

Quality Evaluation of Yoghurt Supplemented with Carrot Juice

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ABSTRACT

In the present study, carrot juice was used in the preparation of yoghurt using cow's milk. The effect of refrigerated storage (6°C) in the chemical and microbiological characteristics of yoghurt samples was investigated during 1, 7 and 15 days of storage. The chemical analyses showed that the moisture content was $88 \pm 0.4\%$ in control yoghurt in day 1 which was lower than those of carrot yoghurt samples which ranged between $89 \pm 0.5\%$ and $93 \pm 0.6\%$. The protein content of control yoghurt (A), yoghurt supplemented with 5% carrot juice (B₁), yoghurt supplemented with 10% carrot juice (B₂) and yoghurt supplemented with 15% carrot juice (B₃) was $4 \pm 0.06\%$, $3.9 \pm 0.02\%$, $3.9 \pm 0.01\%$ and $3.8 \pm 0.02\%$, respectively. The ash content of carrot yoghurt samples ranged between $0.45 \pm 0.004\%$ and $0.6 \pm 0.07\%$. The total solids content was $12 \pm 0.7\%$ in control yoghurt at day 1 which was higher than those of carrot yoghurt samples ($11 \pm 0.3\%$ and $7 \pm 0.6\%$). However, the total solids content of carrot yoghurt decreased during storage. The acidity (expressed as lactic acid %) increased progressively during storage of all yoghurt samples while the pH decreased. The microbiological analyses revealed entire absence of coliform bacteria during storage; however, few numbers of yeasts were detected in the control yoghurt. On the other hand, the total count of bacteria in control yoghurt was 3.3×10^4 c.f.u/ml at day 1 increased in carrot yoghurt samples to the range 3.5×10^4 - 4×10^4 c.f.u/ml. Also lactic acid bacteria increased in all yoghurt samples. The

sensory evaluation indicated acceptance of all yoghurt samples, with preference to the yoghurt prepared using 5% carrot juice, especially in its colour, texture and flavour.

INTRODUCTION

Milk is a complete food for human nutrition; it contains all the basic components required for the development and maintenance of human life. Milk and milk products have been used as important food for human since before the dawn of civilization. From historical experience they have long been regarded as the best cornerstone to build nourishing diets.

Yoghurt is rich in protein, fat, iron, minerals and vitamin C. In many African countries, yoghurt is more likely to be produced as naturally soured milk and to be consumed by the adult more than fresh milk. It is generally considered a safer product as its unique flavor appeals to so many people, so that it has been given by nutritionists to incorporate inexpensive source of nutrients to make it an almost complete food in these areas (Frank, 1970).

Yoghurt has been prepared from milk obtained from cows, goats, sheep, mares, camels and other animals, even including the leopard (Carls, 1978). It is now sold with different flavors e.g. with ginger and herbs which are added to the fresh milk before fermentation or served with sugar syrup and various fruits and vegetables such as carrot.

Carrot (*Daucus carota* L.) is one of the more commonly used vegetables for human nutrition. It is rich in beta carotene, ascorbic acid, tocopherol and classified as vitaminized food (Hashimoto and Nagayama, 2004). Carrots are also good source of carbohydrate, calcium, phosphorous, iron, potassium, magnesium, copper, manganese and sulphur. It is an excellent source of vitamin A, B₁, B₂, C, E, thiamin, folic acid and riboflavin but lack in protein and fat. Blending of yoghurt with carrot juice would

produce a nutritionally rich food (Ikken *et al.*, 1998; Raum, 2003). The objectives of the study were to use carrot juice to enrich the plain yoghurt, to study the effect of added carrot on chemical and microbiological properties as well as consumer acceptance during cold storage of yoghurt.

MATERIALS AND METHODS

Materials

Fresh cow's milk samples were collected from El Nesheshiba dairy farm (the University of Gezira Farm) in April – 2009 in sterilized containers with sieves and transferred to the laboratory under aseptic conditions. The carrot tubers obtained from Wad Medani local market and transferred to the laboratory of Department of Food Science and Technology. 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, in addition to tenderize the carrot tissues. The juice was extracted using a blender with sieves.

