.20^{e} (±0.00)	3.20^{e} (±0.00)	3.10^{f} (±0.00)	3.20^{B}
0.3% (AG)	3.40^{c} (±0.00)	3.30^{d} (±0.00)	3.30^{d} (±0.00)	3.20^{e} (±0.00)	3.30^{AB}
0.5% (AG)	3.60^{a} (±0.00)	3.50^{b} (±0.00)	3.40^{c} (±0.00)	3.30^{d} (±0.00)	3.45^{A}
Overall	3.37^{A}	3.27^{B}	3.25^{B}	3.14^{C}	
$Lsd_{0.05}$	0.0005259^{**}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.5 Lactose

Table 5, revealed that, lactose content of yoghurt influenced significantly (P≤0.05) by Arabic Gum (AG) level during the storage period. Obviously, inverse relationship between lactose content and gum level, as Arabic Gum level increased, lactose content of yoghurt decreased. Untreated sample reported the highest lactose content. Sample stabilized with 0.1% Arabic gum had 3.83% lactose. While, sample stabilized with 0.5% Arabic gum had lactose content of 3.73%. Slightly lower lactose content 3.20%, for untreated sample was reported by Ismaeil (2018). Hamad *et al.*, (2016) found that, (Robe) sample stabilized by 5% Gum Arabic had lactose content of 4.355%, while, untreated sample had lactose content of 4.163%. In contrary, Abuzeid (2008) found that, the highest lactose content reported for control yoghurt 2.08%, whereas, the lowest one reported for stabilized yoghurt 2.06%.

However, lactose content reduced throughout the storage period, for instances, at initial time samples had lactose content of 4.36%, at the eighth day of storage was 3.40%, then continued to reduce to reach 3.25% at the end of the experiment. Similar reduction was observed by Abdelgadir (2018) who found that, the mean of lactose content at initial time was 5.87%, then it reduce to 4.835 at the end of storage period. This could be attributed to the fact that, the gradual decreased in lactose during storage period could be due to the conversion of lactose into lactic acid by lactic acid bacteria as stated by Elhassan (2017).

Moreover, Hassan and Amjad (2010) stated that, the reduction of lactose content through storage period due to the breakdown of lactose into lactic acid.

Table 5: Effect of Arabic Gum (AG) and storage period on Lactose content of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	4.09^{f} ±0.02	4.63^{k} ±0.01	3.88^{o} ±0.00	3.62^{p} ±0.00	4.05^{A}
0.1% (AG)	4.32^{c} ±0.01	4.02^{d} ±0.05	3.64^{h} ±0.01	3.34^{j} ±0.03	3.83^{B}
0.3% (AG)	4.58^{b} ±0.00	3.94^{e} ±0.04	3.48^{i} ±0.00	3.32^{m} ±0.01	3.83^{B}
0.5% (AG)	4.67^{a} ±0.01	3.72^{g} ±0.00	3.32^{l} ±0.01	3.23^{n} ±0.00	3.73^{C}
Overall	4.41^{A}	4.07^{B}	3.58^{C}	3.37^{D}	
$Lsd_{0.05}$	0.0005259^{**}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.6 Ash

Data in Table 6, showed that there were significant differences (P≤ 0.05) in ash content in case of treatments as well as storage period. Clearly, the lowest ash content was reported for untreated sample 1.15%, whereas, the highest ash content was reported for the sample treated with 0.5% Arabic Gum 1.32%. Abdelgadir (2018) found that, yoghurt treated by 0.1% and 0.3% Arabic Gum reported ash content of 1.30% and 1.50%, respectively. These results agreed with that result found by Niamah (2016), who pointed out that, Gum Arabic had (P≤0.05) influence on ash content of set yoghurt. Abuzeid (2008) in his study reported that inulin and mucilage stabilizers had notable effect on ash content of yoghurt. Bakar (2011) who reported that, untreated yoghurt had ash content of 0.50%. All these could be attributed to the fact that, the gums contain vary amounts of minerals, high content of Ca^{2}, Mg^{2} and K^{+} of polysaccharides in GA, and the effect of the gum in the metabolism of Ca and possibly

phosphate as stated by Onishi *et al.*, (2008). The results of the current study were supported with that stated by Bakar (2011) who reported that, yoghurt was a good source of minerals.

However, ash content significantly (P≤0.05) reduced during the storage period. Ash content of the sample at zero time was 1.34%, then, it reduced to register 1.13%, after the twelvth day of experiment. This reduction in ash content explained by the high lipolytic activity of lactic acid bacteria during this period of storage as mentioned by Hassan and Amjad (2010). Similar reduction was obtained by Abdelgadir (2018); Ismaeil (2018); Niamah (2016) and Abuzeid (2008). Moreover, Abdelgadir (2018) mentioned that, the ash content indicates the presence of inorganic elements existing in salt form.

