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MANUFACTURE OF YOGHURT DRINK SUPPLEMENTED WITH CARROT AND GUAVA PULPS

Asala R.M. Mohammed*, M.M. Omar, M.M. El-Abbassy and S.A. Khalifa

Food Sci. Dept., Fac. Agric., Zagazig Univ., Egypt

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ABSTRACT: This study was designed to evaluate some properties of fruit yoghurts made with adding carrot and guava pulp during storage. The obtained results revealed that, the pH was decreased by time of storage while acidity was increased in all types of drinking yoghurt. Adding of 10, 15 and 20% guava pulp in yoghurt increased significantly ($p<0.05$) the total phenolic compounds (TPC), antioxidant activity (AA), fiber content and ascorbic acid (Vitamin c). The rheological and sensory properties of yoghurt were improved comparing to the control samples, While the protein content, pH value and syneresis decreased significantly ($p<0.05$) than control samples. On the other hand, Addition of 10, 15 and 20% carrot pulp to yoghurt increased (TPC), (AA), ascorbic acid and fiber content, while the protein content, pH value decreased. Along the storage period of all treatments, the TS, acidity, synersis and viscosity increased significantly, while the pH value, ascorbic acid, acetaldehyde content, AA,TPC were decreased significantly.

Key words: Drinking yoghurt, protein content, carrot pulp, ascorbic acid, guava pulp.

INTRODUCTION

Yoghurt is a popular fermented milk product containing both *Lactobacillus bulgaricus* and *Streptococcus thermophilus* cultures. Both intervention and observational studies have associated yoghurt consumption with several benefits to human health, including increased digestibility of lactose and assimilation of certain nutrients, enhancement of bone mineral acquisition, weight management, heart health, metabolic health and digestive and immune health. Yogurt is among the most common dairy products consumed around the world **(Saint-Eve *et al.*, 2006)**. Functional foods have become a trend; its functional properties have also been studied with additions of "functional" ingredients such as fruit pulp and the addition of different fruit juice in yoghurt. Utilizing of fruit juices in yoghurt manufacture resulted in more delicious product. In this case the flavoured yoghurt becomes tastier with pleasant flavour. The healthy attributes of yoghurt can be also improved by adding different fruits as a source of beneficial constituents such as fiber and antioxidants **(O'Rell and Chandan, 2006)**. There is increasing evidence that fruits and vegetables may protect against numerous chronic diseases, including cancer, cardio- and cerebro-vascular, ocular, and neurological diseases **(Block *et al.*, 1992)**. The protective effect of fruits and vegetables has generally been attributed to their antioxidant constituents, including vitamin C (ascorbic acid), vitamin E (α-tocopherol), carotenoids, glutathione, flavonoids and phenolic acids, as well as other unidentified compounds **(Sies and Stahl, 1995)**. Total antioxidant capacity of many fruits and vegetables has been determined by the oxygen radical absorbance capacity assay (ORAC), which measures the ability of plant extracts to scavenge peroxyl radicals **(Cao *et al.*, 1996)**. Polyphenol and flavonoids are metabolic products widely distributed in foods of plant origin and they have numerous biological and pharmacological properties **(Cook and Samman, 1996)**.

Guava (*Psidium guajava*) is a fruit high in nutritional value, six to seven times richer in vitamin C than other citrious fruits (traditional

***Corresponding author: Tel. :** +201124970587
E-mail address: asalaramadan12@gmail.com

source of this vitamin). It also stands out due to its elevated amounts of sugar, vitamin A, vitamin B (thiamin and niacin) and significant amounts of phosphorus, iron and calcium. It characterized by its typical aroma and flavour. The quantity of fiber found in the fruit provides it with high digestive capacity and excellent quality. These fruits has attracted attention of agro business due to some of its characteristics such as flavour, appearance and functional compound **(McCook-Russell *et al*., 2012)**.

Carrot (*Dauces carota*) is a favourite vegetable from a long time, due to its nutritive value. Carrot is generally rich in antioxidants such as vitamin A, C and β- carotene and polyphenols compounds **(Luciano *et al*., 2009)**.

The aim of this study was to evaluate the properties of different fruit and vegetable pulp (guava and carrot). Utilizing it in fortification of drinking yoghurt at different levels (10%, 15% and 20%) and evaluating the effect of fortification on the properties of yoghurt drink was given considerable attention.

