ACTA SCIENTIARUM POLONORUM
Acta Sci. Pol. Technol. Aliment. 18(1) 2019, 53–63
www.food.actapol.net pISSN 1644-0730 eISSN 1898-9594 http://dx.doi.org/10.17306/J.AFS.2019.0602

ORIGINAL PAPER

Received: 15.08.2018
Accepted: 14.12.2018

CHARACTERISTICS OF FERMENTED CAMEL'S MILK FORTIFIED WITH KIWI OR AVOCADO FRUITS

Tarek N. Soliman[1]✉, Samera H. Shehata[2]

[1]Dairy Department, Food Industries and Nutrition Research Division, National Research Centre
El-Buhouth St., Dokki, Cairo, **Egypt**
[2]Department of Dairy Science and Technology, Menoufia University
Shibin Elkom, Cairo, **Egypt**

ABSTRACT

Background. The aim of this study was to develop nutritious fermented milk products from camel's milk fortified with kiwi fruit and avocado puree, and fermented using probiotic strains.
Material and methods. Stirred yoghurt made from camel's milk, supplemented with avocado and kiwi fruit puree as natural additives at different levels (2, 4 and 6%) and fermented with a mixture of yoghurt culture and probiotic *Lb. acidophilus* and *B. lactis*. The stirred yoghurt was chemically analyzed, and the microbial count, antioxidant activity and total phenolic content were determined. The stirred yoghurt from different treatments was assessed for viscosity and sensory properties.
Results. The highest viable counts of *Lb. acidophilus* and *B. lactis* were enumerated in yoghurts fortified with 6% avocado, whereas the control had significantly lower counts. The radical scavenging activity (RSA) and the total phenol content (TPC) decreased for the control of the stirred camel's milk yoghurt after 21 days of storage, whereas the samples fortified with kiwi or avocado puree retained high RSA and TPC content throughout the storage period compared to the control.
Conclusion. Addition of 4% avocado or 6% kiwi pastes to fermented camel's milk produces a higher quality and acceptability of camel's milk.

Keywords: camel's milk, avocado, kiwi, chemical analysis, stirred yogurt, antioxidant activity, physical properties, sensory evaluation

INTRODUCTION

Yogurt is one of the most popular fermented foods and is traditionally consumed in many countries (Shori and Baba, 2014). It is widely consumed as a functional food because of its good taste and nutritional properties and as an excellent vehicle for delivering probiotics to consumers (Amirdivani and Baba, 2011). Camel's milk and its products contain all the essential nutrients (Korlepara et al., 2017) and are considered to be good nutritional sources for the human diet in many parts of the world. Camel's milk differs from other mammals' milk as it contains high levels of insulin, immunoglobulins, vitamins and minerals (Abbas et al., 2013). Additionally, it has several potential health benefits, such as anticarcinogenic (Magjeed, 2005) and antidiabetic (Agrawal et al., 2007) activities, and it has been recommended for children who are allergic to bovine milk (El-Agamy et al., 2009). Camel's milk products have become available in pharmacies throughout the world due to a popular and growing demand (Sulieman et al., 2018). Incorporating dietary fiber in camel's milk can

✉tariknour.nrc@gmail.com, https://orcid.org/0000-0002-1138-9133; phone 002 0237082628, 002 01155945511

make it even healthier. Dietary fibers have many positive health effects and aid disease prevention through the maintenance of gastrointestinal health, protection against colon cancer, lowering of total and low density lipoprotein cholesterol in the blood serum, and reduction of postprandial blood glucose levels, increase of calcium bioavailability (Elleuch et al., 2008).

Probiotics are increasingly used as food supplements that maintain healthy gut micro flora and may provide protection against gastrointestinal disorders, including infections and inflammatory syndromes of the bowel (Nomato, 2005; Parvez et al., 2006). It has been suggested that fruit juices could serve as suitable media for cultivating probiotic bacteria (Mattila-Sandholm et al., 2002).

Antioxidants have become a popular research topic because sufficient levels cannot be generated by the human body and hence they have to be provided in the diet. They are defined as any substance that, when present at low concentrations, significantly delays or prevents the oxidation of that substrate in a chain reaction (Halliwell and Whiteman, 2004). Phenolic compounds possess antioxidant capabilities which have a free radical scavenging mechanism and produce potential alterations of physiological antioxidant status and imbalances in the free radical enzymatic defense system. Fruits and vegetables are essential foods which are beneficial for health due to their constituents' low levels of phenolic substances (Abdel-Moneim et al., 2017).

