Improving the Quality and Sensory Properties of Drinkable Yogurt Made from Goat and Sheep Milk with Date Puree

Sameh S. Yacoub[*1], Mai G. Mohamed[1], Ahmed Helal[1], Sameh A. Awad[2]

ABSTRACT

Goat's milk (GM), sheep's milk (SM), and its fermentation products are renowned for their nutritional and health advantages, yet they often face challenges in the market due to their distinctive flavor, which some consumers find unpleasant. The incorporation of fruit purees presents an appealing solution for enhancing taste, odor and masking the undesirable flavors in these dairy products. The current study aimed to investigate the effects of supplementing plain fermented GM or SM with date puree (DP) at concentrations of 1.5, 3, and 5% on physicochemical, antioxidant, rheological and sensory properties of the products. The pH-values, ash, fibers, antioxidants, and viscosity of both flavored goat drinkable yogurt (FGY) and flavored sheep-drinkable yogurt (FSY) were significantly higher ($p \leq 0.05$) compared to both plain drinkables. Drinkable yogurt fortified with 5% DP had a higher total solid content, while samples fortified with 1.5% and 3% DP had higher protein and fat contents than the control samples. The addition of DP improved significantly ($p \leq 0.05$) the sensory attributes of FGY and FSY, and the yogurt samples were more acceptable than controls. The cold storage (5◦C) for 10 days had significant effects ($p \leq 0.05$) on the properties of all yogurt samples. In conclusion, the addition of DP improved the physicochemical, rheological, and all sensory properties of goat and sheep yogurt.

Key words: Goat milk, Sheep milk, Date palm, Fermented beverage, Fortification.

INTRODUCTION

Dairy goat and dairy sheep husbandry play a crucial role in the economies of numerous countries, particularly within the Mediterranean and Middle Eastern regions (FAO, 2003). The small ruminant dairy industry comprises a substantial population of sheep and goats globally, totaling approximately 2,200 million animals, with 20.8% designated for dairy purposes. Dairy sheep and goat farming systems are environmentally sustainable and contribute significantly to the development of rural communities (Pulina *et al.*, 2018).

Sheep milk has shown promise as a suitable medium for delivering prebiotic fibers and probiotic bacteria, making it a promising avenue for the development of functional dairy products (Albenzio *et al.*, 2016 and Balthazar *et al.*, 2018). The processing of sheep milk results in products (such as fat and proteins) with a compelling nutritional profile and a favorable yield, particularly in the production of cheese and yogurt, when compared to the milk of other domestic mammals (Ribeiro *et al.*, 2007 and Balthazar *et al.*, 2017).

Goat milk stands apart from cow or human milk due to its increased digestibility, unique alkalinity, higher buffering capacity, and specific therapeutic benefits in both human medicine and nutrition, while there are species-specific variations in milk composition, the fundamental nutrient makeup of goat milk closely resembles that of cow milk (Park *et al.*, 2017). According to global statistical data, the majority of goat's milk is utilized in cheese production. Nevertheless, goat's milk is also employed in the manufacturing of various dairy products, including fermented dairy items (El-Zahar, 2009 and Peres *et al.*, 2016). The disadvantage of using goat milk in the production of fermented dairy products is the possibility of the specific goat milk taste appearance (Park, 2006 and Peres *et al.*, 2016).

Fermented milk products are highly desired and valued by consumers due to their health advantages, convenience, and ease of portability. Moreover, beverage yogurts contain probiotics that enhance the characteristics of the natural microorganisms in the human gut (Sobti *et al.*, 2021). Drinkable yogurts, which are fermented milk products, are widely consumed globally, spanning regions such as the Middle East, Africa, Asia, and various European countries (Stanton *et al.*, 2001). These products are made through lactic acid fermentation using milk from cows, goats, camels, buffaloes, or sheep (Ladokun & Oni, 2014 and Konuspayeva & Faye, 2021). In the dairy industry of European and North American markets, a recent scientific and technological trend involves the production of ready-to-drink products containing fruit pulp and bioactive compounds (Zulueta *et al.*, 2013). The most common approach to enhance the antioxidant and nutritional properties, as well as consumer perception of yogurts, involves supplementing them

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[1]Food, Dairy Science &Techno. Dept., Fac. of Agric., Damanhour Univ., Egypt.

[2]Dairy Science & Techno. Dept., Fac. of Agric., Alex. Univ., Egypt.

*Corresponding author: sameh.said@agr.dmu.edu.eg

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with value-added components like fruits in the form of juices, concentrates or purees (Caleja *et al.,* 2016). Several studies have stated the effect of the addition fruit flavors in masking flavor in goat milk yogurts (Machado *et al.,* 2017). Additionally, incorporating fruits like pineapples, blueberries, peaches, mangoes strawberries and apricots can enhance the quality of fermented milk products due to their aromatic flavors and heightened antioxidant properties. Numerous studies have explored the development of fermented buffalo milk products using various sweeteners, colorants, and flavoring agents (Sadaghdar *et al.*, 2012 and Nikmaram *et al.*, 2015).

Conversely, dates are considered one of the foremost fruit crops in Egypt and the Arab world. They are consumed at various stages of ripeness (tamr, rutub and khalal). Besides being eaten fresh, dates undergo diverse processing methods, yielding products such as date paste, date syrup, and depis. These derivatives find their way into a multitude of products like jam, preserves, jelly, and date bars (Yousef *et al.*, 2013). In 2011, Egypt emerged as the top global producer of dates, contributing 1.373.570 tons, which accounted for 20% of the world's total production (FAOSTAT, 2013).

To be consistent with and responsive to consumers' demands and expectations, milk-fruit beverages should be manufactured in a way that boosts their nutritional profile. Date palm considered as an almost ideal food, rich and inexpensive source of essential nutrients such as vitamins, minerals and carbohydrates and dietary fiber (Al-Farsi & Lee, 2008 and Biglari *et al.*, 2009), with low levels of lipids and proteins (Ghnimi *et al.*, 2017). Furthermore, date fruits also contain important phenolic compounds, isoflavones, phenolic acids, cinnamic acid derivatives, flavones, anthocyanidins, volatile compounds and nutraceutical compounds (Maqsood *et al.,* 2020 and Echegaray *et al.,* 2023) with functional effects, including, antimicrobial, antioxidant, antimutagenic, anti-inflammatory, hepato-protective, anticancer, gastro-protective and immune-stimulatory activities (Echegaray *et al.*, 2020 and Fernández-López *et al.*, 2022).

The study aimed to enhance the quality, antioxidant behavior and sensory properties of goats' and sheeps' milk drinkable yogurt. To achieve these, various levels (1.5%, 3%, and 5%) of date puree were used to make goat and sheep drinkable yogurt, and the physicochemical, rheological, antioxidant and sensory properties of final products were assessed during storage (5°C) for 10 days.

