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Effect of Adding Carob Extract to Yogurt

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ABSTRACT

This research aims to study the effect of different concentrations of carob extract to a milk product, which is yogurt, in order to raise the nutritional value and support it with many important minerals needed by the human body. All samples were analyzed chemically, determination of minerals and evaluated for its sensory to find out the effect of adding the extract on it. The carob juice extract was added in concentrations 5%, 10%, and 20%, the results indicate an increase in the ratio of both total solids and carbohydrates and decrease in the percentage of fats with increasing the adding carob juice extract, also the total acidity and pH were decreased in some different concentration over the storage periods. In addition to that some necessary minerals were increased such as iron, zinc, copper and manganese especially iron. The product fortified with carob extract showed very good sensory results in terms of color, taste and general acceptance with the different concentration of carob juice in the different storage periods (1, 3 and 7 days).

Keywords: yoghurt, carob extract, chemical composition, minerals

INTRODUCTION

The carob tree (*Ceratonia siliqua* L.) is a long-lived evergreen tree that has been grown in the Mediterranean region, and can survive the its environmental conditions^(1,2). The carob Pulp is rich in polyphenols, dietary fibers that have been found of an important health beneficial, that helps to lose weight by inhibiting the responsible hormone of hunger, and also reduces cholesterol by reducing the levels of LDL. The pods and seed gums have been reported to have antioxidant properties, thereby protecting against degenerative diseases to possess anti-acidulate and other protective roles in the stomach also cancer prevention and improved digestion. The health benefits of carobs are mainly attributed to their rich in anti-oxidants, vitamins like A and B and several important minerals such as calcium, zinc, potassium, phosphorus, and iron, Manganese and copper and that play important role in vital function^(3,4,5,6,7,8,9). Iron is gets t in the formation hemoglobin, myoglobin, Mn is an essential nutrient for a variety of metabolic functions such as, immunological system, nervous system, and play role in antioxidant enzymes to produce free radicals also Copper and zinc is an essential element as a component of metalloenzymes. and in immune system respectively and zinc deficient may cause, diarrhea, and intercurrent infections due to cell-mediated immune disorders^(9,10). The carob has wide uses in many field industrial such as the pharmaceutical because its treat constipation and heartburn, persistent cough and for diarrhea because of the high pectin and tannin content of the carob pods^(11,12). In the food industry as substitute for cocoa because it contain fewer calories, are caffeine-free and it do not interfere with the body's assimilation of calcium, unlike cocoa and chocolate. Also It is a valuable natural food thickener, and stabilizer, which is commonly added to a variety of products, for example, ice creams, sweets, and soups^(2,13). Fermented milk

products, also known as cultured dairy foods there is an evidence that it have been produced since around 10,000 BC. It can be defined as type of milk product that have some bio chemical change by beneficial bacteria found naturally otherwise added to have the desire change, that change known by fermentation^(14,15). According to the variation of milk type and its heat treatment, the percentage of fat in milk, fermentation temperature and the type of lactic acid bacteria (*Lactobacillus*, *Lacto coccus*, *Leuconostoc*, and *Streptococcus thermophiles*) There are many of fermented dairy product like sour cream, fermented milk, *Acidophilus* milk and yoghurt^(14,16). The benefits of fermented dairy product is improving the digestibility of milk, lactose – intolerance patience can digest product like yogurt much better than plain milk, reduce the cholesterol level in blood, some of lactic acid bacteria have Antimicrobial action, the ability to inhibit cancer cells and increases the shelf life of it^(15,16)

The yoghurt country of origin is the Balkans and the Middle East, it is defined by (FDA) as a fermented dairy product get from the fermentation of milk by two species of bacterial cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophiles*^(16,17). The commercial yoghurts divided to three-category plan, fruit and flavored, it is a good source of protein, riboflavin vitamin B12, calcium, magnesium, and potassium^(18,19). Yoghurt consider one of the most commonly consumed fermented milk product in Egypt, in recent times, for health promoting, they use the natural food additives into the diet. One of these substances is carob. It is a natural with flavor like chocolate and sweetener.⁽²⁰⁾

The objective of the study:

1. Producing a natural color product without adding any dyes resembling cocoa or chocolate color.
2. Improve the nutritional value by increasing the content of mineral elements, especially iron and copper, as a

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- result of the addition of carob to fermented milk
- To achieve the maximum health benefit by adding carob concentrate to the fermented milk (yoghurt).

