

EFFECT OF GUM ARABIC AS PREBIOTIC ON PROBIOTICS AND QUALITY OF YOGHURT DURING COLD STORAGE

Fatima Abbas Eldawo Elawad¹, Mashair A. Sulieman¹ and Elhadi A. I. Elkhalil^{*2}

Address (es):

¹Department of Food Science and Technology, Faculty of Agriculture, University of Khartoum, Shambat 13314 Sudan²Department of Botany and Agric. Biotechnology, Faculty of Agriculture, University of Khartoum, 13314 Shambat, Sudan*Corresponding author: eaikhalil@yahoo.com or aelkhalil@uofk.edu<https://doi.org/10.36547/be.236>

ABSTRACT

This study was conducted to determine the effect of gum Arabic concentrations (0%, 0.7%, 0.9% or 1%) as prebiotic in yoghurt quality and probiotics, experiments were conducted using fresh cow's milk with 3% starter culture during cold storage in two types of yoghurt (plain and Flavored). The physicochemical parameters included: (moisture, ash content, total solids content, crude protein, fat content, lactose content, pH value and titratable acidity) were measured. Whereas microbial analyses were achieved including: total viable bacteria, lactic acid bacteria, total coliform, *E. coli* bacteria, yeasts and moulds, as well as the sensory evaluation of produced yoghurt was done. The results showed that no significant difference ($p \leq 0.05$) in all parameters. While showed significant difference ($p \leq 0.05$) in moisture content in the first day. While the addition of Gum Arabic on yoghurt samples during cold storage led to decreased in total viable bacteria, lactic acid bacteria and improve the quality and microbial properties through increasing the percentage of total solids, protein, fat, lactose and free from total coliform, yeast and mould. Organoleptic properties of the yogurt increased as the percentage of GA advanced in all tested samples. Yogurt produced using (1%) GA had acceptable characteristics. Addition of Gum Arabic to yoghurt product led to improve the quality and microbial properties. This improvement could be due to high amount of uronides.

Keywords: Gum Arabic, Prebiotic, Probiotic, Physicochemical properties, Yoghurt

INTRODUCTION

Food particularly dairy products have been considered as an ideal vehicle for delivering probiotic bacteria to the human gastrointestinal tract (Ross *et al.*, 2002). Some dairy products enhance microbial survival in gastric juice, most likely due to a buffering or protective effect (Ross *et al.*, 2005). At present probiotic bacteria have been mainly incorporated into dairy product such as yoghurt, fermented milks, milk powder, ice cream and cheese (Ranadheera *et al.*, 2010). Yoghurt is defined by the Food and Drug Administration (FDA) as a fermented dairy product derived from the fermentation of milk by two species of bacterial cultures, *Streptococcus thermophilus* (*S. thermophilus*) and *Lactobacillus bulgaricus* (*L. bulgaricus*) (Freites, 2017). Probiotics can be defined as "Live microbial feed supplements that beneficially affect the host animal by improving its intestinal microbial balance (Champagne *et al.*, 2005). The addition of prebiotic to variety of food products has become a more common occurrence in recent years. A prebiotic is defined as "non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and / or activity of one or a limited number of bacteria in the colon, and thus improves host health" (Gibson *et al.*, 2004). Gum Arabic (GA) is one member of prebiotic group. Probiotic and prebiotic is symbiotic product (Clark *et al.*, 1993). Acacia gum (Known as Arabic gum) a type of fiber, is a natural gum made of hardened plants juicer of various species of the acacia tree. It's grows principally in Sudan. It was collected from *Acacia nilotica*, *Acacia senegal* and *Acacia seyal* (Al-Assaf, 2005). When prebiotics are added to processed foods, stability during processing becomes an important factor. Processing conditions such as heat, acidity, and Millard reactions may have an effect on stability of prebiotic. The prebiotic ability of gum studied by various scientists show the effect of Arabic gum as a nutrient medium for *Lactobacilli* and *Bifidobacteria* because it is a fermentable fiber (Bisar *et al.*, 2014). Addition of gum Arabic to yoghurt formulation will serve two purposes, first is to act as prebiotic substance and second is it accompanies health benefits to yoghurt consumers (Ali *et al.*, 2009). The acidity and cold storage handling of products could reflect very on the viability of probiotic bacteria (Tamime *et al.*, 2005). This study was aiming to study the effect of adding different concentrations of gum Arabic in physicochemical properties of plain and flavored yoghurt, and to study their impact on probiotic bacteria during storage.