MATERIALS AND METHODES

Materials

Fresh buffalo´s milk (6.8% fat and 9.86% milk solids not fat MSNF) was obtained from the Dairy Products, Food Science Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt. Direct vat set yoghurt starter (FD-DVS ABY-3 Probio-Tec®) containing (*Streptococcus thermophilus, Lactobacillus delbreuckii* subsp *bulgaricus*) was obtained from Chr. Hansen Inc. Laboratories, Milwaukee, WI, by Misr Food Additives (MIFAD), Egypt. Commercial grade sugar was purchased from the local market. Stabilizer (Lacta) was obtained from Mefad, Egypt. Guava fruits (*Psidium guajava*) and Carrot roots (*Daucus carota*) were purchased from the local market.

Methods

Preparation of carrot and guava pulp

Carrot roots were washed thoroughly with water, peeled by sharp knife and cut longitudinally into halves. These halves were steam blanched for five minutes to inactivate pectinase and peroxidase enzymes. Followed by blending using electric juicer, Guava pulp was washed and cut into pieces then blended using electric juicer without added water. All pulps were heat treated at 85ºC for 15min, rapidly cooled and frozen until being used.

Preparation of sweetened solution containing stabilizer

Sweetened solution containing sugar 22.5 g/l and CMC 0.1 g/l was prepared, heated at 85ºC for 15min, cooled and stored at 5 ºC until use. The above mentioned concentration of sugar and stabilizer were chosen on the basic that addition of sugar at ratio of 8% was perceived on most approtiate sweetness yoghurt drink and adding 0.15% carboxy methyl cellulose (CMC), the formula gave the desired body and texture to full fat yoghurt drink by sensory acceptability test according to **Khalil (2013)**.

Preparation of yoghurt

The milk was standardized to 3% fat, then heated at 85ºC for 30 min and then cooled to 43-45ºC and inoculated with 3% starter, poured in glass cups and incubated at 42±1ºC until complete coagulation, cooled at 42 ºC for 18 hr.

Preparation of different drinking yoghurt formulation

The prepared yoghurt was divided into 7 portions. The first portion was left without additives (control). To the other portion 10, 15 and 20% *W/W* of carrot pulp and guava pulp were added to yoghurt. All treatments were sweetened with sugar solution and stabilizer to give 8% sugar and 0.15% stabilizer (Table1) followed by mixing and storage at 5±1ºC for 12 days. Samples for analysis were taken when fresh then after 3, 6, 9 and 12 days of storage for different examination.

Chemical analyses of carrot and guava pulp

The total soluble solids (TSS) content (as Brix) were measured using refractometer at 20ºC. The moisture, protein, fat, fiber content, total sugar, ash, total acidity and pH value were determined according to **AOAC (1995)**. colour of pulp was measured as described by **Jamilah *et al*. (2011)** using Hunter lab (colour spectrophotometer, USA) in food safty Laboratory, Fac. Agric, Zagazig Univ. The antioxidant

Table 1. Formulation of different drinking yoghurt mixes (%)

Item	Control	Carrot pulp			Guava pulp		
		T1	T2	T3	T4	T5	T6
Yoghurt	60	50	45	40	50	45	40
Carrot pulp	—	10	15	20	—	—	—
Guava pulp	—	—	—	—	10	15	20
Water with sugar and stabilizer	40	40	40	40	40	40	40

(T1= 10% carrot pulp), (T2= 15% carrot pulp), (T3= 20% carrot pulp),
(T4=10% guava pulp), (T5=15% guava pulp), (T6=20% guava pulp)

activity of all pulp was measured by using DPPH (2,2-diphenyl-1- picrylhydrazyl) assay according to **Nishino *et al.* (2000)**.The total phenolic compounds (TPC) were estimated by Foline-Ciocalteu reagents as described by **Cliffe *et al.* (1994)**. Ascorbic acid was determined using the method of **Osborn and Voogt (1978)**.

Chemical analyses of milk and drinking yoghurt

Total solids, fat, and protein contents of milk and drinking yoghurt were determined according to **AOAC (1995)**. Lactose content was determined according to **Nickerson *et al.* (1975**). pH value of drinking yoghurt samples were done according to **AOAC (1995)** when fresh and during 12 days of cold storage at 5ºC. Colour of drinking yoghurt was measured as described by **Jamilah *et al*. (2011)** using Hunter lab (colour spectrophotometer, USA) in food safty Laboratory, Fac. Agric, Zagazig Univ.