MATERIALS AND METHODS

Materials:

- Whole fresh goat's milk (GM), and sheep's milk (SM) were obtained from local farm of goat and sheep. The GM consisted of 4.1% fat, 3.59% protein, 4.2% lactose, and 8.62% non-fat solids, and the SM consisted of 5.56% fat, 5.27% protein, 4.39% lactose, and 10.57% non-fat solids.
- Date puree (DP): Dates palm (*Phoenix dactylifera*) fruits were purchased from local market. Date puree (DP) was prepared as follows: Fruits were washed under running water to remove any foreign impurities until cleaned. date seeds were removed manually. Fruit pulp was processed by scalding at 85°C for 15 min., blended using electric blender until homogeneous and packed in glass jars and kept frozen until use. According to the manufacturer, the date puree (DP) consisted of 90% (w/v) fruit pulp and 10% water.
- Yogurt starter culture: *Streptococcus thermophilus* and *Lactobacillus delbruekii ssp. bulgaricus* in the ratio of 1:1, w/w, Chris-Hansen A/S, Horsholm, Denmark.
- Gelatin was obtained from Sigma-Aldrich Corp. (St. Louis, MO, USA).
- Sucrose was obtained from local market.

Methods

Preparation of flavored drinkable yoghurts:

Flavored goat yogurt (FGY) and flavored sheep yogurt (FSY) were prepared by addition to milk 0.2% gelatin, 5% sucrose, and date puree at levels (0%, 1.5%, 3%, and 5%) (Table 1), and mixed to homogenous, the mixtures were heat treated at 90˚C for 10 min., cooled to 44˚C for inoculated with 1.5% bacterial starter culture, and incubated at 42 - 45˚C for 4h. then refrigerated for 8 h. Samples of plain and flavored goat and sheep yogurt were stirred gently thoroughly using spoons under sterile conditions, and storage cooled at 6±2 °C and analyzed after (1, 5, and 10) days.

Analytical Methods

Physicochemical composition:

The content of total solids, fat, total nitrogen (protein), ash, and fiber, along with pH values (measured using a pH meter, model HANNA HI9321 microprocessor) and titratable acidity, were analyzed in samples of goat's and sheep's milk, as well as flavored drinkable yogurt, following the procedures outlined in AOAC (2012). Additionally, total carbohydrates were calculated by difference for all samples analyzed, as described in Guzmán-González *et al.* (1999). Antioxidant activity was assessed according to the method outlined in Li *et al.* (2009).

Table 1. Abbreviation codes of different prepared goat and sheep drinkable yogurt samples

Treatments		Goat milk	Sheep milk	Date puree percent		
				1.5%	3%	5%
Goat yogurt(control)	GY	√				
Flavored goat yogurt	FGY1	√		√		
	FGY2	√			√	
	FGY3	√				√
Sheep yogurt(control)	SY		√			
Flavored sheep yogurt	FSY1		√	√		
	FSY2		√		√	
	FSY3		√			√

Rheological properties:

The viscometer was set to operate within the range of 10 to 50 rpm, and data on viscosity, shear stress and shear rate were digitally monitored and directly recorded by the instrument. The SC4-21 spindle was chosen for the measurements, and the procedure was conducted according to Khalil (2013).

Organoleptic properties:

Fermented goat's and sheep's milk samples used for drinkable yogurt supplemented with DP were evaluated along the storage period for color, odor, taste, body & texture and overall acceptability by ten of members in Food & Dairy Science and Technology Dept., Faculty of Agriculture, Damanhour University, Egypt. Results were recorded in a score sheet described by Kebary and Hussein (1999).

Statistical analysis:

Each sample was measured in three replicates, and the reported values include mean and standard deviation. Statistical analyses were conducted using CoStat software, version 6.400 (CoHort software, Monterey, CA, USA) (SAS, 1996). To determine the significance of differences among all treatments the three-way analysis of variance (ANOVA) and the least significant difference (LSD) test were employed, differences were considered significant at ($p \leq 0.05$).

RESULTS AND DISCUSSION

Physicochemical properties of goat and sheep drinkable yogurt flavored with date puree:

The physicochemical properties (total solids, fat, protein, ash, crude fibers, carbohydrates content, pH, antioxidants and viscosity) of the controls and flavored GM and SM yogurt were illustrated in Table (2). The samples were examined to determine the influence of adding date puree (DP) on the quality properties of the GM and SM products. It could be noticed that total solids, carbohydrate, protein, and fat in FSY were higher than FGY. While, carbohydrate and ash content in FGY were higher than FSY. Some of these components such as, total solids and carbohydrates are increased by the increase of the ratio of added date puree (DP), but protein, fat and ash were decreased by the addition of DP in both FGY and FSY on basic of dry matter. These results agree with those reported by Almosawi & Hassan (2019) and Tawfek *et al.* (2021). At the same time, these findings are partially consistent with those reported by Kale *et al.* (2011), who found that supplementation of yogurt with varying levels of date palm paste reduced moisture content while increasing total solids, fat, and protein levels. The different date puree levels examined showed varying percent of total solids. Consequently, GM and SM yogurt fortified with 5% date puree had higher dry matter content (23.29%) than the control samples ($p \leq 0.05$) as shown in Table (2). Specifically, FSY3 observed the highest dry matter content while FGY1 samples observed the lowest dry matter content (17.51%). The storage period had significantly affected on the components of all drinkable yogurt samples, Total solids, fat, protein and total carbohydrates were increased with prolonged of storage period, while pH values were decreased with prolonged of storage period, but ash content hadn't significant effects during storage period.

The pH values of controls and flavored drinkable yogurt samples were determined during the refrigerated storage period (10 days) and the data are shown in Table (2). Overall, the pH rates of all drinkable yogurt samples demonstrated a significant and consistent decrease ($p \leq 0.05$) from the first day of storage throughout the entire 10-days storage period. Based on the type of milk utilized in the production of drinkable yogurt samples, the pH-values were higher and differ significantly in drinkable yogurt produced with goat milk (GM) than produced with sheep milk (SM) when 1-day and up to the end of storage period (10 days). This could be attributed to the variations in the composition of milk used in yogurt manufacture. Specifically, sheep milk had the highest carbohydrate content (4.39%), as presented in Table (2). This higher carbohydrate content likely enhancement the growth of lactic acid bacteria (LAB) during the fermentation step, leading to increased acidity values in the all drinkable yogurt samples made with sheep milk compared to that made with goat milk. Furthermore, during the storage period for10 days, it is worth noting that the all drinkable yogurt samples made using goat milk observed the most significant decrease in pH-values rate when compared to those made with sheep milk. Indeed, the pH- values in the 1-to-10-day period exhibited the following increments: 0.34, 0.37, 0.2, 0.14, 0.12, 0.11, 0.9 and 0.11 for GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2 and FSY3 samples respectively (Table 2). On the other hand, based on the level of date puree used, the pH-values of the drinkable yogurt samples flavored with (1.5% and 3%) date puree were the lower without any significant differences when compared to the GY and SY samples. While drinkable yogurt samples flavored with (5%) date puree were the lowest pH- values with significant differences when compared to all others drinkable yogurt samples during the cold storage period (10 days) (Table 2). Ismail (2015) reported that incorporating dates into milk led to an increase in titratable acidity and a decrease in pH values of yogurt, possibly due to compounds found in dates.