MATERIALS AND METHODS

Samples Collection

Milks samples were obtained from the University of Khartoum farm. Gum Arabic (GA) and flavor were obtained from local market in Khartoum. All sample of yoghurt were dispatched in ice box, held at (4-7°C).

Yoghurt production

Yoghurt was made from fresh milk; the milk was pasteurized with homogenization for 15 min. at temp. 83°C and milk was cooling up to 45°C and then added 3% starter culture then distributed to seven portions as follows: A=Control + 0% GA, B=Control + 0.7% GA+ with flavor, C=Control + 0.9% GA+ with flavor, D=Control + 1% GA+ with flavor, E= Control + 0.7% GA, F= Control + 0.9% GA, and G= Control +1% GA.

After that all samples were incubated at 43°C for 4-5 hrs. The obtained yoghurt transferred to refrigerator at 6°C±1. The produced yoghurt samples were evaluated for their physicochemical, microbial and sensorial properties at three intervals of storage periods of 1, 7 and 14 days.

Physicochemical Analysis

Moisture, total solids and titratable acidity content were determined according to the Association of Official Analytical Chemists methods (AOAC, 2008). The fat content was determined by Gerber method according to Bradly *et al.* (1992). The protein, ash and lactose contents were determined using methods of AOAC, (2003). pH analysis was carried out using a pH meter (model 11 microprocessor).

Microbiological Analysis

The total viable count of bacteria was carried out by using the pour plate count method as described by Harrigan (1998). Determination of coliform bacteria was carried out by using the most probable number (MPN) technique. Yeast and Moulds were measured from suitable dilution 0.1 ml was aseptically transferred into solidified potato dextrose agar containing 1.5 ml of sterile (1:10) tartaric acid per 100 ml of medium to inhibit bacterial growth and then plates were incubated at 28°C for 72 hrs. Lactic acid bacteria were isolated using selective media as MRS agar containing nystatin 10 grams per liter. The plates were incubated by using anaerobic jars at 37°C for 48-72 hrs.

Sensory Evaluation

Yoghurt samples were subject to sensory evaluation for color, aroma, taste, texture and overall acceptability using ten untrained panelists from the faculty of agriculture university of Khartoum. Their answer formulated as data then evaluated using proper statistical model (Obi *et al.*, 2010).

Statistical Analysis

The data collected from the different treatment was subject to analysis of variance and whenever appropriate the mean separation procedure of Duncan was employed (Steel and Torrie, 1980).

RESULT AND DISCUSSION

Effect of Gum Arabic on Moisture, Ash and Total Solids (%) content of Yoghurt (plain and flavored)

The effect of different concentration of gum Arabic and storage periods on the moisture content, Ash content and total solid of set and flavored yoghurt are shown in Table 1. Regardless of the treatments the moisture of yoghurt showed significant changes in day 1 ($p \leq 0.05$). On other hand the moisture content of samples stored for 7, 14 days were showed not significant ($p \leq 0.05$). The moisture content decreased with level of gum comparing with control and decreased slightly with storage. When the addition of GA was disregarded, storage period had no effect ($p \leq 0.05$) on moisture content of yoghurt. These results are in line with the finding of **Niamah et al., (2016)**. According to the result obtained the Ash content was nearly similar to the findings reported by **Niamah et al., (2016)** who stated ash content of 0.70-0.79%. On the other hand the ash content decreased with level of gum concentration comparing with control with decrease slightly in ash content with storage periods contradicted with **Abdalarhman (2018)**. According to the results obtained the T.S content of yoghurt was nearly to the findings reported by **Abdalarhman (2018)**. Who stated T.S 12.27-12.67%. Yoghurt samples differing in their gum concentration shows increase of the level gum comparing with control with decreased with storage period. In other side, there was no significant differences between control and yoghurt with different

concentrations of gum Arabic were found in moisture, ash and total solids interestingly, similar findings were found by **(Fayed, 2015)**.