Determination of total phenolic compounds (TPC) in all pulps and drinking yoghurt

Five grams of pulp or drinking yoghurt were mixed with 100 ml of 70% methanol and stirred at room temperature for 2 hr., and filtered through whatman filter paper No.1. The total phenolic compounds were determination in the mathanolic extract. One ml of sample was added to 5 ml from folin-Ciocalteu reagent (previously diluted with water 1:10, *V/V*) and sodium carbonate (75 g/l, 4 ml). The tubes were vortex mixed for 15 s and allowed to stand for 30 min at 40ºC for colour evolution. Absorbance was measured at 765 nm using spectrophotometer. Gallic acid was applied to gain the standard curve (20-200 µg/ml), and the lowering of Foline-Ciocalteu reagent by the samples was expressed as mg of gallic acid equivalents (GAE) per g of extract. The calibration equation for gallic acid was y= 0.001x +0.0563 (R^2 =0.9792), Where (y) is the absorbance and (x) is concentration of gallic acid µg/ ml **(Cliffe *et al.*, 1994).**

Determination of Antioxidant Activity (DPPH-assay) All Pulps and Drinking Yoghurt

The DPPH (2, 2-diphenyl-1- picrylhydrazyl) radical scavenging activity was determination by the method of **Nishino *et al*. (2000)** The radical scavenging capacity of the samples was measured as a decrease in the absorbance of DPPH radical and it was calculated using the following equation:

Radical scavenging activity (%)=

$(A_{control} - A_{sample})/A_{control}$ x 100

Where: ($A_{control}$) is the absorbance of blank

(A_{sample}) is the absorbance of sample

Flavour Compounds

Acetaldehyde and diacelyl in control and drinking yoghurt samples were determined according to **Less and Jago (1969**). Acetaldehyde reacts with semi-carbazide to form semi-carbazone which has absorption value at wave length of 224 nm While diacetyle has an absorption value at wave length of 270 nm.

Rheological Analysis

Syneresis

The released whey from drinking yoghurt samples was measured according to the method of **Aryana (2003)**. The quantity of whey collected from every sample in graduated cylinder after 3 hr., of drainage at 20˚C was used as index of syneresis.

Viscosity

Viscosity of drinking yoghurt samples were determined by the method of **Aryana (2003)** using Rotational Viscometer Type Lab. Line Model 5437.

Sensory evaluation

Yoghurt treatments were evaluated by 11 panelists of staff members of Department of Food Science, Faculty of Agriculture, Zagazig University in the following parameters, flavour= 45 points, body and texture = 35 points, appearance =10 points, acidity= 10 points according to the scale that suggested by **El-Etriby *et al*. (1997)**.

Statistical Analyses

The obtained data were statistically analyzed by a statistical for social science package "SPSS" version 20 for Microsoft windows, SPSS Inc according to **Dominick and Derrick (2001)**.

RESULTS AND DISCUSSION

Chemical Composition of Carrot Pulp, Guava Pulp and Milk

Table 2 shows the chemical composition of ingredients used in the manufacture of drinking yoghurt. Carrot pulp contained 12.9% total solids, 0.4%fat, 2.11%protien, 6.15% total sugar, 2.03% total fiber. The fiber in food increase the feeling of fullness (**Lyly *et al.*, 2009)**, also fibers increase the viscosity and thickness of the products by its water holding capacity **(Harries and Smith, 2006)**. Total phenols were 138.7%, 11mg Vitam. C/100 gm pulp and 20.12% antioxidant activity. The pH was 6.59 and 0.6% acidity. Guava pulp contained 9.5% total solid, 12.56% total sugar, 4.11% total fiber, 175.70% total phenols, 98.3 mg Vitam. C/100 g pulp, 65.23% antioxidant activity, 4.36 pH and 0.8% acidity. These results indicated that carrot and guava pulp can be used as functional ingredients.