Carrot juice analysis

The extracted carrot juice was analyzed chemically by determining moisture, and total soluble solids "TSS" percent according to the AOAC (2000). The titratable acidity and total sugars content were determined according to Ranganna (1979). Total carotenoids and riboflavin were determined by the method described by Reddy and Sisrunk (1980).

Preparation of yoghurt

For preparation of control yoghurt, clean milk was heated to the boiling point, then cooled gradually until reached (43 – 45°C) and inoculated with previous batch of yoghurt, then incubated in a warm room (42 °C) for 7 hours and stored in refrigerator. For preparation of carrot yoghurt, 5%, 10% and 15% carrot juice were added to 95%, 90% and 85% fresh cow's milk, respectively, before inoculation with the starter culture and incubated for 7 hours at 42°C. The control cow's milk yoghurt was coded A while yoghurt produced using cow's milk supplemented with 5%, 10% and 15% carrot juice were coded B1, B2 and B3, respectively.

Chemical analyses of yoghurt

The percentages of moisture, ash, protein and titrable acidity were determined in all yoghurt samples according to AOAC (1990) methods. The carbohydrates % was obtained by subtracting sum of moisture, ash and protein contents from 100. The pH of the various samples was accomplished using a pH meter model CG 840. Total volatile fatty acids (TVFA) were determined by the distillation method described by Kosikowski (1982).

Chemical components were analyzed on different samples of yoghurt stored at 6 °C for different intervals of time (1 day, 7 days and 15 days) as described previously.

Microbiological analyses of yoghurt

For determination of microbial viable counts of yoghurt samples, appropriate dilutions of the respective sample in 1 ml aliquots were surface plated on pre-poured plates of Nutrient agar for total plate counts, MRS agar for lactic acid bacteria, MacConkey agar for the enumeration of coliforms and Potato dextrose agar for moulds and yeasts. The Nutrient agar plates and MacConkey agar plates were incubated for 24-48 hrs, while, the PDA plates were incubated for 72 hrs at 25°C. Characteristics colonies appearing on the respective selective agar media were counted and multiplied by the dilution factor and expressed as colony forming units per milliliter (cfu/ ml).

All microbiological analyses were conducted on different samples of yoghurt stored at 6 °C for different intervals of time (1 day, 7 days, 15 days).

Sensory evaluation of yoghurt

All types of yoghurt were subjected to sensory evaluation using 8 panelists at the second day of storage. The storage temperature was 6°C. The panelists were asked to rank the samples for visual colour, viscosity, flavour, appearance and overall acceptability using 4 point hedonic scale with 1 as the highest score and 4 the lowest. For these evaluations, a special testing area was used so that distractions can be minimized and conditions can be controlled, the testing room was quiet, comfortable with uniform level of lighting and good ventilation. Each panelist was provided with water for rinsing. All these conditions were equalized for all tests. The samples were given codes before being tested.

Statistical analysis

All scores of the sensory evaluation were analyzed by the analysis of variance (ANOVA) according to SAS (1982). To determine whether there were significant differences between means for each variable, least significant difference (LSD) test was used.

RESULTS AND DISCUSSION

As presented in Table 1 moisture content of carrot juice represents its major component (90.52%), while total soluble solids, titratable acidity, total sugars, total carotenoids and riboflavin were 6.85, 2.238%, 38.30%, 11.25 mg/100g and 0.58 mg/g, respectively.

Effect of storage on the chemical characteristics of yoghurt

The data in Table (2) shows the effect of storage on control yoghurt made from raw milk(A) as well as the yoghurt made from cows' milk supplemented with different levels of carrot juice (5%, 10% and 15%) stored at 6°C for 1, 7 days and 15 days.