Effect of Gum Arabic on Crude Protein, Fat and Lactose content of Yoghurt (plain and Flavored)

The effect of different concentration of gum Arabic and storage periods on the crude protein, fat content and lactose content of set and flavored yoghurt are shown in Table 2. The protein content according to the results obtained increased with level of gum Arabic comparing with control. However when the storage period was disregarded, addition of gum Arabic resulted in slightly increase. The result is similar to the reported by **(Amid et al., 2012; Abdalarhman, 2018)**. According to the results obtained the fat content increased with level of GA in flavored yoghurt comparing with control, in other side decreased with set yoghurt. Apparently when the storage period was disregarded fat content of yoghurt samples decreased slightly. Storage period had no effect ($p \geq 0.05$) on the fat content of yoghurt. These results contracted with **Abdalarhman, (2018)**. According to the results obtained the lactose content ranged between 2.95-4.26%. Apparently when the storage period disregarded lactose content of yoghurt decreased slightly. Storage period had no effect ($p \geq 0.05$) on lactose content of yoghurt these results contracted with **Abdalarhman (2018)**. It worth mentioned that there was no significant differences between control and yoghurt with different concentrations of gum Arabic were found in crude protein, fat content and lactose content (%) of yoghurt (Plain & Flavored).

Table 1 Effect of gum Arabic and storage period on the moisture content (%), Ash content (%) and total solid (TS) (%) of yoghurt:

Treatment	Storage Period (days)								
	Moisture %			Ash %			TS%		
	Day 1	Day 7	Day 14	Day1	Day7	Day 14	Day1	Day7	Day 14
A	88.50 ^a ±0.04	88.54 ^a ±0.07	88.06 ^a ±0.10	0.78 ^a ±0.02	0.66 ^a ±0.03	0.69 ^a ±0.01	11.85 ^a ±0.05	11.42 ^a ±0.08	11.92 ^a ±0.06
B	87.79 ^b ±0.65	89.15 ^b ±0.01	88.23 ^b ±0.03	0.74 ^b ±0.07	0.71 ^c ±0.02	0.67 ^{cd} ±0.01	12.5 ^b ±0.06	10.84 ^c ±0.03	11.79 ^b ±0.01
C	87.52 ^c ±0.08	88.41 ^c ±0.02	89.51 ^c ±0.06	0.77 ^b ±0.01	0.67 ^{bc} ±0.01	0.71 ^b ±0.05	12.95 ^c ±0.05	11.63 ^d ±0.03	10.48 ^d ±0.09
D	87.37 ^d ±0.01	88.75 ^c ±0.02	87.01 ^{de} ±0.10	0.77 ^b ±0.01	0.71 ^{bc} ±0.01	0.7 ^{cd} ±0.02	13.5 ^d ±0.11	11.10 ^e ±0.06	12.98 ^e ±0.06
E	87.55 ^c ±0.02	87.33 ^e ±0.02	87.02 ^e ±0.02	0.73 ^b ±0.02	0.71 ^b ±0.04	0.65 ^d ±0.01	12.9 ^c ±0.06	12.66 ^d ±0.05	11.72 ^c ±0.01
F	87.32 ^d ±0.01	87.62 ^f ±0.02	87.19 ^d ±0.06	0.76 ^b ±0.02	0.73 ^{bc} ±0.02	0.78 ^{bc} ±0.02	12.9 ^c ±0.01	12.37 ^b ±0.06	11.6 ^b ±0.02
G	87.6 ^c ±0.01	89.24 ^d ±0.07	86.72 ^f ±0.07	0.62 ^b ±0.015	0.45 ^b ±0.06	0.66 ^{bcd} ±0.01	13.3 ^d ±0.12	10.75 ^c ±0.05	12.11 ^c ±0.02
Mean	87.69±0.39	88.43±0.69	87.67±0.93	0.74±0.06	0.66±0.07	0.69±0.08	12.84±0.50	11.54±0.66	11.80±0.67

Values are mean ± SD

Values with same letter in the same column are not significantly different at level ($p \leq 0.05$)

A=Control (0% GA), B=Sample containing (0.7% GA) flavored, C=Sample containing (0.9% GA) flavored, D=Sample containing (1%GA) flavored, E= Sample containing (0.7% GA), F= Sample containing (0.9% GA), G= Sample containing (1%GA)

Table 2 Effect of gum Arabic and storage period on crude protein, Fat and Lactose Content (%) of yoghurt:

Treatment	Storage Period (days)								
	Protein			Fat			Lactose		
	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14
A	2.0 ^a ±0.12	2.8 ^a ±0.10	2.8 ^a ±0.06	4.25 ^c ±0.06	4.1 ^c ±0.06	4.3 ^d ±0.06	3.68 ^a ±0.02	3.58 ^a ±0.09	3.58 ^a ±0.09
B	2.3 ^b ±0.06	2.7 ^{ab} ±0.10	2.7 ^a ±0.11	3.5 ^b ±0.06	4.05 ^{ab} ±0.10	5.0 ^{ab} ±0.06	3.9 ^c ±0.10	3.31 ^c ±0.04	3.23 ^d ±0.03
C	2.3 ^c ±0.10	2.6 ^{ab} ±0.12	2.6 ^a ±0.10	3.6 ^c ±0.10	4.35 ^{bc} ±0.06	3.9 ^{abc} ±0.06	3.16 ^c ±0.07	3.09 ^c ±0.05	3.09 ^c ±0.05
D	2.3 ^d ±0.12	2.7 ^b ±0.06	2.7 ^a ±0.12	4.6 ^c ±0.10	4.4 ^{cd} ±0.10	4.3 ^c ±0.11	2.9 ^b ±0.05	3.0 ^b ±0.06	2.95 ^b ±0.06
E	1.8 ^b ±0.06	2.6 ^{ab} ±0.12	2.55 ^a ±0.12	3.9 ^d ±0.06	3.55 ^d ±0.10	3.15 ^a ±0.06	4.1 ^{cd} ±0.03	4.0 ^d ±0.06	4.01 ^b ±0.06
F	2.9 ^d ±0.12	2.8 ^{ab} ±0.12	2.75 ^a ±0.10	3.35 ^a ±0.06	3.7 ^a ±0.06	3.2 ^{abc} ±0.06	4.0 ^b ±0.02	3.8 ^b ±0.08	3.78 ^b ±0.08
G	2.8 ^d ±0.06	2.6 ^b ±0.12	2.6 ^a ±0.12	3.4 ^{ab} ±0.06	3.25 ^a ±0.06	3.35 ^{bc} ±0.06	4.3 ^d ±0.01	4.0 ^d ±0.06	4.01 ^b ±0.07
Mean	2.34±0.34	2.67±0.12	2.67±0.09	4.08±0.30	3.91±0.30	3.88±0.31	3.72±0.24	3.54±0.25	3.52±0.21

Values are mean ± SD

Values with same letter in the same column are not significantly different at level ($p \leq 0.05$)

A=Control (0% GA)

B=Sample containing (0.7% GA) flavored

C=Sample containing (0.9% GA) flavored

D=Sample containing (1% GA) flavored

E= Sample containing (0.7% GA)

F= Sample containing (0.9% GA)

G= Sample containing (1%GA)

Effect of Gum Arabic on Titratable Acidity and pH value (%) of Yoghurt (plain & Flavored)

The effect of different concentration of gum Arabic and storage periods on Titratable Acidity and pH value (%) of set and flavored yoghurt are shown in Table 3. According to the results obtained the pH value generally increased with level of GA comparing with control, in other side decreased with when addition of gum. Apparently when the storage period was disregarded pH value of yoghurt samples decreased in 7 day but increased in 14 day. Storage period had no effect ($p \geq 0.05$) on pH value of yoghurt these results in contradict with **Abd alrhman (2018)**. According to the results obtained the titratable acidity ranged between

0.4-1.02% nearly to the findings reported by **Niamah et al., (2016)** who stated ach content of 0.85- 0.91. Apparently when the storage period was disregarded titratable acidity (%) of yoghurt sample decreased at 1% GA level (set yoghurt) then reaches its peak (1.02) at 0.9% GA level (Flavored). When the addition of GA disregarded, storage period had no effect ($p \geq 0.05$) on titratable acidity (%) of yoghurt, these results in contradict with **Abd alrhman, (2018)**. In other side, there was no significant differences between control and yoghurt with different concentrations of gum Arabic were found in pH value and titratable acidity (%) of yoghurt (Plain & Flavored).