Table 6: Effect of Arabic Gum (AG) and storage period on Ash content of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	1.25^{h} ±0.02	1.21^{k} ±0.01	1.18^{m} ±0.00	0.97^{o} ±0.03	1.15^{D}
0.1% (AG)	1.32^{e} ±0.02	1.28^{f} ±0.01	1.18^{l} ±0.01	1.13^{n} ±0.02	1.23^{C}
0.3% (AG)	1.38^{b} ±0.01	1.33^{d} ±0.01	1.22^{j} ±0.01	1.18^{l} ±0.01	1.28^{B}
0.5% (AG)	1.42^{a} ±0.01	1.37^{c} ±0.00	1.26^{g} ±0.01	1.23^{i} ±0.01	1.32^{A}
Overall	1.34^{A}	1.30^{B}	1.21^{C}	1.13^{D}	
$Lsd_{0.05}$	0.0005259^{**}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

3.7 Acidity

Data in Table 7, shows the effect of Arabic Gum in acidity content of yoghurt. Acidity content of the samples significantly (P≤0.05) influenced by gum concentration. Clearly, acidity content increased as gum level increased. Untreated sample reported the lowest acidity content 1.18%, then, it increased to 1.28% at level 0.3% AG, while, at level 0.5% registered 1.37% acidity content. Low acidity in control sample can be explained by the weak growth of probiotic bacteria in the milk and lactose hydrolyze. Niamah (2016) obtained that

control sample had lower acidity among the yoghurt stabilized by Gum Arabic. Similar results were noticed by Hamad *et al.*, (2016) who found that, acidity was significantly (P≤0.05) effected by Arabic gum addition. In contrast, Abdelgadir (2018) found that, acidity content of the yoghurt insignificantly (P≥0.05) influenced by the gum concentration. Supporting fact was stated by Kumar and Mishra (2004) who reported that, colloid type has an effect on the acidity development.

It is evident from Table 4.12, that there was insignificant (P≥0.05) relationship between the acidity content and storage period. Acidity content at initial time was 1.17 %, then it increased to 1.31% at day fivth, and 1.35% at the end of storage period (day tewelv). Similar increment of acidity content was noticed by Hamad *et al.*, (2016); Abdelgadir (2018); Niamah (2016).

Moreover, Elhassan (2017) stated that, the development of lactic acid under controlled conditions during fermentation is essential for the formation of yoghurt gel network. Acidity is the most typical characteristic of yoghurt which is affecting consumer acceptance because it gives the taste to yoghurt and also determines the shelf-life of product Abdelgadir (2018).

Table 7: Effect of Arabic Gum (AG) and storage period on Acidity content of yoghurt

Treatment	Storage period (days)				Overall
	0	4	8	12	
Control	1.123^{e} ±0.02	1.187^{de} ±0.10	1.220^{cde} ±0.00	1.177^{de} ±0.13	1.18^{D}
0.1% (AG)	1.120^{e} ±0.00	1.240^{cde} ±0.07	1.320^{abc} ±0.12	1.430^{a} ±0.03	1.28^{C}
0.3% (AG)	1.237^{cde} ±0.09	1.287^{bcd} ±0.04	1.333^{abc} ±0.06	1.397^{ab} ±0.16	1.30^{B}
0.5% (AG)	1.183^{de} ±0.03	1.300^{bcd} ±0.09	1.370^{ab} ±0.07	1.440^{a} ±0.03	1.37^{A}
Overall	1.17^{BC}	1.25^{B}	1.31^{AB}	1.35^{A}	
$Lsd_{0.05}$	0.1288^{*}				

Values are means ± SD.

*Means in the same column for the same parameter bearing the same superscript small letters are not significantly different (P≥0.05).

* *Means in the same row for the same parameter bearing different superscript capital letters are significantly different (P≤0.05).

4- Conclusion and recommendations:

4-1 Conclusion

- Concentration of gum had significant (P≤0.05) influence on the moisture content of yoghurt.
- Arabic Gum (AG) had significant (P≤0.05) influence on the Total Solids (T.S) of yoghurt.
- Protein content was significant (P≤0.05) effect with gum level.
- As gum level increased, fat content of the sample increased significantly.
- As Arabic Gum level increased, lactose content of yoghurt decreased.
- Acidity content of the samples significantly (P≤0.05) influenced by gum concentration.
- Regarding storage period, moisture content, T.S, protein and ash content significantly (P≤0.05) deceased as storage period increased.
- Lactose and acidity significantly (P≤0.05) increased as storage period increased.

4.2 Recommendations

* Yoghurt with Arabic gum, could be recommended for better chemical composition.

* Further work should be conducted on yoghurt to cover the sensory properties, amino acids and fatty acids.

* Shelf life of ice cream should be determined

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