Table 1. Chemical composition of extracted carrot juice

Parameter	Value
Moisture %	90.5
Total soluble solids% (T.S.S)	6.8
Titratable acidity as citric acid% (T.A)	2.2
Total sugars%	38.3
Total carotenoids (mg/100g)	11.2
Riboflavin mg/g	0.5
PH	6.1

The moisture content was found to be $88 \pm 0.4\%$ in control yoghurt in day 1, however, this value was lower than those of carrot yoghurt samples B₁, B₂ and B₃ which were $89 \pm$

0.5%, $91 \pm 0.3\%$ and $93 \pm 0.6\%$, respectively. The moisture content of control yoghurt increased after 7 and 15 days of storage to $90 \pm 0.7\%$ and $91.0 \pm 0.3\%$, respectively. This increase could be attributed to the high amount of free water. On the other hand, moisture content of carrot yoghurt samples B₁, B₂ and B₃ increased after 7 days of storage to $90 \pm 0.7\%$, $92 \pm 0.7\%$ and $94 \pm 0.5\%$, respectively. The increase continued after 15 days of storage to reach $92 \pm 0.7\%$, $94 \pm 0.5\%$ and $95 \pm 0.4\%$ in carrot yoghurt samples B₁, B₂ and B₃, respectively.

The protein content was $4 \pm 0.06\%$ in control yoghurt at day 1, however, this value was higher than that reported by Osman (2004) who recorded a value of 3.3% of yoghurt, and higher than those of carrot yoghurt samples B₁, B₂ and B₃ which were $3.98 \pm 0.02\%$, $3.92 \pm 0.01\%$ and $3.89 \pm 0.02\%$ respectively. The protein content of control yoghurt slightly decreased after 7 days and 15 days of storage to $3.5 \pm 0.05\%$ and $3 \pm 0.02\%$ respectively. This decrease could be attributed to the psychrophilic (cold – loving) bacteria which attacked protein and fat causing off flavour and shortened the shelf life. On other hand, protein content of carrot yoghurt samples B₁, B₂ and B₃ decreased after 7 days of storage to $3.93 \pm 0.02\%$, $3.88 \pm 0.01\%$ and $3.80 \pm 0.04\%$ respectively, the decrease continued after 15 days of storage and reached $3.90 \pm 0.03\%$, $3.82 \pm 0.04\%$ and $3.76 \pm 0.05\%$ in carrot yoghurt samples B₁, B₂ and B₃, respectively.

The ash content was $0.4 \pm 0.05\%$ in control yoghurt at day 1, however, this value was lower than those reported by Webb and Johnson (1965) and Frank (1970) who gave values of 0.7% and 0.75% ash content in yoghurt, respectively, and higher than those of carrot yoghurt samples B₁, B₂ and B₃ which was $0.45 \pm 0.004\%$, $0.5 \pm 0.05\%$ and $0.6 \pm 0.07\%$ respectively. The ash content of control yoghurt decreased after 7 days and 15 days of storage to $0.38 \pm 0.04\%$ and $0.32 \pm 0.002\%$ respectively. This decrease could be attributed to the action of fermenting microorganisms which utilized some of the minerals in their nourishment. On the other hand, ash content of carrot yoghurt samples B₁, B₂ and

B₃ slightly decreased after 7 days of storage to $0.43 \pm 0.003\%$, $0.48 \pm 0.007\%$ and $0.58 \pm 0.01\%$, respectively, this decrease continued after 15 days of storage and reached $0.41 \pm 0.01\%$, $0.44 \pm 0.004\%$ and $0.54 \pm 0.006\%$ in carrot yoghurt samples B₁, B₂ and B₃, respectively.

The total solids content was found to be $12 \pm 0.7\%$ in control yoghurt at day 1, however, this value was higher than those of carrot yoghurt samples B₁, B₂ and B₃ which were $11 \pm 0.3\%$, $9 \pm 0.4\%$ and $7 \pm 0.6\%$, respectively. The total solids content of control yoghurt slightly decreased after 7 days and 15 days of storage to $10 \pm 0.4\%$ and $9 \pm 0.4\%$, respectively. On the other hand, however these values decreased after 7 days of storage to $10 \pm 0.4\%$, $8 \pm 0.5\%$ and $6 \pm 0.5\%$, respectively. The decrease continued after 15 days of storage to reach $8 \pm 0.5\%$, $6 \pm 0.5\%$ and $5 \pm 0.7\%$ in carrot yoghurt samples B₁, B₂ and B₃, respectively. The total solids decreased with the increased carrot juice, this may be due to the high moisture content of the added carrot juice.