The fruit of avocado (*Persea Americana*) is considered to be one of the world's healthiest fruits, because of its nutrients, such as vitamin K, dietary fiber, potassium, folic acid, vitamin B6, vitamin C, copper and a reasonable level of calories. Kiwi fruit (*Actinidia deliciosa*) contains high levels of pectic polysaccharides and dietary fiber (Ansell and Drummond, 2011), which can improve the immune system and relieve chronic constipation (Menard et al., 2010). The healthful attributes of kiwi fruit are high ascorbic acid levels (Pal et al., 2015), polyphenols (Sheng et al., 2005), and the presence of flavonoids (Atkinson and Macrae, 2007). In addition, kiwi fruit and avocado could confer prebiotic effects on intestinal micro flora. Therefore, the objectives of this study were to investigate the possibility of making a good quality stirred yoghurt from camel's milk, using avocado or kiwi fruit pastes, as well as the effects of adding them on the chemical composition and content of antioxidants in the milk, the survival of probiotics, and their sensory qualities.

MATERIALS AND METHODS

Fresh camel's milk was obtained from a herd grazing in Matrouh Governorate, Egypt. The gross composition of raw camel's milk was: 11.48 ±0.21% total solids, 3.31 ±0.02% total protein, 3.35 ±0.05% fat, 4.25 ±0.19% lactose, 0.78 ±0.04% ash, 0.18 ±0.01%, titratable acidity and 6.7 ±0.02 pH. Skimmed milk powder, avocado pear (*Perseaamericana*), and kiwi (*Actinidia deliciosa*) fruits were purchased from the local market in Cairo, Egypt.

Microbial cultures

Two commercial lyophilized DVS mixed bacterial starters, namely: Yo-Fast$_1$ containing *Lactobacillus* (Lb.) *delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* as a yoghurt starter, and ABT-5 containing *Bifidobacterium* (B). *Lactis* and *Bifidobacterium animalis* with potential probiotic properties, were supplied by the Chr-Hansen company (Horsholm, Denmark). Freeze-dried bacterial starters were activated separately in sterilized (121°C/10 min) skimmed cow's milk (0.1% fat and 10% SNF) using a 0.02% (W/V) inoculums. The activated cultures were used for inoculation of the camel's milk.

Avocado and kiwi fruit were washed, peeled and mashed using an electric mixer (Brown, Germany) under aseptic conditions. The chemical composition of the resulting fruit pastes is presented in Table 1.

Manufacture of fermented camel's milk

The total solids of the camel's milk were increased to 15.5% using skimmed milk powder homogenized at 55–60°C for 2 min using a highspeed mixer (22,000 rpm/min) (×520, UAC 30-R, Chicago II 6064). The standardized milk was heated at 85°C for 30 min, followed by cooling to 42°C, inoculated with 3% (v/v) of mixed (1:1) Yo-Fast1 and ABT-5 activated culture (10^8–10^9 cfu/ml), and incubated at 42 ±1°C for 6–8 h until a firm curd was obtained. Then, the curd was refrigerated at 4°C overnight before being divided into seven portions. The first portion was kept as a control, while three portions were fortified with 2%, 4%, and

Table 1. The chemical composition percentage of different fruit pastes used in manufacture of flavoured stirred yoghurt

Property	Avocado	Kiwi
Dry matter, %	26.7	16.2
Fat, %	14.5	0.5
Protein, %	1.9	0.9
Crude fiber, %	6.5	3.8
pH value	6.85	3.80
Ash	0.6	0.7
Radical scavenging activity – RSA, %	53.22	77.85
Total phenolic content – TPC	533.65	872.10

6% kiwi respectively, and stirred using the mixer to prepare T1, T2 and T3. The last three portions were fortified with 2%, 4% and 6% (w/w) avocado respectively to give T4, T5 and T6. The prepared yoghurts were immediately stored in a refrigerator at 5 ±1°C, and their chemical, microbiological, rheological, and sensory properties were evaluated during storage.