Chemical Composition of Drinking Yoghurt Samples

Tables 3 show the effect of fortifying drinking yoghurt with carrot and guava pulp on its composition. The moisture content was found to be 88.71% in control yoghurt drink in day 1, and then decreased slightly after 12days of storage to 88.12%. On the other hand, moisture content of carrot drinking yoghurt samples was found to be 86.25%, 85.34, and 84.52%with addition of carrot pulp at ratio of 10%, 15% and 20%, respectively. Then decreased after 12days of storage to reach 86.00%, 85.08 %and 84.12%. The moisture content of drinking yoghurt containing guava pulp reached 87.43, 86.65 and 85.42% in day 1, then decreased after 12 days of cold storage to 87.09, 86.16 and 85.08%. The variations between different types of drinking yoghurt in fat content were slight. during storage period These results are in agreement with **Pereira *et al.* (2008)**, The pH value of different drinking yoghurt decreased with prolong of storage period. It was reported that the high rate of production of lactic acid in yoghurt was observed at the 12^{th} day due to the high bacterial metabolic activity with the consumption of lactose **(Beal *et al.*, 1999)**.

Sensory Properties of Drinking Yoghurt

Table 4 shows the effect of addition of carrot and guava pulp on flavour and body and texture scores compared to control. The flovour, body and texture scores of guava drinking yoghurt were higher than this given to carrot drinking yoghurt. Scores for the sensory evaluation of all treatments decreased as the storage period proceeded **Ibrahim *et al.* (2003)** revealed that the scores for sensory attributes of fermented milk products were decreased with advanced of storage times probably due to the developed of acidity and microbial growth. Table 5 indicated that colour which is an important parameter to the quality of food products because of its association with factors such as freshness, ripeness, desirability, and food safety. These results are in agreement with **Hussein *et al.* (2017**).

Table 2. Chemical composition of ingredients used in the manufacture of drinking yoghurt

Component		Carrot pulp	Gauva pulp	Buffalo milk
Total solids (%)		12.90	9.50	11.78
Fat (%)		0.40	1.05	3
Protein (%)		2.11	1.01	3.68
Lactose (%)		—	—	5.08
Ash (%)		0.35	0.98	—
Total sugar (%)		6.15	12.56	—
Total fiber (%)		2.03	4.11	—
Total phenols (%)		138.70	175.70	—
Vitam. C (Ascorbic acid) (mg/100g)		11.00	98.3	—
Antioxidant activity (%)		20.12	65.23	—
pH value		6.59	4.36	6.64
Acidity (%)		0.60	0.80	0.16
Colour	**L**	43.62	68.43	—
	a	28.98	-3.49	—
	b	23.82	18.04	—

L*: (Lightness), a*: (redness/greenness), b*: (yellowness/blueness)

Table 3. Chemical composition of drinking yoghurt containing carrot pulp during storage at 5ºC for 12 days

Item	Storage period (day)	Control	Carrot pulp (%)			Guava pulp (%)		
			T1	T2	T3	T4	T5	T6
Moisture (%)	**Fresh**	88.71±0.05	86.25±0.01	85.34±0.02	84.52±0.01	87.43±0.02	86.65±0.04	85.42±0.03
	3	88.54±0.02	86.23±0.01	85.31±0.01	84.47±0.04	87.43±0.04	86.43±0.01	85.32±0.02
	6	88.34±0.01	86.17±0.02	85.27±0.06	84.39±0.09	87.23±0.04	86.30±0.02	85.22±0.01
	9	88.21±0.02	86.11±0.01	85.19±0.06	84.22±0.19	87.12 ±0.13	86.26±0.05	85.13±0.11
	12	88.12±0.03	86.0±0.04	85.08±0.07	84.12±0.03	87.09±0.09	86.16±0.14	85.08±0.07
Fat (%)	**Fresh**	3.0±0.05	3.0±0.00	3.2±0. 2	3.3±0.5	3.0±0. 1	3.1±0.1	3.1±0. 1
	3	3.2±0.2	3.1 ±0.09	3.2±0. 1	3.4±0. 1	3.3±0.4	3.2±0.4	3.1±0. 2
	6	3.2±0.2	3.2 ±0.6	3.3±0. 1	3.5±0.3	3.4±0.3	3.3±0.1	3.4±0. 1
	9	3.4±0.4	3.3 ±0.2	3.4±0.5	3.6±0.4	3.5±0.4	3.4±0.4	3.4±0.1
	12	3.5±0.1	3.5 ±0.1	3.6±0.5	3.7±0.4	3.7±0.2	3.5±0.05	3.6±0.05
Acidity	**Fresh**	0.76±0.01	0.79±0.05	0.83±0.02	0.86±0. 03	0.78±0.01	0.85±0.02	0.89±0.01
	3	0.81±0.005	0.85±0.04	0.88±0.01	0.92±0.01	0.85±0.02	0.92±0.03	0.95±0.02
	6	0.84±0.06	0.93±0.02	0.95±0.01	0.98±0.01	0.90±0.04	0.97±0.02	0.99±0.01
	9	0.93 ±0.06	0.97±0.02	0.97±0.03	1.00±0.03	0.93±0.005	0.99±0.01	1.05±0.06
	12	0.95±0.06	0.99±0.11	1.00±0.01	1.10±0.005	0.96±0.08	1.05±0.05	1.00±0.05
pH	**Fresh**	4.73±0.17	4.44±0.01	4.46±0.07	4.45±0.16	4.37±0.07	4.32±0.02	4.30±0.01
	3	4.53±0.06	4.46±0.05	4.42±0.12	4.40±0.11	4.33±0.02	4.28 ±0.08	4.24±0.005
	6	4.46±0.25	4.39±0.15	4.36±0.01	4.32±1.1	4.29±0.005	4.26±0.06	4.22±0.00
	9	4.39±0.05	4.25±0.03	4.21±0.005	4.14±0.05	4.18±0.07	4.12±0.01	4.10±0.005
	12	4.24±0.03	4.16±0.01	4.11±0.01	4.00±0.01	4.11±0.005	4.02±0.005	3.75±0.05