The pH gradually decreased during fermentation of yoghurt. The average pH of control yoghurt at day 1 was 4.9 ± 0.03 which was higher compared with that reported by Frank (1970) who gave a value of 4.4 in control yoghurt, and higher than that of the different carrot yoghurt samples B₁, B₂ and B₃ which had pH values of 4.7 ± 0.08 , 4.6 ± 0.09 and 4.6 ± 0.09 , respectively. The pH in control yoghurt decreased after 7 days and 15 days of storage to 4.4 ± 0.04 and 4 ± 0.06 respectively. The pH of carrot yoghurt samples B₁, B₂ and B₃ decreased after 7 days of storage to 4.2 ± 0.07 , 4.05 ± 0.01 and 4.09 ± 0.04 respectively. The decrease continued after 15 days of storage and reached 4.03 ± 0.003 , 4.02 ± 0.01 and 4.06 ± 0.03 in carrot yoghurt samples B₁, B₂ and B₃, respectively. However, the titratable acidity (expressed as lactic acid%) increased during fermentation of yoghurt. The titratable acidity % of control yoghurt at day 1 of storage was $1.3 \pm 0.04\%$ which was slightly higher than that reported by Frank (1970) who reported a value of 1.2% titratable acidity in cows milk yoghurt. The obtained titratable acidity of control

yoghurt was lower than that of carrot yoghurt samples B₁, B₂ and B₃ which averaged $1.5 \pm 0.04\%$, $1.8 \pm 0.05\%$ and $2 \pm 0.08\%$, respectively. The increase in acidity of control yoghurt reached $1.7 \pm 0.04\%$ at 7 days of storage while in carrot yoghurt samples B₁, B₂ and B₃ the acidity averaged $1.8 \pm 0.03\%$, $2 \pm 0.08\%$ and $2.5 \pm 0.15\%$, respectively. The increase in acidity continued until 15th day of storage, it reached $2 \pm 0.08\%$ in control yoghurt and $2 \pm 0.08\%$, $2.3 \pm 0.04\%$ and $2.8 \pm 0.17\%$ in carrot yoghurt samples B₁, B₂ and B₃, respectively. The titratable acidity (% as lactic acid) increased in all types of yoghurt and pH decreased progressively during the storage period. Osman (2004) reported a similar trend of results, and this may be due to the presence of lactic acid as a result of conversion of lactose by the microorganisms.

Effect of storage on the microbiological characteristics of carrot yoghurt

Table (3) shows the microbiological characteristics of control yoghurt and carrot yoghurt at different storage periods. The total count of bacteria in control yoghurt was 3.3×10^4 c.f.u/ml at day 1. On the other hand, total count of bacteria in carrot yoghurt samples B₁, B₂ and B₃ slightly increased to 3.5×10^4 cfu/ml, 3.8×10^4 cfu/ml and 4×10^4 cfu/ml, respectively. However, the total count continued to increase in the 7th day of storage to 4.2×10^4 cfu/ml, 4.6×10^4 cfu/ml and 4.8×10^4 cfu/ml in carrot yoghurt samples B₁, B₂ and B₃ and 3.6×10^4 cfu/ml in the control yoghurt. It also continued to increase after 15 days of storage to 4.5×10^4 cfu/ml, 4.9×10^4 cfu/ml and 5.1×10^4 cfu/ml in carrot yoghurt (B₁, B₂ and B₃) and 3.8×10^4 cfu/ml in the control yoghurt. The lactic acid bacteria of control yoghurt at day 1 was 8.4×10^5 cfu/ml increased to 3.5×10^4 , 8.2×10^5 , 9.1×10^7 cfu/ml in carrot yoghurt samples B₁, B₂ and B₃, respectively.

The total yeasts and moulds count at day 1 was 1.8×10^2 c.f.u/ml in the control yoghurt, while in carrot yoghurt samples B₁, B₂ and B₃, the total yeasts and moulds count were 3×10^2 c.f.u/ml, 2.7×10^2 c.f.u/ml and 2.2×10^3 c.f.u/ml, respectively. After storage for 7 days and 15 days, the number of total yeasts and moulds decreased in all carrot yoghurt samples when compared with that of control yoghurt. The inhibition of the

growth of yeasts and moulds in carrot yoghurt may be attributed to the action of isocoumarine which is naturally present in trace amount in carrot (Hohn and Kuns, 2003).