MATERIALS AND METHODS

- Fresh cow milk obtained from herd of Damanhour Agricultural Secondary School.
- Carob was obtained from local market, Damanhour city, Egypt.
- All the chemicals used in the analysis were purchased from Sigma Chemical Company, USA.

Carob leaves (*Ceratonia siliqua*.) fruit (*Hyphaenethebaica*) powder was mixed with sterile H₂O at 1: 10 in a bottle in which the final volume of plant extracts was 0.1 g/ml. The obtained mixture was left for 12 hours (Shori and Baba, 2011a) in water bath (70°C), followed by centrifugation (6000 rpm, 15 mins). The supernatant was collected and concentrated in a rotary evaporator.

Fresh full-fat cow milk was heated at 90 ° C for 10 minutes then sucrose and dried skim milk were added at concentration of 5% and 3%, respectively. The mixture were divided into 4 portions (T1) control, (T2), (T3) and (T4) the carob juice was added to the other 3 portion at 5%,10% and 20%, respectively. All treated samples were cooled to 45°C to add 3% of the yoghurt starter and flipping, then it placed in to yogurt Glass 80 ml. The resultant yoghurt was kept in a refrigerator (4±2°C) for one week.

All of the examined samples were analyzed for total solids, protein, fat, total carbohydrate, pH and acidity. Total solids was determined by dry oven at 105°C for 6 hr and titratable acidity were estimated in all yoghurt samples by the method described by AOAC(1990)⁽²¹⁾, also protein and fat contents were determined in all samples as described by Ling (1963)⁽²²⁾. Minerals (Cu, Fe, Zn and Mn) were determined in all samples as described by atomic absorption using a model () (AOAC 1990)⁽²¹⁾.

Sensory evaluation of the examined treatments were carried out at room temperature under normal lighting conditions in transparent glass cups coded with random,

three-digit numbers⁽²³⁾ after 1, 3 and 7. Each yoghurt treatments were evaluated using a hedonic scale from 9 to 1 (9 = like extremely, 5 = neither like nor dislike, 1 = dislike extremely), all samples analyzed for color, flavor and over all acceptability. Water was also provided to the assessors to cleanse their mouths before and after tasting each sample. The average value scores of all sensory evaluations were used in the analysis.

Statistical analysis were done for the obtained data according to the methods of Clarke and Kempson (1997)⁽²⁴⁾.

RESULTS AND DISCUSSION

Chemical Composition of Yoghurt

The chemical composition of yoghurt samples with different ratio of carob extract in Table (1) show significant differences (p<0.05) between T2,T3 ,T4 and control.

In general, the total solid content increased in all treatment with added different concentrations of the carob juice extraction, TS content ranged from 19.8% to 21.21 % in the examined treatments T1 to T4. This indicates that with increasing of the addition of carob juice to yoghurt this increasing the total solids.

The protein contents decrease slightly in samples which range from 3.65% to 3.52%, indicating that the content of protein decreases with the addition of carob juice to the yoghurt.

Fat and lactose contents decrease significantly, which varied in its fat content from 4 % in control sample (T1), to 3% in treatment 4 (T4), and from 4.2% in control samples(T1) to 3.46% in treatment 4 (T4) for lactose, the fat and lactose content decrease with the addition of carob juice.

Total carbohydrate (T) and solid not fat (SNF) increase in an all treat meant. the total carbohydrate (T) ranges between 11.8% in control sample (T1) to 13.7% in treatment 4 (T4) and from 15.5% in control sample (T1) to 18.5% in treatment 4(T4) for solid not fat (SNF) which indicates that increasing the concentration of carob juice in all treatment leads to raise the total carbohydrate(T) and SNF. All These results are consistent with scientists; Ayaz, *et.al.* (2007)⁽²⁵⁾.