Table 4. Sensory properties of fresh drinking yoghurt

Treatment	Sensory evaluation				
	Appearance (10)	Flavour (45)	Body and texture (35)	Acidity (10)	Total (100)
Control	8.81±0.7	42.90±1	32.09±4	8.54±1	92.36±17.21
T_1	8.18±0.6	43.18±0.7	31.81±3.5	7.72±0.6	90.90±17.67
T_2	8.27±0.6	43.27±0.9	31.90±2	7.54±0.5	91±17.75
T_3	8.00±1.00	43.45±1.1	31.54±2	7.81±0.7	90.81±17.76
T_4	8.27±0.7	42.90±1.0	32.90±1.5	8.1±0.8	92.19±17.63
T_5	8.36±1.1	42.90±1.3	33.09±1.3	8±0.7	92.36±17.67
T_6	8.45±1	43.27±1.4	33.45±1	8±0.8	93.18±17.85

Table 5. Colour of fresh yoghurt drink

Treatment	L^*	a^*	b^*
Control	64.62±0.5	-1.39±0.05	12.18±0.03
T_1	53.92±1.2	12.77±0.09	19.33±0.3
T_2	39.21±0.1	16.35±0.04	20.02±0.05
T_3	62.07±0.08	22.48±0.01	27.79±0.05
T_4	81.05±0.06	-1.57±0.4	64.81±0.07
T_5	64.81±0.07	-0.4±0.01	10.82±0.005
T_6	76.42±0.5	-1.13±0.005	12.78±0.01

L*: (Lightness), a*: (redness/greenness), b*: (yellowness/blueness

Rheological Properties of Carrot and Guava Drinks during Storage Period

Table 6 shows the viscosity of drinking yoghurt. The viscosity of carrot and guava yoghurt drink increased remarkably ($p<0.05$) with the increase of the added percentage from these additives compared to control samples which can be attributed to the higher total solids of the fruit additives. Moreover, there was an increase in synersis of samples till the end of storage. The high values of synersis may be due to high acidity resulting in shrinkage of the protein matrix and separation of whey. These results agree with **Wijesinghe *et al.* (2018)**.

The Phenolic Compounds, Ascorbic Acid and Antioxidant Activity of Drinking Yoghurt

Table 7 shows that the addition of guava and carrot pulp to yoghurt increased the total phenolic compounds (TPC) and antioxidant activity (AA), Also TPC decreased with extending the storage period. In addition, the storage period affect the yoghurt properties by increasing its acidity and antioxidant activities by increasing the storage time. On the other hand, the ascorbic acid content of yoghurt samples was higher in guava and carrot drinking yoghurt. During storage period the ascorbic acid content was decreased.

The Protein and Fiber Contents of Drinking Yoghurt

Table 8 shows the protein content and fiber content of drinking yoghurt samples. The protein content showed increasing in the order carrot yoghurt > guava yoghurt. The fiber content was higher in yoghurt supplemented with guava pulp > carrot pulp.