Table 3 Effect of gum Arabic and storage period on the PH value and Titratable acidity (%) of yoghurt:

Treatment	Storage Period (days)					
	pH			Titratable Acidity		
	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14
A	3.6 ^f ±0.01	3.5 ^a ±0.01	3.4 ^a ±0.01	0.8 ^a ±0.02	0.89 ^a ±0.01	1.2 ^c ±0.01
B	3.6 ^c ±0.01	3.6 ^d ±0.01	3.9 ^c ±0.01	0.9 ^b ±0.01	0.81 ^b ±0.01	0.9 ^c ±0.01
C	3.6 ^d ±0.01	3.5 ^a ±0.01	3.8 ^b ±0.01	0.9 ^d ±0.01	1.02 ^f ±0.01	1.0 ^d ±0.01
D	3.6 ^{bc} ±0.01	3.6 ^b ±0.01	4.0 ^d ±0.01	0.7 ^b ±0.02	0.95 ^e ±0.01	0.9 ^c ±0.00
E	3.9 ^c ±0.01	3.9 ^e ±0.01	4.1 ^e ±0.01	0.9 ^d ±0.02	0.86 ^c ±0.01	0.5 ^b ±0.01
F	3.8 ^a ±0.01	3.8 ^{bc} ±0.01	4.1 ^e ±0.01	0.7 ^d ±0.01	0.54 ^b ±0.01	0.4 ^a ±0.01
G	3.7 ^{ab} ±0.01	3.6 ^d ±0.01	4.3 ^e ±0.01	0.6 ^c ±0.01	0.62 ^d ±0.01	0.4 ^b ±0.03
Mean	3.7±0.01	3.6±0.01	3.9±0.01	0.78±0.01	0.81±0.01	0.76±0.00

Values are mean ± SD

Values with same letter in the same column are not significantly different at level ($p \leq 0.05$)

A=Control (0% GA), B=Sample containing (0.7% GA) flavored, C=Sample containing (0.9% GA) flavored, D=Sample containing (1% GA) flavored, E= Sample containing (0.7% GA), F= Sample containing (0.9% GA), G= Sample containing (1%GA)

Table 4 Effect of gum Arabic and storage on Total viable Bacteria, Lactic Acid, Total Coliform and *E. coli* Bacteria of yoghurt (Set & Flavored):

Treatment	Storage Period (days)											
	T. Viable (log10 cfu/gm)			Lactic Acid (log10 cfu/gm)			Coliform (MNP/g)			<i>E. coli</i> (MNP/g)		
	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14
A	5.73 ^a ±0.01	5.61 ^a ±0.00	5.76 ^b ±0.01	6.9 ^a ±0.03	6.83 ^a ±0.00	5.8 ^a ±0.02	NG	8.0 ^b ±1.52	14 ^a ±1.52	NG	NG	5.0 ^a ±2.08
B	5.82 ^d ±0.01	5.75 ^d ±0.01	5.73 ^b ±0.01	5.5 ^b ±0.01	6.7 ^c ±0.02	5.9 ^c ±0.03	NG	NG	3.7 ^b ±1.52	NG	NG	NG
C	5.96 ^c ±0.01	5.85 ^d ±0.00	5.82 ^c ±0.01	5.8 ^d ±0.01	6.89 ^d ±0.01	5.7 ^c ±0.02	NG	NG	NG	NG	NG	NG
D	5.90 ^e ±0.00	5.71 ^f ±0.02	5.96 ^f ±0.02	5.8 ^c ±0.02	6.86 ^c ±0.03	5.8 ^b ±0.02	NG	NG	NG	NG	NG	NG
E	5.53 ^c ±0.01	5.84 ^c ±0.00	5.91 ^c ±0.01	6.9 ^{bc} ±0.03	6.91 ^{cd} ±0.02	5.7 ^c ±0.02	NG	1.5 ^a ±1.00	3.3 ^b ±0.58	NG	NG	NG
F	5.87 ^b ±0.01	5.67 ^c ±0.01	5.85 ^d ±0.00	5.8 ^d ±0.01	6.86 ^b ±0.04	5.8 ^b ±0.02	NG	NG	NG	NG	NG	NG
G	5.68 ^c ±0.01	5.85 ^b ±0.01	5.75 ^a ±0.01	5.7 ^e ±0.02	5.71 ^c ±0.02	5.7 ^b ±0.03	NG	NG	NG	NG	NG	NG
Mean	5.78±0.09	5.75±0.09	5.82±0.08	6.09±0.40	6.68±0.41	5.77±0.69	NG	1.35±2.66	2.92±4.69	NG	NG	0.76±2.02

Values are mean ± SD

Values with same letter in the same column are not significantly different at level ($p \leq 0.05$)