Alternatively, titratable acidity values of GY and SY increased by addition of DP which may be ascribed to compounds present in dates (Table 2). Moreover, the increase in titratable acidity in fortified yogurt was more than that observed in the control. This refers to the activation of added dates to yogurt microorganisms during storage. Al-Otaibi and El-Demerdash (2013) reported that the acidity values in fermented camel milk fortified with 1%, 2.5%, and 5% date depis were higher than as compared to the control group.

The impact of DP on the chemical composition of the FGY and FSY could be explained on the basis of richness of different date cultivars with carbohydrates (both reducing and non-reducing sugars), minerals, dietary fibers and poorness of them with protein and fat (Al-Farsi & Lee, 2008; El-Ghazali *et al.*, 2010 and Al-Tamim, 2014).

The changes in fiber content when first day and during the cold storage (10 days) of yogurt samples are presented in Fig. (1). The addition of DP to goat and sheep drinkable yogurt observed significantly increase in crude fiber content as compared with controls. In the same time, fiber content increment gradually with increase the percent of date puree, FGY3 and FSY3 were the highest fiber content (381.07, 416.5mg/100g). No significant differences in fiber content according to milk type, while significant differences were observed according to storage period.

Antioxidants are bioactive compounds that inhibit oxidation reactions triggered by oxygen or peroxides, thereby safeguarding cells against the harmful effects of oxidative stress (Genovese *et al.*, 2008). Some researchers have demonstrated the efficacy of fruits, being a natural source of antioxidants, in protecting against oxidative stress (Hassimotto *et al.*, 2005). The levels of total antioxidant (mg/100 g) of GY, SY, FGY and FSY are presented in Fig. (2). The result showed that the total antioxidant of GY samples were higher than SY when fresh and during cold storage period (10 days), in the same time fortification of goat and sheep drinkable yogurt using different levels (1.5, 3 and 5%) of DP had significantly increased the levels of total antioxidant as compared with controls. Regarding total antioxidant (mg/100 g), 5% in both of FGY and FSY had the highest values (79.22 and 50.62 mg/100 g) in samples. Similar to the findings reported by Jambi (2018), it was observed that incorporating 1% to 5% of date powder led to an increase in the DPPH radical scavenging activity within yogurt samples. This observed effect might be explained by its high content of phenolics and antioxidants (Amerinasab *et al.*, 2015). Hence, due to its high content of bioactive components, DP has several beneficial effects related to oxidative stress, anemia, cancer and diabetes. The levels of total antioxidant in both FGY and FSY were significantly increased during cold storage, whereas those in plain yogurt fluctuated. The enhancement in the bioactive properties of FGY and FSY during storage was linked to the breakdown of complex compounds and high molecular weight, consequently releasing thebioactive compounds.

Viscosity of goat and sheep drinkable yogurt samples:

The viscosity of goat and sheep drinkable yogurt following the addition of DP and cold storage (10 days) is shown in Fig. (3). Significant differences ($p \leq 0.05$) in viscosity were noted among the yogurt samples. In addition, SY samples observed viscosity values higher than GY samples. Generally, incorporation of DP concomitantly ($p \leq 0.05$) increased the viscosity as compared with controls. Addition of 5% DP was observed the highest viscosity values (473 and 669 mPas) for the FGY3 and FSY3 respectively, whereas the lowest value (420 and 601 mPas) was observed for controls of goat and sheep yogurt samples. The increase in the viscosity following the addition of DP is may be due to the high content of total solids and carbohydrates improve the capacity to bind water.

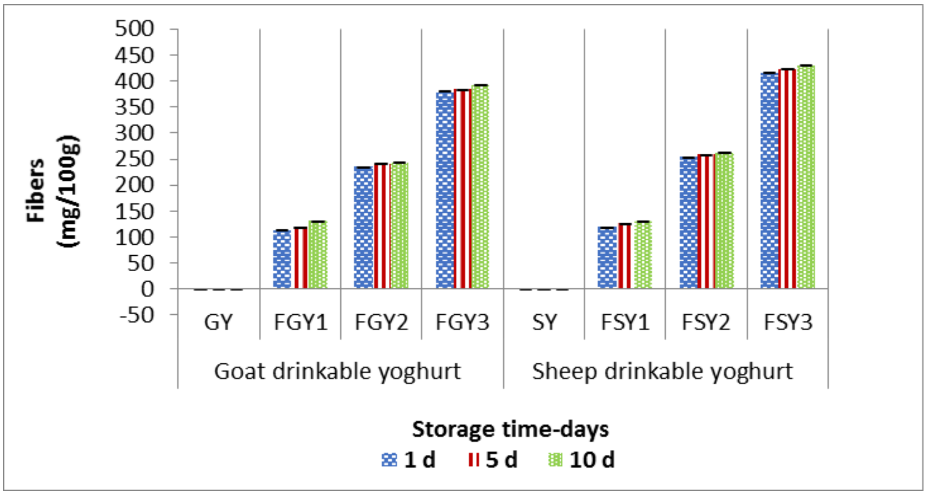
Table 2. Effect of addition date puree on the physicochemical composition of goat and sheep drinkable yogurt samples