The coliform bacteria were not detected in all yoghurt samples which indicated the proper hygienic measures of milk handling and yoghurt preparation. Also this may be due to the inhibitory effect of carrot and acidity on coliform organism. In addition carrot is considered as antibacterial agent against pathogenic microorganisms which may get access into yoghurt either before or even after processing rendering the product unsafe for human consumption (Babic *et al.*, 1994, Nyati, 2000).

Table 2. Chemical composition, total solids, TVFA and pH of control and carrot yoghurt samples during different storage periods

Parameter	1 day				7 days				15 days			
	A	B ₁	B ₂	B ₃	A	B ₁	B ₂	B ₃	A	B ₁	B ₂	B ₃
Moisture (%)	88 ± 0.4	89 ± 0.5	91 ± 0.3	93 ± 0.6	90 ± 0.7	90 ± 0.7	92 ± 0.7	94 ± 0.5	91 ± 0.3	92 ± 0.7	94 ± 0.5	95 ± 0.4
Protein (%)	4.0 ± 0.6	3.9 ± 0.02	3.9 ± 0.01	3.8 ± 0.02	3.5 ± 0.05	3.9 ± 0.02	3.8 ± 0.01	3.8 ± 0.04	3 ± 0.02	3.9 ± 0.03	3.8 ± 0.04	3.7 ± 0.05
Ash (%)	0.4 ± 0.01	0.45 ± 0.014	0.5 ± 0.05	0.6 ± 0.7	0.38 ± 0.04	0.4 ± 0.01	0.48 ± 0.007	0.58 ± 0.007	0.32 ± 0.002	0.41 ± 0.01	0.4 ± 0.01	0.5 ± 0.01
Total solids (%)	12 ± 0.7	11 ± 0.3	9 ± 0.4	7 ± 0.6	10 ± 0.4	10 ± 0.4	8 ± 0.5	6 ± 0.5	9 ± 0.4	8 ± 0.5	6 ± 0.5	5 ± 0.7
Fat (%)	26.8 ± 0.1	28.1 ± 0.2	27.4 ± 0.1	27.2 ± 1.3	27.3 ± 0.8	28.2 ± 0.4	27.7 ± 0.6	27.4 ± 0.5	28.1 ± 0.3	28.2 ± 0.3	27.7 ± 0.3	27.5 ± 0.7
TVFA*	0.25 ± 0.04	0.26 ± 0.1	0.22 ± 0.1	0.21 ± 0.05	0.27 ± 0.1	0.25 ± 0.04	0.21 ± 0.02	0.19 ± 0.08	0.25 ± 0.05	0.23 ± 0.06	0.2 ± 0.05	0.20 ± 0.03
pH	4.9 ± 0.03	4.7 ± 0.08	4.6 ± 0.09	4.6 ± 0.09	4.4 ± 0.04	4.2 ± 0.07	4.05 ± 0.01	4.09 ± 0.04	4 ± 0.06	4.03 ± 0.003	4.0 ± 0.01	4.0 ± 0.03
Acidity (%)	1.3 ± 0.04	1.5 ± 0.04	1.8 ± 0.05	2 ± 0.08	1.7 ± 0.04	1.8 ± 0.03	2 ± 0.08	2.5 ± 0.15	2 ± 0.08	2 ± 0.08	2.3 ± 0.04	2.8 ± 0.17

A : Control yoghurt; B₁ : Yoghurt supplemented with 5% carrot juice.

B₂ : Yoghurt supplemented with 10% carrot juice ; B₃ : Yoghurt supplemented with 15% carrot juice.