Chemical analysis

Yoghurt samples from the different treatments were analyzed in triplicate. Physical parameters (pH, acidity) and chemical parameters (total solids, total protein, fat content, and Ash) were determined according to the methods described by AOAC (2016). The total carbohydrates in milk and yoghurt samples were determined as described by Krishnaveni et al. (1984).

Microbiological analysis

Preparation and sterilization of the serial diluent was done as described by Richardson (1985). Enumeration of *Streptococcus thermophilus* was carried out using a modified M-17 medium and that of *Lactobacillus bulgaricus* was done on a modified MRS medium. The plates were incubated at 37°C for 48 h. Pour plate techniques using a plate count agar medium incubated at 32°C for 48 h were used for the total bacterial count. The colonies were counted according to Marshall (1992). The identification of purified colonies was carried out according to Barrow and Feltham (1993).

Determination of total phenolic content (TPC)

Total phenolic content (TPC) was determined according to Jayaprakasha et al. (2001) by using a Folin-Ciocalteu reagent. Aliquot of 0.5 ml of sample was mixed with 0.5 ml of 10-fold-diluted Folin-Ciocalteu reagent. After 3 min, 4 ml of 7.5% sodium carbonate solution was added. The mixture was allowed to stand for 30 min in the dark at room temperature before the absorbance was measured at 765 nm using a spectrophotometer (model 2010, Cecil Instr. Ltd., Cambridge, UK). The final results were expressed in milligrams of Gallic acid of the equivalent per gram of dry weight (DW).

DPPH radical scavenging activity

The free radical scavenging activity (RSA) of the samples was measured using the method of Brand-Williams et al. (1995). An aliquot (100 µl) of the sample was mixed with 2.9 ml of 1,1-diphenyl-2-pycrylhydrazyl (DPPH) in methanol. The mixture was shaken vigorously and left to stand for 30 min. The absorbance of the resulting solution was measured at 517 nm by a UV-visible spectrophotometer. The antioxidant activity was calculated using the following equation:

$$\text{RSA, \%} = (\text{abs}_{\text{control}} - \text{abs}_{\text{sample}}) \cdot 100 / \text{abs}_{\text{control}}$$

Viscosity

The apparent viscosity of the fermented camel's milk was measured according to Hamed et al. (2008) using a Bohlin coaxial cylinder viscometer (Bohlin Instrument Inc., Sweden) attached to a work station loaded with software of the V88 viscometery programme. The viscometer probe, system C30, was placed in the yoghurt sample cup, and measurements of viscosity were carried out at 20°C ±2°C in the up mode at shear rates ranging from 37 to 1238 1/s.

Sensory evaluation

Stirred yoghurt samples were judged for flavour (45 points), body and texture (40 points), and color and appearance (15 points) by 15 panelists from the staff members of the Dairy Science and Technology Department, Faculty of Agriculture, Menoufia University, and staff members of the Dairy Science Department, National Research Centre, Dokki, Cairo, Egypt.

The scorecard was designed as described by Ismael et al. (2014).

Statistical analysis

Statistical analysis was performed according to SAS V.9.4, using the General Linear Model (GLM). The model was:

$$Y_{ijk} = \mu + t_i + d_j + e_{ijk}$$

where:

μ – the overall mean,
t_i – treated effect,
d_j – day effect,
e_{ijk} – the experimental error.

Duncan's multiple range was used to separate among three replicates at $P \leq 0.05$.

RESULTS AND DISCUSSION

Table 2 shows the chemical compositions of fermented camel's milk in the control, and when fortified by the addition of 2, 4, and 6% kiwi or avocado fruit pastes. The effect of adding kiwi pastes on the total solids and ash of the stirred camel's milk yoghurt was 15.50, 15.51, 15.53, and 15.54 respectively for total solids, and the ash was 1.09, 1.08, 1.07, and 1.07 respectively. These findings were statistically insignificant ($P < 0.05$). However, the total protein and fat contents decreased significantly ($P < 0.05$). The addition of avocado into the stirred yogurt significantly increased ($P < 0.05$) the total solids, which were 15.50, 15.72, 15.95, and 16.17 respectively. In addition, the fat contents were 3.35, 3.57, 3.80, and 4.00 respectively, but the total protein decreased to 4.64, 4.59, 4.53, and 4.48 respectively. This can be attributed to the high total solids and fat content of avocado compared to the standardized camel's milk. Carbohydrates were increased by increasing the ratio of the added fruit pastes.