Component (%)	Storage time (days)	Treatments Codes *							
		GY (control)	FGY1	FGY2	FGY3	SY (control)	FSY1	FSY2	FSY3
Total Solids	1	19.05±0.2^{B,b,C}	17.51±0.18^{B,d,C}	18.37±0.19^{B,c,C}	19.48±0.15^{B,a,C}	22.86±0.14^{A,b,C}	21.5±0.13^{A,d,C}	22.25±0.12^{A,c,C}	23.29±0.14^{A,a,C}
	5	19.41±0.14^{B,b,B}	17.88±0.15^{B,d,B}	18.65±0.18^{B,c,B}	19.82±0.13^{B,a,B}	23.15±0.19^{A,b,B}	21.9±0.2^{A,d,B}	22.68±0.18^{A,c,B}	23.55±0.17^{A,a,B}
	10	19.69±0.18^{B,b,A}	18.08±0.24^{B,d,A}	18.99±0.22^{B,c,A}	20.13±0.19^{B,a,A}	23.5±0.14^{A,b,A}	22.37±0.18^{A,d,A}	23±0.19^{A,c,A}	23.96±0.24^{A,a,A}
Fat/dm	1	20.2±0.05^{B,c,C}	22.1±0.04^{B,a,C}	20.9±0.07^{B,b,C}	19.3±0.07^{B,d,C}	26.54±0.07^{A,c,C}	28.71±0.04^{A,a,C}	27.3±0.05^{A,b,C}	25.65±0.05^{A,d,C}
	5	20.58±0.07^{B,c,B}	22.57±0.06^{B,a,B}	21.22±0.08^{B,b,B}	19.64±0.04^{B,d,B}	26.87±0.06^{A,c,B}	28.36±0.05^{A,a,B}	27.79±0.06^{A,b,B}	25.93±0.04^{A,d,B}
	10	20.87±0.06^{B,c,A}	22.82±0.08^{B,a,A}	21.61±0.07^{B,b,A}	19.94±0.04^{B,d,A}	27.29±0.07^{A,c,A}	28.97±0.05^{A,a,A}	28.2±0.04^{A,b,A}	26.38±0.04^{A,d,A}
Protein/dm	1	17.51±0.04^{B,c,C}	19.39±0.05^{B,a,C}	18.39±0.06^{B,b,C}	17.24±0.03^{B,d,C}	21.32±0.04^{A,c,C}	23.18±0.03^{A,a,C}	22.2±0.05^{A,b,C}	20.95±0.07^{A,d,C}
	5	17.84±0.06^{B,c,B}	19.8±0.06^{B,a,B}	18.67±0.05^{B,b,B}	17.54±0.06^{B,d,B}	21.59±0.04^{A,c,B}	23.61±0.05^{A,a,B}	22.63±0.05^{A,b,B}	21.18±0.06^{A,d,B}
	10	18.1±0.05^{B,c,A}	20.02±0.05^{B,a,A}	19.01±0.03^{B,b,A}	17.82±0.05^{B,d,A}	21.92±0.05^{A,c,A}	24.12±0.02^{A,a,A}	22.95±0.06^{A,b,A}	21.55±0.05^{A,d,A}
Ash/dm	1	4.05±0.04^{A,d,A}	4.57±0.06^{A,a,A}	4.42±0.06^{A,b,A}	4.25±0.04^{A,c,A}	3.87±0.03^{B,d,A}	4.09±0.04^{B,a,A}	3.99±0.06^{B,b,A}	3.87±0.06^{B,c,A}
	5	4.13±0.03^{A,d,A}	4.67±0.04^{A,a,A}	4.49±0.05^{A,b,A}	4.3±0.06^{A,c,A}	3.91±0.07^{B,d,A}	4.17±0.04^{B,a,A}	4.06±0.03^{B,b,A}	3.91±0.09^{B,c,A}
	10	4.19±0.05^{A,d,A}	4.72±0.05^{A,a,A}	4.57±0.06^{A,b,A}	4.39±0.05^{A,c,A}	3.98±0.02^{B,d,A}	4.26±0.06^{B,a,A}	4.12±0.05^{B,b,A}	3.98±0.07^{B,c,A}
Carbohydrates/ dm	1	57.55±0.24^{A,a,C}	52.45±0.23^{A,d,C}	54.25±0.29^{A,c,C}	56.3±0.29^{A,b,C}	50.1±0.16^{B,a,C}	45.42±0.3^{B,d,C}	47.29±0.3^{B,c,C}	49.6±0.28^{B,b,C}
	5	58.64±0.25^{A,a,B}	53.51±0.22^{A,d,B}	55.08±0.33^{A,c,B}	57.28±0.32^{A,b,B}	50.74±0.36^{B,a,B}	46.27±0.33^{B,d,B}	48.2±0.22^{B,c,B}	50.15±0.26^{B,b,B}
	10	59.48±0.26^{A,a,A}	54.16±0.29^{A,d,A}	56.05±0.27^{A,c,A}	58.18±0.23^{A,b,A}	51.5±0.56^{B,a,A}	47.25±0.26^{B,d,A}	48.88±0.24^{B,c,A}	51.03±0.25^{B,b,A}
pH-Values	1	4.82±0.01^{A,a,A}	4.84±0.01^{A,a,A}	4.82±0.03^{A,a,A}	4.77±0.08^{A,b,A}	4.64±0.04^{B,a,A}	4.63±0.07^{B,a,A}	4.62±0.01^{B,a,A}	4.62±0.03^{B,b,A}
	5	4.64±0 .02^{A,a,B}	4.73±0.05^{A,a,B}	4.68±0.05^{A,a,B}	4.62±0.04^{A,b,B}	4.59±0.01^{B,a,B}	4.56±0.05^{B,a,B}	4.59±0.04^{B,a,B}	4.53±0.01^{B,b,B}
	10	4.58±0.07^{A,a,C}	4.57±0.01^{A,a,C}	4.62±0.01^{A,a,C}	4.63±0.02^{A,b,C}	4.53±0.06^{B,a,C}	4.52±0.01^{B,a,C}	4.53±0.02^{B,a,C}	4.51±0.03^{B,b,C}
Titratable acidity	1	0.81±0.05^{B,a,C}	0.77±0.01^{B,c,C}	0.8±0.02^{B,b,C}	0.82±0.01^{B,b,C}	0.97±0.03^{A,a,C}	1.01±0.01^{A,c,C}	1± 0.02^{A,b,C}	1.03±0.02^{A,b,C}
	5	1.11±0.06^{B,a,B}	0.93±0.03^{B,c,B}	1.01±0.01^{B,b,B}	0.96±0.04^{B,b,B}	1.11±0.02^{A,a,B}	1.08±0.02^{A,c,B}	1.09±0.01^{A,b,B}	1.08±0.01^{A,b,B}
	10	1.1±0.03^{B,a,A}	1.04±0.03^{B,c,A}	1.04±0.01^{B,b,A}	1.10±0.03^{B,b,A}	1.15±0.02^{A,a,A}	1.15±0.04^{A,c,A}	1.16±0.04^{A,b,A}	1.18±0.03^{A,b,A}

* Treatments (GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2, and FSY3) presented in Table1. Results are the mean of three different determinations ± standard deviation, and letters of significant effects of factors (milk type, date puree level, storage period), respectively. Means that are followed by the same letter in the row and the same capital letter in the column did not differ significantly ($p \leq 0.05$).

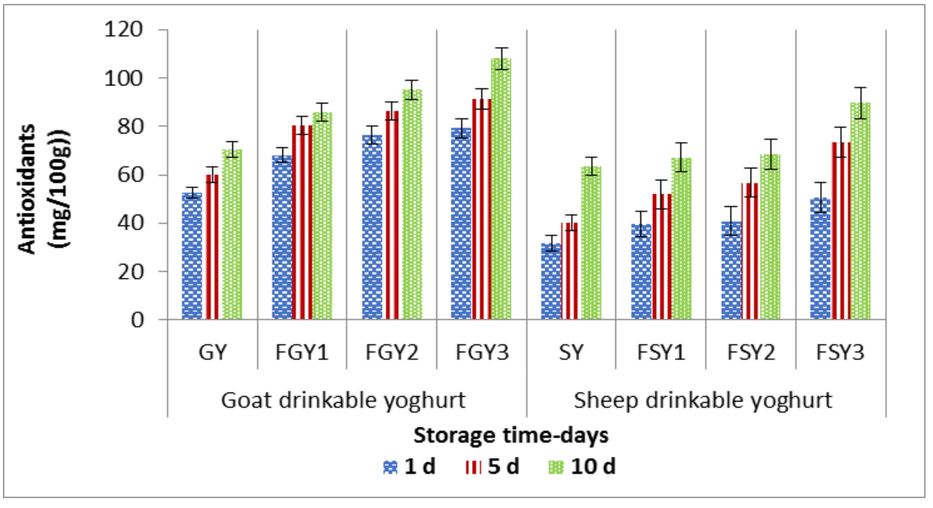
Moreover, changes in formulation composition, types of starter cultures, heat treatment conditions, and processing methods could also influence the viscosity of yogurt, as indicated by Sun-Waterhouse *et al.* (2013).