TVFA: Total volatile fatty acids

Table 3. Microbiological characteristics (c.f.u/ml) of yoghurt samples during storage

Parameter (cfu/ml)	Yoghurt											
	1 days				7 days				15 days			
	A	B ₁	B ₂	B ₃	A	B ₁	B ₂	B ₃	A	B ₁	B ₂	B ₃
Total count of bacteria	3.3x10 ⁸	3.5x10 ⁸	3.8x10 ⁸	4.0x10 ⁸	3.6x10 ⁸	4.2x10 ⁸	4.6x10 ⁸	4.8x10 ⁸	3.8x10 ⁸	4.5x10 ⁸	4.9x10 ⁸	5.1x10 ⁸
Lactic acid bacteria	8.4 x 10 ⁷	7.8 x 10 ⁷	8.2 x 10 ⁷	9.1 x 10 ⁷	8.6 x 10 ⁷	8.5 x 10 ⁷	8.7 x 10 ⁷	9.0 x 10 ⁷	1.5 x 10 ⁷	4.5 x 10 ⁷	7.5 x 10 ⁷	8.8 x 10 ⁷
Total yeasts and moulds	1.8x10 ²	3.0x10 ²	2.7x10 ²	2.2x10 ²	4.0x10 ²	2.2x10 ²	2.4x10 ²	2.0x10 ²	5.3x10 ⁴	1.7x10 ²	1.6x10 ²	1.4x10 ²
Coliform bacteria	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

A : Control yoghurt.

B₁ : Yoghurt supplemented with 5% carrot juice.

B₂ : Yoghurt supplemented with 10% carrot juice.

B₃ : Yoghurt supplemented with 15% carrot juice.

Sensory evaluation of control and carrot yoghurts

Table (4) summarizes the mean scores for sensory attributes as determined by panelists for control and carrot yoghurt samples. The result indicated that the panelists mostly preferred carrot yoghurt supplemented with 5% carrot juice. In addition, there were notable differences between control yoghurt and carrot yoghurt samples, those differences were highly significant ($P < 0.005$) in colour and significant ($P < 0.05$) in texture and flavour.

Table 4. Means scores for sensory evaluation of various yoghurt samples

Samples	Quality attributes				
	Colour	Texture	Flavour	Appearance	Overall acceptance
A	6 ^b	6 ^{ab}	5 ^{ab}	6 ^{ab}	6 ^a
B ₁	7 ^a	6 ^a	6 ^a	6 ^{ab}	6 ^a
B ₂	4 ^c	5 ^b	5 ^b	5 ^b	6 ^a
B ₃	6 ^b	6 ^a	5 ^a	6 ^a	6 ^a
SE±	0.15	0.14	0.15	0.14	0.15
Level significant	***	**	**	*	NS
Grand mean	6	6	6	6	6

- Means are based on a point scale (9 is excellent and 1 is extremely bad)
- a, b and c means in the column with different superscripts are significantly different ($P < 0.05$) or highly significantly different ($P < 0.005$).
- a, b and c means in the column with the same superscripts are not significantly different ($P < 0.05$).

A : Control yoghurt.

B₁ : Yoghurt supplemented with 5% carrot juice.

B₂ : Yoghurt supplemented with 10% carrot juice.

B₃ : Yoghurt supplemented with 15% carrot juice.

Table (5) summarizes the interaction between time and sensory attributes as determined by panelists for control yoghurt and carrot yoghurt samples. The results indicated insignificant differences ($P > 0.05$) in colour, texture, flavour, appearance and over all acceptance during storage of yoghurt samples.

Table 5. Interaction between time and quality attributes for control and carrot yoghurts

Sample	Day1				Day7				Day15			
	Colour	Texture	Flavour	Overall acceptance	Colour	Texture	Flavour	Overall acceptance	Colour	Texture	Flavour	Overall acceptance
A	6.2 ^a	6.5 ^a	6.3 ^a	6.8 ^a	5.8 ^a	5.2 ^a	5.1 ^a	6.8 ^a	5.3 ^a	6.2 ^a	5.2 ^a	5.1 ^a
B ₁	7.6 ^a	7.1 ^a	6.7 ^a	7.0 ^a	6.9 ^a	6.0 ^a	6.2 ^a	7.0 ^a	6.3 ^a	6.0 ^a	6.0 ^a	5.6 ^a
B ₂	5.1 ^a	5.7 ^a	6.3 ^a	6.1 ^a	4.2 ^a	4.8 ^a	4.8 ^a	6.1 ^a	4.4 ^a	5.2 ^a	4.3 ^a	4.8 ^a
B ₃	6.4 ^a	7.3 ^a	7.0 ^a	7.0 ^a	6.3 ^a	6.0 ^a	5.6 ^a	7.0 ^a	5.7 ^a	5.7 ^a	5.7 ^a	4.8 ^a
SE%	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

- Means are based on a point scale (9 is excellent and 1 is extremely bad)
- a, b and c means in the column with different superscripts are significantly different ($P < 0.05$) or highly significantly different ($P < 0.005$).
- a, b and c means in the column with the same superscripts are not significantly different ($P < 0.05$).