Table 1. Chemical composition of yogurt samples with different varied addition of carob extract:

Treatment	TS	P	FAT	LAC	T	SNF
T1	19.7±0.173 ^b	3.64±0.020 ^a	4.1±0.1 ^a	4.26±0.11 ^a	11.82±0.49 ^c	15.48±0.26d
T2	20.16±0.115 ^b	3.61±0.15 ^a	3.7±0.17 ^b	3.97±0.02 ^b	12.33±0.20 ^b	16.14±0.04c
T3	20.83±0.04 ^a	3.59±5.703 ^{ab}	3.53±0.05 ^c	3.90±0.01 ^b	12.48±0.07 ^b	17.86±0.05b
T4	21.21±0.10 ^a	3.53±0.01 ^b	3.11±0.11 ^d	3.43±0.032 ^c	13.75±0.05 ^a	18.53±0.05a

TS: total solid p: protein Lac: lactose T: total carbohydrate SNF: solid not fat

T1: control T2: sample with 5% of carob extraction T3: sample with 10% of carob extraction T4: sample with 20% of carob extraction

Effect of storage on Total acidity and pH of yoghurt with carob extract:

Total acidity varied between treatments as shown in Table 2, either when fresh or after 3 or 7 days of storage. T.A. ranged between 1.4% and 0.81% in treated yohurt T1 and T4. This indicates that it decreases by increasing the concentration of carob in T2 and T3, but it increases again in the top concentration T4. After 3 days total acidity ranged between 1 to 0.95% in treatments T1 to T4. After 7 days total acidity decreased by increasing the addition of carob juice in yoghurt, and is no longer increased again, where it ranged between 1.4: 1.1%, that indicate the effect of adding carob juice that enhanced the shelf life of

yoghurt. These results are consistent with Jucey (2004) and Ayaz, *et.al.* (2007)⁽²⁵⁾.

Results illustrated in Table 2 show the changes in pH of yoghurts samples during storage, which were of significant differences (p<0.05), Control fresh samples were of the highest pH value and began to decrease and then increased it ranging between (4.9%: 4.81%). After 3 days pH value ranged between 4.64%: 4.63% in treatments T1 control sample and treatment T4. After 7 days the rate is not fixed as it ranged between 4.53%: 4.48%. These results are consistent with scientists; Jucey, (2004) & Ayaz, *et.al* (2007)⁽²⁵⁾ and F. A Ahmet(2009).⁽²⁶⁾

Table 2. Determination of total acidity (%) and pH value of yoghurt samples with carob extract during storage at 4±2 °C:

Treatments	TA			PH		
	Fresh	3 days	7 day	Fresh	3 days	7 days
T1	B1.3±0.11	C1.2±0.17a	A1.43± 0.05a	A4.89±0. 03a	B4.60±0.08a	B4.54±0.05a
T2	C0.78±0.01b	B1.04±0.01b	A1.26± 0.11b	A4.78±0. 01b	B4.44±0.04b	C4.32±0.02 c
T3	C0.65±0.04c	B1.14±0.04a	A1.24±0.05b	A4.87±0.06a	B4.59±0.01a	B4.53±0.05a
T4	C0.84±0.03b	B0.98±0.02b	A1.16± 0.11c	A4.81±0.02b	B4.60± 0.02a	C4.46±0.03b

TA: total acidity

Determination of minerals Content:

As shown in Table 3 the, addition of carob extract with different ratio, enhance the yoghurt with minerals Cu, Fe, Zn and Mn , Copper value ranged between 1ppm: 1.5ppm, in treatments T1: T4. Iron content ranged between 7.5ppm to21.5ppm. in treatments T1 to T4, which increased at a high rate and this indicates the presence of a large proportion of iron in the carob affected the presence of yogurt . Also Zinc and manganese value increased by increasing the addition of carob concentration it ranged between (10.0ppm: 15.0 ppm) and (0.75 ppm: 1.0ppm) respectively, in treatment (T1:T4)

Sensory evaluation:

Table 4 shows the changes of sensory evaluation of yoghurt with different concentration carob in different storage period 1 days, 3 days and 7 days at room temperature. Significant difference (p<0.05) were found for all treatments during storage period, in general the results indicate that all of the yoghurt sample with different concentration of carob extraction recorded high

Table 4. Results of sensory evaluation yoghurt with carob juice:

Treatment	Storage period											
	1 day				3 days				7 days			
	Color	Taste	Flavor	overall accept ability	Color	taste	Flavor	overall accept ability	color	Taste	flavor	overall accept ability
T1	9.25± 1.0 ^b	9.8± 0.08 ^a	9.16± 0.09 ^b	9.3± 0.1 ^b	8.9± 0.13 ^c	8.9± 0.13 ^{ab}	8.6± 0.12 ^c	8.8± 0.13 ^b	8.9± 0.13 ^b	8.08± 0.13 ^c	7.9± 0.11 ^b	8.6± 0.10 ^a
T2	9.25± 0.10 ^b	9.08± 0.11 ^c	9.4± 0.085 ^a	9.6± 0.08 ^a	9.33± 0.10 ^a	9.08± 0.11 ^a	9.16± 0.09 ^a	8.8± 0.11 ^b	8.9± 0.08 ^b	8.5± 1 ^b	8.5± 0.11 ^a	8.6± 0.10 ^a
T3	9.4± 0.08 ^a	9.4± 0.08 ^b	9.3± 0.08 ^a	9.5± 0.08 ^a	9.08± 0.13 ^b	8.9± 0.11 ^{ab}	8.6± 0.14 ^c	9.08± 0.13 ^a	8.25± 0.12 ^c	8.8± 0.09 ^a	8.08± 0.11 ^b	8.5± 0.08 ^a
T4	9.5± 0.08 ^a	9.1± 0.11 ^c	9.1± 0.11 ^b	9.25± 0.10 ^b	9.16± 0.11 ^b	8.8± 0.09 ^b	8.9± 0.085 ^b	9.08± 0.13 ^a	9.25± 0.10 ^a	8.75± 0.14 ^a	8.1± 0.09 ^b	8.3± 0.10 ^b

CONCLUSION

Yoghurt could be successfully made with different carob juice concentrations, from the result obtain yoghurt has been fortified with some essential metals such as iron and manganese as well as the phenolic substances found in the carob. It is possible to obtain a product naturally colored fermented, with a distinctive taste and taste through the addition of natural material is the carob, cheap, and have a desirable impact and nutritional value and vitality high.

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acceptability in all treatments in all storage period

Table 3. Determination of minerals (Cu, Fe, Zn and Mn ppm) in yoghurt samples with carob:

Treatment	Minerals			
	Cu	Fe	Zn	Mn
T1	1.00	7.50	10.0	0.75
T2	1.20	12.5	12.5	0.79
T3	1.35	17.5	13.2	0.89
T4	1.50	21.9	15.0	1.0

Cu: copper Fe: Iron Zn: Zinc Mn: Manganese

In the case of the fresh yoghurt samples, control sample (T1) was desirable in terms of taste, while other treatments (T2,T3,and T4) were desirable in terms of color and general acceptance. After storage for 3 days, the yoghurt samples (T2,T3and T4) with carob juice extract was higher than the control in terms of color and taste and flavor and overall acceptance also the samples after storage for 7 days the yoghurt with carob juice extraction was desirable in all terms than the control samples. These results are consistent with scientists F. A Ahmet (2009).⁽²⁶⁾

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تأثير إضافة مستخلص الخروب على الزبادي

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كلية الزراعة – قسم الصناعات الغذائية والالبان – جامعة المنهور

يهدف هذا البحث الى دراسة تأثير تركيزات مختلفة من مستخلص الخروب الى منتج لبنى وهو الزبادي بغرض رفع القيمة الغذائية له وتدعيمه بالعديد من المعادن الهامة التي يحتاجها جسم الانسان. تم اجراء تحليل كيميائي وتقدير للمعادن وتقييم حسي لجميع العينات لمعرفة تأثير اضافته مستخلص الخروب اضيف مستخلص من عصير الخروب بتركيزات 5% و10% و20% وتشير النتائج الى زيادة نسبة كلا من المواد الصلبة الكلية و الكربوهيدرات وانخفاض نسبة الدهون بزياده اضافته نسبة مستخلص عصير الخروب وأيضا تغير كلا من الحموضة والاس الهيدروجيني حيث انخفضت الحموضة والاس الهيدروجيني في بعض التركيزات على مدار فترات الحفظ المختلفة وكذلك أ وجد ان ارتفاع في محتوى بعض المعادن الضرورية كالحديد والزنك والنحاس والمنجنيز. وقد أظهر المنتج المدعم بمستخلص الخروب نتائج حسيه جيدة جدا من حيث اللون والطعم والقبول العام للمنتج على فترات حفظ مختلفة للمنتج يوم وثلاثة أيام وسبعة أيام .