During the cold storage for 10 days, viscosity values observed significant increase ($p \leq 0.05$) for all yogurt samples. The increase in viscosity during storage of controls, FGY and FSY are probably as a result of the yogurt undergoing post-acidification at 4°C, wherein milk protein can form a firmer gel and augmenting the viscosity of the fortified yogurts (Mohammadi-Gouraji *et al.,* 2019). Furthermore, the increased viscosity of FGY and FSY during storage might be attributed to the formation of exopolysaccharides (EPS) by LAB cells under unfavorable conditions, as suggested by Parvarei *et al.* (2021). The exopolysaccharides (EPSs) synthesized by lactic acid bacteria (LAB) are recognized for their ability to interact with milk components, serving as gelling agents, stabilizers, texturizers, and viscosifiers in dairy products (Korcz and Varga, 2021). Furthermore, the interplay between polysaccharides and phenolic compounds in dairy protein, coupled with the protein network in yogurt, could potentially prompt the reorganization of the network, consequently augmenting the viscosity of yogurt over time. A comparable rise in yogurt viscosity has been documented in fortified yogurts containing phycocyanin (Mohammadi-Gouraji *et al.*, 2019). Moreover, a similar rise in the viscosity of yogurt fortified with grape pomace during refrigerated storage has been stated by Demirkol and Tarakci (2018).



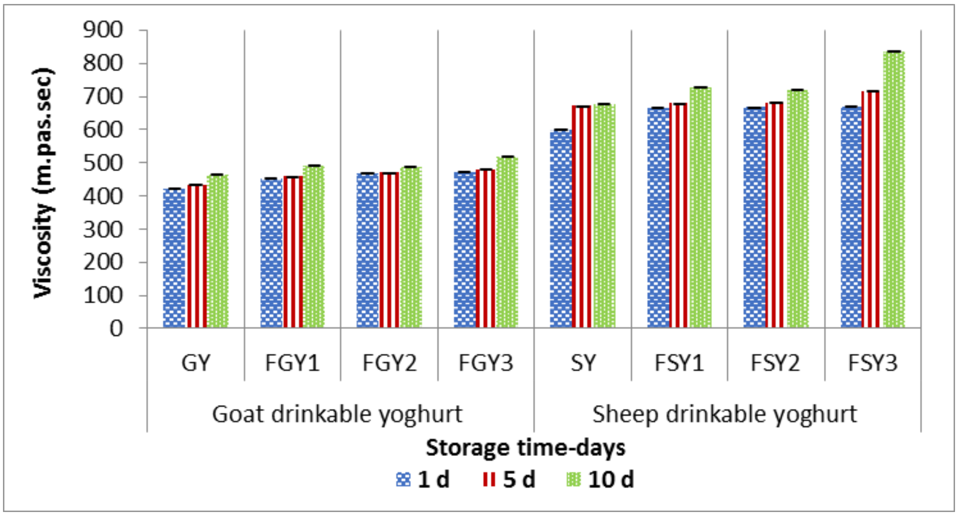
*** Treatments (GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2, and FSY3) presented in Table1**

Fig.1. Crude fibers content of drinkable goat and sheep yogurt flavored with date puree



*** Treatments (GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2, and FSY3) presented in Table1**

Fig. 2. Total antioxidant of drinkable goat and sheep yogurt flavored with date puree



*** Treatments (GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2, and FSY3) presented in Table1**

Fig. 3. Viscosity values of drinkable goat and sheep yogurt flavored with date puree

In general, the influence of date puree with varying concentrations used in this study is in agreement with the trends given by Mehanna *et al.* (2017) who utilized date paste and date syrup in the preparation of stirred yogurt and yogurt drink, respectively.

Sensory attributes of goat and sheep drinkable yogurt samples:

The evaluation of organoleptic properties is a vital indicator of potential consumer preferences. The popularity of yogurt as a food component depends mainly on its sensory characteristics and addition of different flavors to yogurt has been found to increase options for consumers and helps in marketing yogurt and retaining consumer interests (Routray and Mishra, 2011). The organoleptic characteristics of goat and sheep drinkable yogurt samples during 10 days of cold storage period are shown in **Table (3)**. The color, odor, taste, body, texture, and overall acceptability were evaluated, the results showed that there were significant differences ($p \leq 0.05$) between the all drinkable yogurt in all sensory attributes scores. According to the panelists' evaluation, flavored yogurt samples had a higher value ($p \leq 0.05$) compared plain yogurt, The addition of DP to GY and SY increased and improve their color, odor, taste, body, texture, and overall acceptability scores. Moreover, the sensory scores increased along with the DP concentrations. The GY and SY flavored with DP at level 5% were the most acceptable samples and achieved the highest score for all sensory properties, while plain GY and plain SY were achieved the lowest score for all sensory properties all over the storage period. The enhancement of sensory properties of FGY and FSY is likely due to the flavor and sweet taste of date puree, whereas the improvement in the storage stability of the FGY and FSY may be due to the high sugar content of date syrup, which reduced the water activity of the developed product and thereby eliminated the growth of spoilage microorganisms. These results agreed with that obtained by Ismail (2015) and Mehanna *et al.* (2017). Consistent with these findings, fortifying fermented dairy products with dates notably enhanced their sensory characteristics when compared to plain samples, as evidenced by Hariri *et al.* (2020) and Tawfek *et al.* (2021). According to the cold storage for 10 days, the scores of color, texture and overall acceptability decreased significantly for all drinkable yoghurt. But, the score of odor and taste had decreased with any significant differences. Overall, the results of this study suggest that fortifying GY and SY with date puree improved the sensory appeal of this product, potentially facilitating its widespread production, trade, and consumption of this dairy beverage.