Acidity and pH values

Figure 1 shows the values of pH and the acidity of fermented camel's milk fortified with kiwi or avocado pastes. The pH values decreased during storage while the lactic acid percentage (LA, %) values of all samples increased. The addition of kiwi caused a significant increase in the developed acidity of the yoghurt during refrigerated storage. This was higher than the increase found in the control and avocado treatments. The addition of 6.0% kiwi gave the highest development in acidity. These results could be attributed to the high ascorbic acid content of kiwi. Statistical analysis showed that the addition of kiwi and avocado had

Table 2. Chemical composition of stirred camel yoghurt fortified with different ratios of fruit pastes when fresh and during storage at 5 ±1°C (mean ±standard deviation), %

Yoghurt samples	Total solids	Protein	Fat	Ash	Total carbohydrates
Control	15.50^{b} ±0.23	4.64^{a} ±0.05	3.35^{d} ±0.05	1.09^{a} ±0.02	6.41^{b} ±0.04
T1	15.51^{b} ±0.25	4.57^{cab} ±0.09	3.30^{d} ±0.06	1.08^{a} ±0.01	6.47^{b} ±0.03
T2	15.53^{b} ±0.23	4.49^{cab} ±0.03	3.25^{d} ±0.04	1.07^{a} ±0.01	6.53^{ab} ±0.05
T3	15.54^{b} ±0.22	4.42^{c} ±0.07	3.18^{d} ±0.08	1.07^{a} ±0.02	6.65^{a} ±0.07
T4	15.72^{ab} ±0.21	4.59^{ab} ±0.04	3.57^{c} ±0.05	1.08^{a} ±0.01	6.45^{b} ±0.03
T5	15.95^{ab} ±0.19	4.53^{cab} ±0.06	3.80^{b} ±0.07	1.07^{a} ±0.03	6.49^{b} ±0.04
T6	16.17^{a} ±0.20	4.48^{cb} ±0.03	4.00^{a} ±0.10	1.06^{a} ±0.02	6.54^{ab} ±0.05
P value	<0.05	<0.05	<0.05	<0.5	<0.05

Control – control fermented camel's milk treatment; T1, T2, T3 – fermented camel's milk fortified with kiwi at ratio 2%, 4% and 6% respectively; T4, T5, T6 – fermented camel's milk fortified with avocado at ratio 2%, 4%, and 6% respectively.
$^{a–d}$Means (±standard deviation) in the same column with different letters are significantly different ($P < 0.05$).