Conclusion

The addition (10, 15 and 20%) of carrot or guava pulp improved sensory properties, specially addition of 20% of carrot pulp and 20% of guava pulp improve rheological and sensory properties and increase the total phenolic compounds (TPC), antioxidant activity (AA), fiber content and ascorbic acid (vitamin c).

Table 6. Rheological properties of carrot and guava drinks during storage period at 5ºC for 12 days

Item	Storage period (day)	Carrot pulp (%)				Guava pulp (%)		
		Control	T1	T2	T3	T4	T5	T6
Viscosity (CPS)	Fresh	152±6.08	1330±4.50	2154±3.60	2472±3.78	1205±5	1946±1.52	2275±4.35
	3	175±4.35	1506±5.29	2554±4.16	2669±4.16	1321±4.72	2427±2.51	2905±5.03
	6	185±4.35	1664±4.04	2653±3.21	2773±4.04	1503±5.77	2521±5.29	2805±5.13
	9	184±3.51	1882±3.46	2986±1.52	2993±4.04	1906±5.50	2742±3.51	2994±3.60
	12	193±2.88	1981±2.88	3015±5	3125±4	2015±5	2942±3.51	3020±2.51
Syneresis Ml Whey/30gm	Fresh	7.33±0.23	5.7±0.1	3.26±0.2	2.96±1.50	4.5±1	2.93±0.3	1.33±0.05
	3	7.53±0.25	5.9±0.01	3.36±1.10	2.9±1.1	4.63±0.1	3.2±0.8	1.56±0.6
	6	7.8±0.4	5.46±0.51	3.66±0.86	3.13±0.2	4.86±1.00	3.7±0.3	1.86±0.05
	9	7.9±0.7	6.3±0.1	3.86±0.7	3.36±1.40	4.83±0.35	3.9±0.3	1.93±0.05
	12	8.2±0.36	6.8±2.06	3.9±0.1	3.7±0.8	5.06±0.15	4.33±0.41	1.9±07

Table 7. Ascorbic acid, total phenolic compounds (TPC) and antioxidant activity (AA) of carrot yoghurt drink during storage at 5ºC for 12 days

Item	Storage period (day)	Control	Carrot pulp (%)			Guava pulp (%)		
			T1	T2	T3	T4	T5	T6
Ascorbic acid (mg/100g)	Fresh	1.53±0.01	3.69±0.48	4.70±0.15	6.50±0.01	20.88±0.05	33.75±0.02	40.46±0.07
	3	1.44±0.005	3.59±0.005	4.62±0.64	6.48±1.25	20.76±0.02	33.62±0.01	40.38±1.47
	6	1.38±0.16	3.52±0.005	4.58±0.1	6.41±0.10	20.65±0.005	33.59±0.17	40.33±0.01
	9	1.30±0.02	3.37±0.26	4.50±0.01	6.21±0.01	20.48±0.00	33.53±0.01	40.27±0.02
	12	1.24±0.04	3.27±0.005	4.39±0.02	6.18±0.06	20.43±0.01	33.47±0.01	40.17±0.07
TPC (mg/100gm)	Fresh	8.8±0.45	15.5±0.98	23.23±0.41	32.73±0.47	51.6±0.18	63.4±2.42	89.99±0.40
	3	7.8±0.55	14.76±0.68	22.2±0.43	31.6±1.47	50.63±0.85	62.96±1.05	88.66±0.49
	6	6.13±0.20	13.96±0.95	21.23±1.00	29.96±0.05	49.63±0.55	61.96±1.05	87.7±0.60
	9	5.09±1.15	13.3±1.12	20.63±0.55	29.63±0.55	48.86±0.80	61.26±1.41	86.96±1.00
	12	2.83±0.20	11.63±1.09	19.73±1.02	27.96±1.00	46.73±0.64	60.66±1.15	85.4±0.55
AA (%)	Fresh	36.52±0.05	22.40±0.15	37.98±0.00	40.61±0.38	33.35±0.005	44.59±0.04	50.65±0.20
	3	36.21±0.005	22.37±0.07	37.82±0.02	40.60±0.04	32.72±0.03	44.15±0.04	50.61±0.005
	6	36.13±0.06	21.59±0.00	37.47±0.02	40.31±0.01	32.54±0.05	44.04±0.04	50.56±0.01
	9	35.87±0.00	21.41±0.005	35.17±0.07	40.28±0.03	32.41±0.02	43.35±0.005	50.53±0.02
	12	35.51±0.01	21.15±0.005	35.06±0.005	40.22±0.03	32.26±0.005	43.31±0.005	50.51±0.03

TPC: (Total Phenolic Compound), AA: (Antioxidant Activity).