Table 3. Effect of addition date puree on the sensory properties of goat and sheep drinkable yogurt samples

Properties	**Storage time**	**Treatments Codes ***							
(Score)	**(days)**	**GY**	**FGY1**	**FGY2**	**FGY3**	**SY**	**FSY1**	**FSY2**	**FSY3**
Color (10)	1	8.5±0.97^{A,d,A}	8.9±0.57^{A,c,A}	8.9±0.73^{A,b,A}	9.2±0.63^{A,a,A}	7.9±0.32^{B,d,A}	8.5±0.53^{B,c,A}	9.2±0.42B^{,b,A}	9.4±0.70^{B,a,A}
	5	8.4±0.96^{A,d,A}	8.9±0.32^{A,c,A}	8.9±0.74^{A,b,A}	9.1±0.57^{A,a,A}	7.7±0.48^{B,d,A}	8.5±0.53^{B,c,A}	9.1±0.32^{B,b,A}	9.4±0.69^{B,a,A}
	10	8.2±0.79^{A,d,B}	8.7±0.48^{A,c,B}	8.5±0.53^{A,b,B}	8.9±0.32^{A,a,B}	7.4±0.52^{B,d,B}	8.3±0.48^{B,c,B}	8.7±0.48^{B,b,B}	9.0±0.82^{B,a,B}
Odor (10)	1	8.2±0.78^{A,b,A}	9.4±0.52^{A,a,A}	9.4±0.52^{A,a,A}	9.4±0.52^{A,a,A}	8.3±0.48^{B,b,A}	9.2±0.42^{B,a,A}	9.2±0.42^{B,a,A}	9.3±0.48^{B,a,A}
	5	7.8±0.63^{A,b,A}	9.2±0.42^{A,a,A}	9.1±0.32^{A,a,A}	9.2±0.32^{A,a,A}	8.2±0.42^{B,b,A}	9.0±0.67^{B,a,A}	9.0±0.47^{B,a,A}	9.0±0.00^{B,a,A}
	10	7.8±0.79^{A,b,A}	8.9±0.32^{A,a,A}	9.1±0.32^{A,a,A}	9.1±0.32^{A,a,A}	7.9±0.32^{B,b,A}	8.7±0.48^{B,a,A}	8.6±0.52^{B,a,A}	8.7±0.48^{B,a,A}
Taste (10)	1	7.9±0.88^{B,c,A}	8.7±0.48^{B,b,A}	8.8±0.42^{B,b,A}	9.3±0.48^{B,a,A}	7.9±0.74^{A,c,A}	9.0±0.67^{A,b,A}	9.1±0.88^{A,b,A}	9.5±0.71^{A,a,A}
	5	7.7±0.67^{B,c,A}	8.6±0.51^{B,b,A}	8.6±0.52^{B,b,A}	9.0±0.47^{B,a,A}	7.7±0.48^{A,c,A}	8.8±0.42^{A,b,A}	9.1±0.74^{A,b,A}	9.3±0.68^{A,a,A}
	10	7.7±0.82^{B,c,B}	8.5±0.53^{B,b,B}	8.4±0.70^{B,b,B}	8.9±0.31^{B,a,B}	7.4±0.52^{A,c,B}	8.6±0.52^{A,b,B}	8.6±0.52^{A,b,B}	9.0±0.48^{A,a,B}
Texture (10)	1	8.7±0.67^{A,b,A}	8.9±0.56^{A,a,A}	9.0±0.82^{A,a,A}	9.1±0.88^{A,a,A}	8.9±0.74^{A,b,A}	9.2±0.42^{A,a,A}	9.0±0.82^{A,a,A}	9.2±0.92^{A,a,A}
	5	8.6±0.7^{A,b,A}	8.9±0.57^{A,a,A}	9.0±0.82^{A,a,A}	9.1±0.87^{A,a,A}	8.6±0.52^{A,b,A}	9.1±0.32^{A,a,A}	9.0±0.67^{A,a,A}	9.2±0.79^{A,a,A}
	10	8.2±0.92^{A,b,B}	8.6±0.52^{A,a,B}	8.7±0.48^{A,a,B}	8.9±0.74^{A,a,B}	8.3±0.48^{A,b,B}	9.0±0.00^{A,a,B}	9.0±0.47^{A,a,B}	9.0±0.67^{A,a,B}
Overall acceptability (10)	1	8.0±0.67^{A,d,A}	9.1±0.32^{A,c,A}	9.1±0.32^{A,b,A}	9.6±0.52^{A,a,A}	8.2±0.42^{A,d,A}	8.9±0.56^{A,c,A}	9.2±0.63^{A,b,A}	9.5±0.71^{A,a,A}
	5	7.7±0.48^{A,d,A}	9.0±0.00^{A,c,A}	9.1±0.32^{A,b,A}	9.5±0.53^{A,a,A}	7.8±0.42^{A,d,A}	8.8±0.42^{A,c,A}	9.2±0.63^{A,b,A}	9.4±0.70^{A,a,A}
	10	7.7±0.67^{A,d,B}	8.8±0.42^{A,c,B}	8.9±0.32^{A,b,B}	9.2±0.42^{A,a,B}	7.7±0.48^{A,d,B}	8.5±0.71^{A,c,B}	9.0±0.47^{A,b,B}	9.0±0.47^{A,a,B}

* Treatments (GY, FGY1, FGY2, FGY3, SY, FSY1, FSY2, and FSY3) presented in Table1. Results are the mean of three different determinations ± standard deviation, and letters of significant effects of factors (milk type, date puree level, storage period), respectively. Means that are followed by the same letter in the row and the same capital letter in the column did not differ significantly ($p \leq 0.05$).

CONCLUSION

The benefits of non-bovine milk and its products, particularly Goat milk (GM) and sheep milk (SM), have been extensively studied and repeatedly emphasized. However, the development of GM and SM products is limited because of difficulties in processing and consumption, mainly by local consumers. The study's conclusion is that addition of date puree (DP) to drinkable yogurt made from goat or sheep in level up to 5% changes the product's physical and chemical properties as well as its flavor acceptability.

DP improved the physical properties and sensory attributes of flavored yogurts in comparison with control samples, which was attributed to the viscosity and antioxidant compounds that constitute the extracts and exopolysaccharides (EPS) released by lactic acid bacteria (LAB). DP also made the yogurt thicker while it was stored at 5°C for 10 days, which changed its consistency and appearance. This could be because of the bioactive properties of the extracts and the bacterial EPS. Overall, DP can improve and enhance the consumer acceptability of the products manufactured using GM and SM.

REFERENCES

Albenzio, M., A. Santillo, M. Avondo, A. Nudda, S. Chessa, A. Pirisi and S. Banni. 2016. Nutritional properties of small ruminant food products and their role on human health. Small Rumin. Res. 135: 3-12.

Al-Farsi, M.A. and C.Y. Lee. 2008. Nutritional and functional properties of dates: a review. Crit. Rev. Food Sci. Nutr. 48: 877-887.

Almosawi, B.N.E. and T.A. Hassan. 2019. Influence of fortification with extracts of three varieties of Iraqi dates on the viability of *Lactobacillus plantarum* in probiotic fermented milk products. Iraqi J. Biotech. 18: 216-223.

Al-Otaibi and El-Demerdash. 2013. Nutritive value and characterization properties of fermented camel milk fortified with some date palm products chemical, bacteriological and sensory properties. Int. J. Food Sci. Nutr. 2: 174-180.

Al-Tamim, E.A.A. 2014. Comparative study on the chemical composition of Saudi Sukkari and Egyptian Swei date palm fruits. J. Am. Sci. 10: 149-153.

Amerinasab, A., M. Labbafi, M. Mousavi and F. Khodaiyan. 2015. Development of a novel yoghurt based on date liquid sugar: physicochemical and sensory characterization. J. Food Sci. Technol. 52: 6583-6590.