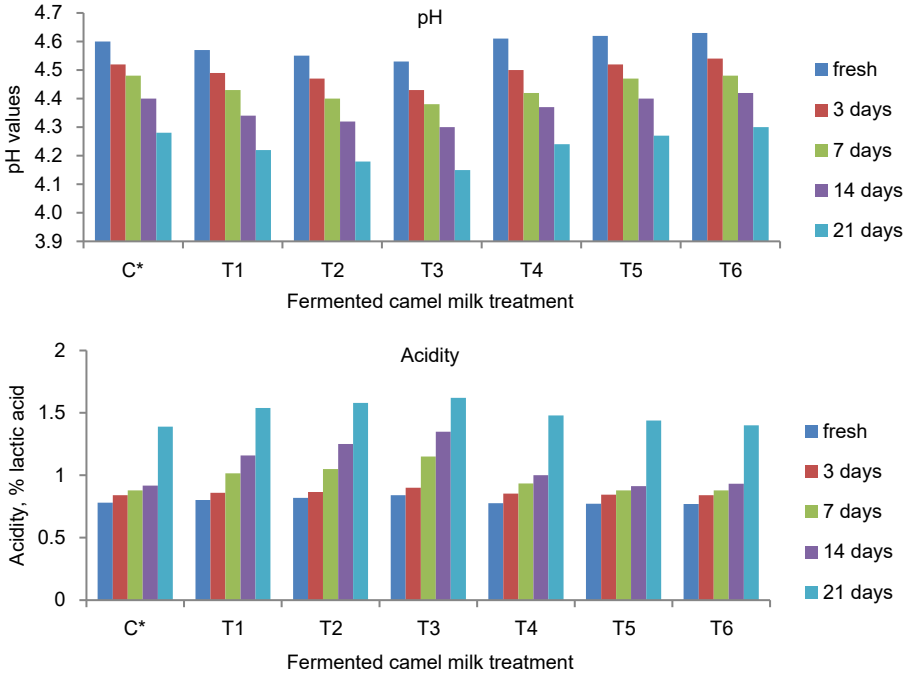

Fig. 1. pH and acidity (expressed as percent of lactic acid) content value of fermented camel's milk fortified with different ratios of kiwi or avocado when fresh and during storage at 5 ±2°C.*As written under Table 2

significant ($P < 0.05$) effects on the development of acidity and the decrease in the pH.

Antioxidant activity

The DPPH radical scavenging activity (RSA) of stirred camel's milk yoghurt samples fortified with kiwi and avocado was higher than the control and this increase was proportional to the percentage of the added kiwi and avocado. During cold storage, the RSA increased significantly for all camel's milk yoghurt samples and those fortified with kiwi or avocado still had a higher RSA percentage than the control (Table 3). These results are in agreement with those of Collins et al. (2001), who found that kiwi is a rich source of vitamin C and other antioxidants, and with the free radical scavenging activity and antioxidant properties of avocado (Antasionasti, et al., 2017). The TPC of stirred camel's milk yoghurt fortified with 2, 4, and 6% kiwi and avocado are recorded in Table 3. It was obvious that there were significant increases in the TPC of stirred camel's milk yoghurt fortified with kiwi or avocado which were proportional to the concentration of the added kiwi and avocado. This can be ascribed to high levels of TPC, and antioxidant activity (Collins et al., 2001). During cold storage, TPC gradually decreased for the control stirred camel's milk yoghurt after 21 days of storage, whereas the fortified samples with kiwi or avocado maintained a higher TPC content than the control throughout the storage period.

Microbiological analysis of fermented camel's milk during storage

The changes in the microbiological quality of the control, and kiwi and avocado fortified stirred camel's milk yoghurt during cooled storage are presented in Table 4. The counts of S. *thermophilus* & *bifidobacteria* peaked during the first 14 days and then declined slightly in all samples until the end of the storage period. Espírito Santo et al. (2010), observed higher counts of *S. thermophilus* in stirred camel's milk yoghurt fermented by *Lactobacillus* (*Lb.*) *delbrueckii* ssp. *bulgaricus* and *L. acidophilus*, which reinforces the positive correlation between *S. thermophilus* and these two probiotic strains. Furthermore,

Table 3. DPPH radical scavenging activity (RSA, %) and total phenol content (TPC, µg gallic acid/g) of fermented camel's milk fortified with different ratios of kiwi and avocado when fresh and during storage at 5 ±2°C

Fermented camel milk samples*	Radical scavenging activity – RSA, %							Total phenol content – TPC, µg gallic acid/g						
	0	3 days	7 days	14 days	21 days	SEM	*P* value	0	3 days	7 days	14 days	21 days	SEM	*P* value
Control	7.76	13.99	17.08	20.07	18.58	0.188	<0.05	141.45	144.75	153	176.35	163.80	1.43	<0.05
T1	11.79	17.44	18.78	21.10	22.70	0.188	<0.05	170.25	181.20	194.65	205.20	212.30	1.43	<0.05
T2	17.89	19.44	22.06	24.95	25.59	0.188	<0.05	189.25	204.05	222.10	239.10	250.85	1.43	<0.05
T3	21.48	25.06	27.87	30.87	32.03	0.188	<0.05	223.40	230.70	250.75	257.95	261.85	1.43	<0.05
T4	14.82	17.47	23.72	25.12	25.60	0.188	<0.05	245.20	259.25	357.20	410.80	416.60	1.43	<0.05
T5	19.76	23.83	25.12	25.96	25.95	0.188	<0.05	319.05	339.80	376.05	498.25	518.60	1.43	<0.05
T6	23.55	25.19	25.98	27.03	27.74	0.188	<0.05	344.50	371.80	480.55	510.75	527.60	1.43	<0.05
SEM	0.158	0.158	0.158	0.158	0.158			1.21	1.21	1.21	1.21	1.21		
P value	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05		

*As written under Table 2.