A=Control (0% GA), B=Sample containing (0.7% GA) flavored, C=Sample containing (0.9% GA) flavored, D=Sample containing (1% GA) flavored, E= Sample containing (0.7% GA), F= Sample containing (0.9% GA), G= Sample containing (1%GA), NG= No Growth

Table 5 Effect of gum Arabic and storage period on yeast and mould (log cfu/g) of yoghurt:

Treatment	Storage Period (days)		
	Day 1	Day 7	Day 14
A	2.55 ^a ±0.09	3.7 ^a ±0.04	3.71 ^a ±0.03
B	NG	NG	2.60 ^b ±0.09
C	NG	NG	NG
D	NG	NG	NG
E	NG	NG	2.60 ^b ±0.09
F	NG	NG	NG
G	NG	NG	NG
Mean	0.36±0.93	0.52±1.32	1.25±1.55

Values are mean ± SD

Values with same letter in the same column are not significantly different at level (p ≤ 0.05)

A=Control (0% GA), B=Sample containing (0.7% GA) flavored, C=Sample containing (0.9% GA) flavored, D=Sample containing (1% GA) flavored, E= Sample containing (0.7% GA), F= Sample containing (0.9% GA), G= Sample containing (1%GA), NG= No Growth

Sensory evaluation of yoghurt

Table 6 shows the sensory evaluation samples in different levels of GA (%) of yoghurt (plain & Flavored). There were relative differences in appearance, taste, aroma, texture and general acceptability. The results showed that no significant difference between samples in appearance, taste, aroma, texture and acceptability (p ≤ 0.05). In appearance between the samples, the sample (C) had the best appearance as well as taste. In aroma between the samples the sample (f) had the best aroma among other samples. In texture between the samples, the samples (C&D) were the best. The sensory evaluation indicated that the overall acceptability was the best for sample (F &G) which containing 0.9 and 1% GA respectively.

Table 6 Sensory evaluation of yoghurt:

Treatment	Quality attributes				
	Appearance	Taste	Aroma	Texture	Overall acceptability
	Scores				
A	3.7 ^a ±0.82	3.6 ^a ±0.70	3.4 ^a ±1.07	3.8 ^a ±0.79	3.6 ^a ±0.84
B	3.9 ^a ±0.87	3.4 ^a ±0.52	3.3 ^a ±1.34	3.2 ^a ±0.79	3.4 ^a ±0.84
C	4.0 ^b ±0.82	3.8 ^b ±0.79	3.1 ^a ±0.99	3.7 ^a ±0.67	3.3 ^a ±0.48
D	3.8 ^a ±0.92	3.5 ^a ±0.97	3.1 ^a ±1.10	3.7 ^a ±0.95	3.4 ^a ±0.97
E	3.4 ^a ±0.52	3.2 ^a ±0.58	3.4 ^a ±0.67	3.4 ^a ±0.52	3.5 ^a ±0.52
F	3.3 ^a ±0.63	3.5 ^a ±0.71	3.7 ^b ±0.67	3.4 ^a ±0.84	3.7 ^b ±0.67
G	3.6 ^a ±0.52	3.4 ^a ±0.50	3.4 ^a ±0.72	3.5 ^a ±0.71	3.7 ^b ±0.48
Mean	3.7±0.76	3.5±0.69	3.3±0.95	3.5±0.76	3.5±0.70

Values are mean ± SD

Values with same letter in the same column are not significantly different at level (p ≤ 0.05)

A=Control (0% GA), B=Sample containing (0.7% GA) flavored, C=Sample containing (0.9% GA) flavored, D=Sample containing (1% GA) flavored, E= Sample containing (0.7% GA), F= Sample containing (0.9% GA), G= Sample containing (1%GA)

CONCLUSION

It could be concluded from this study that adding Gum Arabic (GA) to yoghurt was a significantly affected the physicochemical and microbial analysis of yoghurt (plain and Flavored). The storage period showed significant changes on both physicochemical and microbial parameters. It is worth mentioned that GA additive prolonged the shelf life of yoghurt up to 14 days. Addition of 1% Gum Arabic to yoghurt product led to improve the nutritional value through increasing the percentage of total solids, protein, fat, lactose and free from total coliform, *E. coli* and yeast & mould. These results showed the addition of 0.9 and 1% gum Arabic to yoghurt had higher acceptability.

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