AOAC. 2012. Association of official analytical chemists. No. 994.12. Chapter 4, 19th Edition, 9-13.

Balthazar, C.F., H.L.A. Silva, E.A. Esmerino, R.S. Rocha, J. Moraes, M.A.V. Carmo, L. Azevedo, I. Camps, Y.K.D. Abud, C. Sant'Anna, R.M. Franco, M.Q. Freitas, M.C. Silva, R.S.L. Raices, G.B. Escher, D. Granato, C.S. Ranadheera, F. Nazzarro and A.G. Cruz. 2018. The addition of inulin and *Lactobacillus casei* 01 in sheep milk ice cream. Food Chem. 246: 464-472.

Balthazar, C.F., T.C. Pimentel, L.L. Ferrão, C.N. Almada, A. Santillo, M. Albenzio, N. Mollakhalili, A.M. Mortazavian, J.S. Nascimento, M.C. Silva, M.Q. Freitas, A.S. Sant'Ana, D. Granato and A.G. Cruz. 2017. Sheep milk: Physicochemical characteristics and relevance for functional food development. Compr. Rev. Food Sci. Food Saf. 16: 247-262.

Biglari, F., A.F.M. AlKarkhi and A.M. Easa. 2009. Cluster analysis of antioxidant compounds in dates (*Phoenix dactylifera*): Effect of long-term cold storage. Food Chem. 112: 998-1001.

Caleja, C., L. Barros, A.L. Antonio, M. Carocho, M.B.P.P. Oliveira and I.C.F.R. Ferreira. 2016. Fortification of yogurts with different antioxidant preservatives: A comparative study between natural and synthetic additives. Food Chem. 210: 262-268.

Demirkol, M. and Z. Tarakci. 2018. Effect of grape (*Vitis labrusca* L.) pomace dried by different methods on physicochemical, microbiological and bioactive properties of yoghurt. LWT- Food Sci. Technol. 97: 770-777.

Echegaray, N., B. Gullón, M. Pateiro, R. Amarowicz, J.M. Misihairabgwi and J.M. Lorenzo. 2023. Date fruit and its by-products as promising source of bioactive components: A review. Food Rev. Int. 39: 1411-1432.

Echegaray, N., M. Pateiro, B. Gullon, R. Amarowicz, J.M. Misihairabgwi and J.M. Lorenzo. 2020. *Phoenix dactylifera* products in human health–A review. Trends Food Sci. Technol. 105: 238-250.

El-Ghazali, M.N., M. Awad-Allah, E.G. Gadalla and A.A. El-banna. 2010. Comparison between traditional method (offshoots) and tissue cultures for the evaluation of some physical and chemical composition and nutritive value of some Egyptian dry- date cultivars grown at Aswan. Bull. National Nutr. Inst. Arab Repub. Egypt 35: 1-16.

El-Zahar, K. 2009. Antimicrobial activity of sheep yoghurt prepared by different commercial starter strains. Alex. Sci. Exch. J. 30: 187-197.

FAO. 2003. Production Yearbook 2002. Food and Agriculture Organization, UN, Rome, Italy, 271.

FAOSTAT. 2013. Food and Agriculture Organization of the United Nations. Rome, Italy. http://faostat.fao.org/site/339/default.aspx.

Fernández-López, J., M. Viuda-Martos, E. Sayas-Barberá, C. Navarro-Rodríguez de Vera and J.Á. Pérez-Álvarez. 2022. Biological, nutritive, functional and healthy potential of date palm fruit (*Phoenix dactylifera* L.): Current research and future prospects. Agron. 12, 876.

Genovese, M.I., M. Da Silva Pinto, A.E. De Souza Schmidt Gonçalves and F.M. Lajolo. 2008. Bioactive compounds and antioxidant capacity of exotic fruits and commercial frozen pulps from Brazil. Food Sci. Technol. Int. 14: 207-214.

Ghnimi, S., S. Umer, A. Karim and A. Kamal-Eldin. 2017. Date fruit (*Phoenix dactylifera* L.): An underutilized food seeking industrial valorization. NFS J. 6: 1-10.

Guzmán-González, M., F. Morais, M. Ramos and L. Amigo. 1999. Influence of skimmed milk concentrate replacement by dry dairy products in a low fat set-type yoghurt model system. I: Use of whey protein concentrates, milk protein concentrates and skimmed milk powder. J. Sci. Food Agric. 79: 1117-1122.

Hariri, A., N. Ouis, K. Ibri, D. Bouhadi and Z. Benatouche. 2020. Technological characteristics of fermented milk product manufactured by milk-dates mixtures. Acta Agric. Serb. 25: 27-35.

Hassimotto, N.M.A., M.I. Genovese and F.M. Lajolo. 2005. Antioxidant activity of dietary fruits, vegetables, and commercial frozen fruit pulps. J. Agric. Food Chem. 53: 2928-2935.

Ismail, M.M. 2015. Improvement of nutritional and healthy values of yoghurt by fortification with rutub date. J. Microbiol. Biotechnol. Food Sci. 4: 398-406.

Jambi, H.A. 2018. Evaluation of physio-chemical and sensory properties of yogurt prepared with date pits powder. Curr. Sci. Int. 7: 1-9.

Kale, R.V., P.S. Kadam and S.I. Hashmi. 2011. Effect of different varieties of date palm paste incorporation on quality characteristics of yoghurt. Carpathian J. Food Sci. Technol. 3: 28–38.

Kebary, K.M.K. and S.A. Hussein. 1999. Manufacture of low fat Zabady using different fat substitutes. Acta Aliment. 28: 1-14.

Khalil, R.A.M. 2013. The use of pomegranate juice as a natural source for antioxidant in making functional yoghurt drink. Egypt. J. Dairy Sci. 41: 137-149.

Konuspayeva, G. and B. Faye. 2021. Recent advances in camel milk processing. Anim. 11, 1045.

Korcz, E. and L. Varga. 2021. Exopolysaccharides from lactic acid bacteria: Techno-functional application in the food industry. Trends Food Sci. Technol. 110: 375-384.

Ladokun, O. and S. Oni. 2014. Fermented milk products from different milk types. Food Sci. Nutr. 5: 1228–1233.

Li, W., A.W. Hydamaka, L. Lowry and T. Beta. 2009. Comparison of antioxidant capacity and phenolic compounds of berries, chokecherry and seabuckthorn. Cent. Eur. J. Biol. 4: 499-506.

Machado, T.A.D.G., M.E.G. de Oliveira, M.I.F. Campos, P.O.A. de Assis, E.L. de Souza, M.S. Madruga, M.T.B. Pacheco, M.M.E. Pintado and R.D.C.R.D.E. Queiroga. 2017. Impact of honey on quality characteristics of goat yogurt containing probiotic *Lactobacillus acidophilus*. LWT- Food Sci. Technol. 80: 221-229.

Maqsood, S., O. Adiamo, M. Ahmad and P. Mudgil. 2020. Bioactive compounds from date fruit and seed as potential nutraceutical and functional food ingredients. Food Chem. 308, 125522.