Table 4. Changes in the viable counts (mean*) of starter cultures, coliform group and yeasts and molds of camel's milk stirred yoghurt fortified with kiwi or avocado during storage period at 5 ±1°C, log10 CFU/mL

Parameters	Storage period days	Treatments*								
		control	T1	T2	T3	T4	T5	T6		*P* value
1	2	3	4	5	6	7	8	9	10	11
Lactobacilli	fresh	7.18	7.24	7.27	7.37	7.27	7.36	7.30	0.24	<0.05
	3	8.19	8.56	8.65	8.83	8.90	8.93	8.98	0.24	<0.05
	7	8.38	8.82	8.86	8.96	9.00	9.10	9.20	0.24	<0.05
	14	9.08	9.54	9.70	9.71	9.65	9.79	9.87	0.24	<0.05
	21	9.06	9.41	9.46	9.50	9.43	9.45	9.54	0.24	<0.05
		0.80	0.80	0.80	0.80	0.80	0.80	0.80		
	P value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05
Streptococci	fresh	8.34	8.40	8.37	8.57	8.46	8.36	8.47	0.25	<0.05
	3	8.80	8.83	8.85	8.91	8.84	8.90	8.97	0.25	<0.05
	7	8.87	8.91	8.92	8.99	8.98	9.06	9.16	0.25	<0.05
	14	9.18	9.26	9.33	9.40	9.26	9.37	9.57	0.25	<0.05
	21	9.09	9.10	9.13	9.36	9.19	9.24	9.47	0.25	<0.05
		0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.25	
	P value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		

Table 4 – cont.

1	2	3	4	5	6	7	8	9	10	11
Yeast and mold	fresh	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	7	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	14	n.d.	11	15	25	9	12	28	0.61	0.05
	21	n.d.	67	80	104	178	214	247	0.61	<0.05
		0.80	0.80	0.80	0.80	0.80	0.80	0.80		
	P value	0.8	0.01	0.004	0.0002	<0.01	<0.05	<0.05		<0.05
Coliform	fresh	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	7	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	14	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		
	21	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		

*As written under Table 2. n.d. – no data.

the fortification level of kiwi or avocado had a significant effect ($P < 0.05$) on the viable counts of *S. thermophilus* of all stirred camel's milk yoghurt samples. In general, the highest viable counts of *S. thermophilus* were observed in stirred camel's milk yoghurt fortified with 6% avocado. The enhanced growth of *S. thermophilus* may be due to the availability of some nutrients as soluble fructooligosaccharides in avocado (Sendra et al., 2008). On the other hand, the highest viability of *Lactobacillus* (*Lb*.) *delbrueckii* ssp. *bulgaricus* and *L. acidophilus* were noticed during 14 days of storage in all stirred camel's milk yoghurt samples, but then declined thereafter (Table 4). This result was in agreement with previous studies that found significant decreases in the viability of probiotic bacteria after 21 days of refrigerated storage (Kailasapathy et al., 2008; Laniewska-Trokenheim et al., 2010). Additionally, Lankaputhra and Shah (1995) reported that *L. acidophilus* survived better than the traditional yoghurt culture organisms (*L. delbrueckii* subsp. *bulgaricus* and *S. thermophilus*) and *B. bifidum* in yoghurt under acidic conditions. Generally, the highest viable counts of *Lb. acidophilus* and *B. lactis* were observed in yoghurts fortified with 6% avocado, whereas the control had significantly lower values ($P < 0.05$).

Sendra et al. (2008) found that the addition of citrus fiber in fermented milk enhanced the growth and survival of probiotic bacteria. Based on these observations, one can relate the stimulating effect of avocado or kiwi on probiotics to a high content of soluble dietary fiber (Marín et al., 2007). Also, Donkor et al. (2007) observed significantincreases of all probiotics in yoghurt fortified with apple and banana fiber compared to both controls and to passion fruit fiber yoghurt, particularly after 28 days. On the other hand, no coliform bacteria were detected in any sample treatments, either when fresh or during cold storage. Also, yeasts and molds were not detected in the control when fresh or during cold storage, whereas, in fortified samples with kiwi or avocado, they were detected after 14 days of cold storage. The absence of coliform bacteria signifies that the stirred camel's milk yoghurt samples were free from fecal contamination due to the hygienic conditions employed during production (Taha et al., 2011). This may also be due to the role of lactic acid bacteria in the preservation of the product, which is associated with their ability to produce some antimicrobial compounds (Ibrahim et al., 2004).