CONCLUSION

In the present study, carrot juice was used as a supplement to prepare yoghurt from cows' milk in addition to control yoghurt. Combination of carrot juice and yoghurt produced a nutritionally balanced food. The use of carrot juice in preparation of yoghurt from cows' milk resulted in production of safe yoghurt for consumption with good quality and prolonged shelf life. Generally, the prepared yoghurt samples were highly accepted by panelists, who preferred yoghurt prepared with addition of 5% carrot juice due to its colour, texture and flavour. It is highly recommended to encourage dairy industry to use carrot juice in yoghurt in production of dairy products. More research is needed to investigate the therapeutic effects of carrot yoghurt.

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تقييم جودة الزبادي المدعم بإضافة عصير الجذر

عبدالمنعم الهادي سليمان و مشيرة مصطفى عبد الرحمن و الأمين عبدالله الخليفة

قسم علوم و تكنولوجيا الأغذية، كلية الهندسة والتكنولوجيا، جامعة الجزيرة ودمدني

الملخص

في هذه الدراسة تم استخدام عصير الجذر لتحضير الزبادي باستخدام حليب الأبقار . تم تحديد تأثير التخزين علي الخصائص الكيميائية والميكروبية أثناء فترة التخزين (1 ، 7 و 15 يوم) تحت درجة حرارة 6 م ° لأنواع الزبادي المختلفة. ولقد أوضحت التحاليل الكيميائية أن المحتوى الرطوبي $88 \pm 0.4\%$ في الزبادي القياسي في اليوم الأول أقل من محتوى الزبادي المدعم بعصير الجزر و الذي تراوح بين $89 \pm 0.5\%$ و $93 \pm 0.6\%$. البروتين الموجود في الزبادي القياسي (A) و الزبادي المدعم ب 5% عصير جزر (B₁) ، و الزبادي المدعم ب 10% (B₂) و الزبادي المدعم ب 15% (B₃) هو $4 \pm 0.06\%$ ، $3.98 \pm 0.02\%$ ، $3.92 \pm 0.01\%$ و $3.86 \pm 0.02\%$ علي التوالي . تراوح محتوى الزبادي المدعم بعصير الجزر من الرماد بين 0.45 و $0.004 \pm 0.07\%$. محتوى الزبادي القياسي من المواد الصلبة الذائبة ، كان $12 \pm 0.7\%$ في اليوم الأول ، هذه القيمة أكثر من محتوى الزبادي المدعم بعصير الجزر ($11 \pm 0.3\%$ و $7 \pm 0.6\%$) . لكن تناقص محتوى المواد الصلبة الذائبة في أنواع الزبادي المختلفة أثناء فترة التخزين. الحموضة (معبّر عنها بنسبة حمض لاكتيك) زادت تدريجياً أثناء تخزين كل عينات الزبادي مع نقصان في pH. التحاليل المايكروبية أشارت إلي خلو كل العينات أثناء فترة التخزين من البكتريا القولونية بينما ظهر عدد قليل من الخميرة. من ناحية أخرى العد الكلي للبكتريا في الزبادي القياسي 3.3×10^4 خلية/مل في اليوم الأول ارتفع الى المدى $4 \times 10^4 - 3.5 \times 10^4$ c.f.u/ml خلية/مل. أيضاً ارتفعت أعداد بكتيريا حمض اللاكتيك في كل أنواع الزبادي. ولقد أثبت التقدير الحسي قبول كل أنواع الزبادي المصنوع خاصة المصنوع بإستخدام إضافة عصير الجذر بنسبة 5% خاصة لونه وقوامه ونكهته.