Mehanna, N.M., S. Swelam and A.M.A. Asar. 2017. Composition and quality of zabady supplemented with different date cultivars. J. Food Ind. Nutr. Sci. 7: 1-9.

Mohammadi-Gouraji, E., S. Soleimanian-Zad and M. Ghiaci. 2019. Phycocyanin-enriched yogurt and its antibacterial and physicochemical properties during 21 days of storage. LWT-Food Sci. Technol. 102: 230-236.

Nikmaram, P., S.M. Mousavi, Z. Emam-Djomeh, H. Kiani and S.H. Razavi. 2015. Evaluation and prediction of metabolite production, antioxidant activities, and survival of *Lactobacillus casei* 431 in a pomegranate juice supplemented yogurt drink using support vector regression. Food Sci. Biotechnol. 24: 2105-2112.

Park, Y.W. 2006. Goat milk–chemistry and nutrition. In: Park Y.W., Haenlein G.F.W. (eds.). Handbook of Milk of Non-Bovine Mammals. 42-83.

Park, Y.W., C. Jeanjulien and A. Siddique. 2017. Factors affecting sensory quality of goat milk cheeses: A review. J. Adv. Dairy Res. 5: 1-9.

Parvarei, M.M., N. Khorshidian, M.R. Fazeli, A.M. Mortazavian, S.S. Nezhad and S.A. Mortazavi. 2021. Comparative effect of probiotic and paraprobiotic addition on physicochemical, chemometric and microstructural properties of yogurt. LWT- Food Sci. Technol. 144, 111177.

Peres, C., L.A. Tacito and P.L. Rodrigo. 2016. An evaluation of the physicochemical, microbiological and sensory properties of goat cheese. Afr. J. Dairy Farm. Milk Prod. 3: 120-125.

Pulina, G., M.J. Milán, M.P. Lavín, A. Theodoridis, E. Morin, J. Capote, D.L., Thomas, A.H.D. Francesconi and G. Caja. 2018. Invited review: Current production trends, farm structures, and economics of the dairy sheep and goat sectors. J. Dairy Sci. 101: 6715-6729.

Ribeiro, L.C., J.R.O. Pérez, P.H.A. Carvalho, F.F. Silva, J.A. Muniz, G.M.D. Oliveira Júnior and N.V.D. Souza. 2007. Effects of oxytocin on milk yield and composition of Santa Inês ewes. Rev. Bras. Zootec. 36: 438-444.

Routray, W. and H.N. Mishra. 2011. Scientific and technical aspects of yogurt aroma and taste: a review. Compr. Rev. Food Sci. Food Saf. 10: 208-220.

Sadaghdar, Y., A.M. Mortazavian and M.R. Ehsani. 2012. Survival and activity of 5 probiotic lactobacilli strains in 2 types of flavored fermented milk. Food Sci. Biotechnol. 21: 151-157.

SAS. 1996. Statistical analysis system. SAS User's Guide: Statistics. SAS Institute Inc., Cary.

Sobti, B., A.H.A. Aljneibi, H.A.A. Seraidy, A.A.H. Alnaqbi, B. Al-Zain, T. Ramachandran, F. Hamed and A. Kamal-Eldin. 2021. The effect of pectin and sodium alginate on labans made from camel milk and bovine milk. J. Dairy Sci. 104: 5279-5284.

Stanton, C., G. Gardiner, H. Meehan, K. Collins, G. Fitzgerald, P.B. Lynch and R.P. Ross. 2001. Market potential for probiotics. Am. J. Clin. Nutr. 73: 476s-483s.

Sun-Waterhouse, D., J. Zhou and S.S. Wadhwa. 2013. Drinking yoghurts with berry polyphenols added before and after fermentation. Food Control 32: 450-460.

Tawfek, M.A., E.A. Baker and H.A. El-Sayed. 2021. Study properties of fermented camels' and goats' milk beverages fortified with date palm (*Phoenix dactylifera* L.). Food Nutr. Sci. 12: 418-428.

Yousef, M., L. Nateghi and E. Azadi. 2013. Effect of different concentration of fruit additives on some physicochemical properties of yoghurt during storage. Ann. Biol. Res. 4: 244-249.

Zulueta, A., F.J. Barba, M.J. Esteve and A. Frígola. 2013. Changes in quality and nutritional parameters during refrigerated storage of an orange juice–milk beverage treated by equivalent thermal and non-thermal processes for mild pasteurization. Food Bioproc. Tech. 6: 2018-2030.

الملخص العربي

تحسين الجودة والخصائص الحسية لمشروب اليوغورت المصنع من ألبان الماعز والأغنام باستخدام معجون التمر

سامح سعيد يعقوب، مى جلال محمد، أحمد هلال، سامح على عوض

تتميز ألبان الماعز والأغنام ومنتجاتها المتخمرة بفوائد غذائية وصحية عديدة، على الرغم من أنها ترتبط غالبًا بانخفاض قابليتها للتسويق بسبب نكهتها الفريدة، والغير مرغوبة لكثير من المستهلكين. وتعتبر إضافة معجون الفاكهة طريقة جذابة لإضافة طعم مرغوب وإخفاء النكهة الغير المرغوبة لمنتجات هذه الألبان. ويهدف البحث الحالي إلى دراسة تأثير إضافة معجون التمر Date Puree(DP) بتركيزات(١,٥، ٣، ٥%) إلى المشروبات المتخمرة الناتجة من ألبان الماعز والأغنام على الخواص الطبيعية والكيميائية والريولوجية والحسية لهذه المنتجات. وأظهرت النتائج أن إضافة معجون التمر أدى إلى حدوث زيادة معنوية($P \le 0.05$) في قيم الأس الهيدروجيني والرماد والألياف ومضادات الأكسدة واللزوجة في المشروبات المتخمرة المطعمة لألبان الماعز والأغنام بالنسبة لعينات المقارنة. وأوضحت أيضا أن المشروبات المتخمرة المضاف لها معجون التمر بنسبة ٥% كانت أعلى في محتواها من المواد الصلبة الكلية، في حين أن المشروبات المتخمرة المضاف لها معجون التمر بنسبة ١,٥% و٣% كانت أعلى في محتواها من البروتين والدهون بالنسبة لعينات المقارنة. كما أدت إضافة معجون التمر إلى تحسين جميع الصفات الحسية مع وجود فروق معنوية ($p \le 0.05$)، وكانت المشروبات المتخمرة المطعمة لألبان الماعز والأغنام أكثر قبولا من عينات المقارنة. وكان للتخزين المبرد على درجة ٥ مئوية لمدة ١٠ أيام بعض التأثيرات المعنوية ($p \le 0.05$) على خواص المشروبات المتخمرة المطعمة وعينات المقارنة. وفي الخلاصة، أدت إضافة معجون التمر بنسب (١,٥، ٣، و٥%) إلى تحسين الخواص الطبيعية والكيميائية والريولوجية والحسية للمشروبات المتخمرة لألبان الماعز والأغنام.