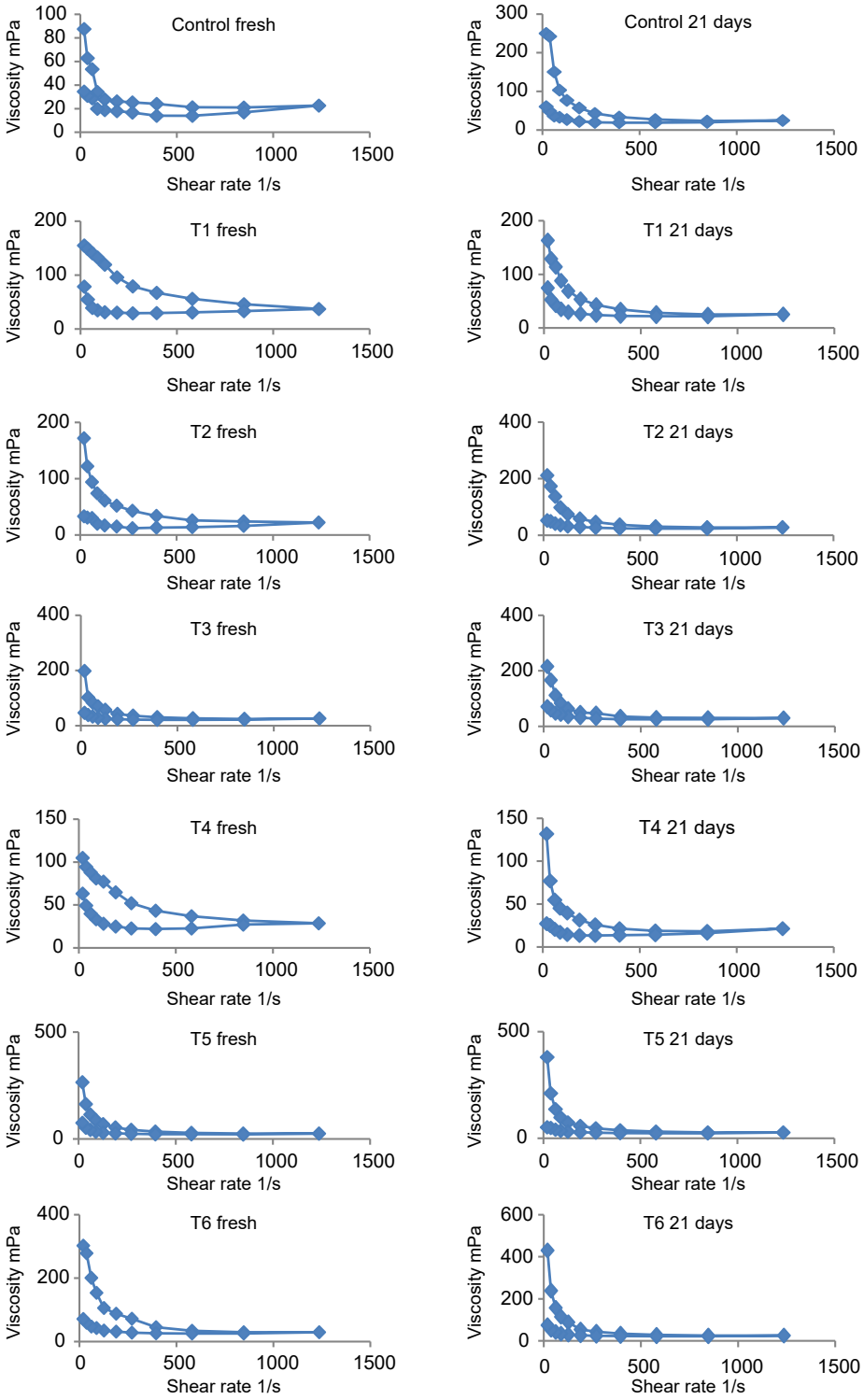

Fig. 2. Viscosity of stirred camel's milk fortified with different ratios of kiwi and avocado when fresh and after 21 days storage at 5 ±2°C