Table 8. Rheological properties of carrot and guava drinks during storage period at 5ºC for 12 days

Item	Storage period (day)	Carrot pulp (%)				Guava pulp (%)		
		Control	T1	T2	T3	T4	T5	T6
Protein content (%)	Fresh	2.74±0.11	2.26±0.02	2.67±0.01	2.92±0.07	2.46±0.13	2.38±0.17	2.22±0.005
	3	2.64±0.10	2.26±0.02	2.68±0.01	2.92±0.005	2.49±0.16	2.39±0.01	2.25±0.02
	6	2.76±0.08	2.30±0.01	2.73±0.03	2.94±0.05	2.52±0.03	2.39±0.02	2.33±0.07
	9	2.79±0.05	2.38±0.03	2.78±0.0	2.96±0.02	2.56±0.13	2.43±0.02	2.33±0.07
	12	2.77±0.14	2.36±0.02	2.78±0.02	2.99±0.01	2.57±0.01	2.47±0.005	2.31±0.005
Fiber content (%)	Fresh	—	0.19±0.01	0.37±0.02	1.52±0.05	1.05±0.03	2.31±0.01	3.42±0.03
	3	—	0.21±0.01	0.41±0.01	1.31±0.26	1.08±0.005	2.43±0.02	3.51±0.01
	6	—	0.24±0.01	0.42±0.01	1.63±0.01	1.08±0.07	2.45±0.02	3.52±0.01
	9	—	0.32±0.01	0.49±0.02	1.55±0.02	1.13±0.02	2.52±0.02	3.53±0.02
	12	—	0.41±0.01	0.52±0.02	1.75±0.005	1.17±0.01	2.52±0.005	3.58±0.01

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تصنيـــع مشـــــروب زبـــــادي مدعـــــم بلـب الجـــزر والجـــوافـــة

أصالة رمضان محمد محمد ـ محمد مغاوري عمر
محمد مجدي العباسي- صلاح احمد خليفة

قسم علوم الأغذية – كلية الزراعة – جامعة الزقازيق - مصر

أجريت هذه الدراسة لتقييم بعض الخواص لمختلف أنواع الزبادي المنكهه، والمصنع بإضافة لب (الجزر والجوافة) وذلك خلال فترة التخزين، أظهرت النتائج المتحصل عليها أنه يحدث انخفاض معنوي في الـ pH خلال التخزين في جميع العينات، وجد أن عينات مشروب الزبادي المدعم بلب الجوافة والجزر لها نفس قيم الـ pH، وعلى الجانب الآخر تزداد الحموضة في جميع العينات بزيادة التخزين، أدى تدعيم الزبادي بثمار الجوافة (١٠، ١٥ و٢٠%) إلى زيادة معنوية في المركبات الفينولية الكلية، النشاط المضاد للأكسدة، محتوي الألياف، حمض الأسكوربيك وكذلك حسنت الخواص الريولوجية والحسية مقارنة بالكنترول، إلا أن محتوي البروتين وقيم ال pH وطرد الشرش Syneresis انخفضت معنويا مقارنة بالكنترول، وأدت إضافة (١٠، ١٥ و٢٠%) من لب الجزر إلي زيادة في المركبات الفينولية، النشاط المضاد للأكسدة ،حمض الاسكوربيك، محتوي الألياف بينما انخفض محتوي البروتين وقيم الـ pH، لوحظ خلال فترة النخزين زيادة معنوية في الجوامد الكلية (TS)، الحموضة، طرد الشرش، اللزوجة بينما إنخفضت قيم الـ pH، حمض الأسكوربيك، محتوي الأستالدهيد ، النشاط المضاد للأكسدة والمركبات الفينولية الكلية(TPC).

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٢- أ.د. عطية عبد المعطي عبد الباقي أستاذ الألبان المتفرغ – كلية الزراعة – جامعة الزقازيق.