Viscosity

Viscosity is a very important factor in determining the quality of fermented camel's milk. Fermented camel's milk with a higher viscosity is liked by consumers, owing to better mouth sensations than thin stirred yoghurt. The high viscosity of yoghurt containing kiwi or avocado pastes compared to the control ($P = 0.05$) can be attributed to the high fiber and fat contents of these fruits, which act as thickening agents. The apparent viscosity increased significantly when increasing the concentration of the added kiwi or avocado pastes from 2% up to 6%, and throughout the storage period. A high ratio of added avocado (6%) resulted in the highest viscosity of stirred camel's milk yoghurt. Similar results were reported by Yonis et al. (2013) for banana yoghurt and Habtegebriel and Admassu (2016) for camel's milk fortified with pectin as a stabilizer.

Sensory evaluation

Samples of control fermented camel's milk and those fortified with 2%, 4% and 6% kiwi or avocado fruits were sensorially evaluated by 15 trained panelists for colour, body and texture, flavour and overall acceptability (Table 5). Statistical analysis showed a significant ($P < 0.05$) overall acceptability for fermented camel's milk fortified with 4% avocado and 6% kiwi. The control sample was white in colour, while the fortified fermented camel's milk had a light greenish colour due to the chlorophyll found in the fruit. The mean scores for colour, body and texture, flavour, and overall acceptability ranged from moderate (control) to high with the fortified sample.

The proanthocyanidin and anthocyanin levels changed constantly during storage causing more acceptability of the product. These results agree with He et al. (2008), who reported that proanthocyanidins, flavonoids, and anthocyanins change the taste of wine as a result of different chemical reactions.

Finally, it could be concluded that the addition of 4% avocado paste or 6% kiwi paste gives a higher quality and acceptability of stirred camel's milk yoghurt. The radical scavenging activity (RSA) and the total phenol content (TPC) decreased for the control of stirred camel's milk yoghurt after 21 days of storage, whereas the fortified samples with kiwi or avocado pastes sustained higher RSA and TPC contents throughout the storage period when compared to the control.

Table 5. Sensory evaluation of stirred camel's milk fortified with different ratios of kiwi and avocado when fresh and after 21 days storage at 5 ±2°C

Samples*	Parameters															
	flavour 50				body and texture 35				colour 15				total 100			
	0	21 days	SEM	*P* value	0	21 days	SEM	*P* value	0	21 days	SEM	*P* value	0	21 days	SEM	*P* value
Control	43.75	41.50	1.06	<0.05	30.50	29.25	0.56	<0.05	11.25	10.00	0.38	<0.05	85.50	80.75	1.44	<0.05
T1	44.75	42.00	1.06	<0.05	30.75	30.00	0.56	<0.05	11.75	10.50	0.38	<0.05	87.25	82.50	1.44	<0.05
T2	44.00	39.00	1.06	<0.05	32.00	29.75	0.56	<0.05	11.50	11.00	0.38	<0.05	87.50	79.75	1.44	<0.05
T3	43.25	41.50	1.06	<0.05	33.25	31.25	0.56	<0.05	12.75	12.25	0.38	<0.05	89.25	85.00	1.44	<0.05
T4	43.00	40.75	1.06	<0.05	32.00	29.75	0.56	<0.05	12.25	11.50	0.38	<0.05	87.25	82.00	1.44	<0.05
T5	47.50	45.00	1.06	<0.05	33.50	33.50	0.56	<0.05	14.50	12.25	0.38	<0.05	95.50	90.75	1.44	<0.05
T6	43.25	40.50	1.06	<0.05	32.75	31.25	0.56	<0.05	13.75	12.50	0.38	<0.05	89.75	84.25	1.44	<0.05
SEM	0.57	0.57			0.30	0.30			0.20	0.20			0.77	0.77		
P value	<0.05	<0.05			<0.05	<0.05			<0.05	<0.05			<0.05	<0.05		

*As written under Table 2.

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