

USE OF FENUGREEK EXTRACT IN RAYEB MILK PRODUCTION

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Abstract

The effect of Rayeb milk supplementation with fenugreek extract (2.5, 5.0, 7.5 and 15%) on the chemical, microbiological and sensory characteristics was studied. Results revealed that use of fenugreek extract in Rayeb milk production increased total solids, ash, fat, diacetyl and carbohydrate contents with increasing fenugreek extract levels. The viscosity of control Rayeb milk markedly increased compared with the treatments during cold storage. Microbiological results showed that the control Rayeb milk had the highest total bacterial count. The yeasts and moulds were not detected through the storage period for all fenugreek extract Rayeb milks. The sporformes were not detected in 7.5 and 15% treatments all over the storage time. The fenugreek extract Rayeb milk treatments gained the highest score either when fresh or throughout storage periods compared with the control. Scores of sensory evaluation decreased by progressing storage period. The texture of Rayeb milk with 15% fenugreek extract became softer and smoother at the end of the storage period. It could be concluded that, the (7.5%) treatment was the best one.

Keywords: Fenugreek, Rayeb milk, chemical, microbiological and sensory characteristics

INTRODUCTION

Rayeb milk is a traditional fermented milk product popular in rural areas of Egypt. Traditional Rayeb milk is made from raw buffalo's milk by spontaneous fermentation (Abd El Gawad *et. al.*, 2010). The interest of consumers was increased to traditional fermented dairy products due to their nutritional and healthy values. Therefore, industrial production of these products was needed.

Plants play a significant role in maintaining human health and improving quality of life for thousands of years. In particular, herbs have been used as food and for medicinal purpose for centuries.

Fenugreek is an annual herb that belongs to the family Leguminosae widely grown in Pakistan, India, Egypt and Middle Eastern Countries (Alarcon – Aguilara *et. al.*, 1998).

Due to its strong flavor and aroma, fenugreek in one of such plants whose leaves and seeds are widely consumed in the African continent as well as in other oriental countries as a spice in food preparations, and as an ingredient in traditional

medicine. Both leaves and seeds should be included in normal diet of family, especially diet of growing kids, pregnant ladies, puberty reaching girls and elder members of the family because they have haematinic (i.e. stimulate blood formation) value (Sharma *et. al.*, 1996). Also, it is widely used as a galactagogue (milk producing agent) by nursing mothers to increase inadequate breast milk supply. Fenugreek is used as a traditional remedy for the treatment of diabetes and hypercholesterolemia in Indian and Chinese medicines (Fleiss, 1988 and Schryver, 2002). It is reported to have restorative and nutritive properties, to simulate digestive processes and being useful in healing of different ulcers in digestive tract (Billand and Adrian 2001). Fenugreek has also been reported to exhibit pharmacological properties such as antitumor, antiviral, antimicrobial, anti – inflammatory, hypotensive and antioxidant activities (Sauvaire *et. al.*, 1991).

Fenugreek is a good source of dietary protein (20-30%) for consumption by human and animals, and the fatty acids content is from 5-10% that are predominantly linoleic, linolenic, oleic and palmitic acids. It has 45-65% total fiber (Fleiss, 1988). It is also a rich source of calcium, iron, α -carotene and other vitamins (Basch *et. al.*, 2003).

In addition, the fenugreek contains lysine and L- tryptophan rich proteins, mucilaginous fiber and other rare chemical constituents such as saponins, coumarin, fenugreekine, nicotinic acid, phytic acid, scopoletin and trigonelline, which are thought to account for many of its presumed therapeutic effects. It may inhibit cholesterol absorption and thought to help lower sugar levels (Miroldi *et. al.*, 2001).

The aim of this study is to improve nutritional and healthy values of Rayeb milk by adding fenugreek extract and to evaluate the effect of fenugreek extract addition on the chemical, microbiological, organoleptical properties.

MATERIALS AND METHODS

Materials:-

Fresh buffalo's milk was obtained from Dairy Factory of Food Technology Research Institute, Agricultural Research Center, Giza , Egypt

Direct Vat Set (DVS) of *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus salivarius* ssp. *thermophilus* in the ratio (1:1) was obtained from Chr. Hansen's Lab. Copenhagen, Denmark.

Fenugreek (*Trigonella foenum- graecum* L.) was obtained from Field Crops Research Institute, Agricultural Research Center, Giza, Egypt

Methods:-**Germination of Fenugreek:**

Fenugreek seed was soaked until appearance of the rootlet (1mm). Water was added to the germinated seeds at a ratio 3:1 and blended using a homogenizer then it was drained in muslin cloth to remove fibers. The filtrate was considered as the fenugreek extract.

Preparation of Rayeb milk:

Rayeb milk was made according to the method described by Tamime and Robinson (1985). Standardized milk (3% fat), was heat treated at 90 °C for 5 min., cooled to 41 °C and then inoculated with 3% of the mixed culture. After coagulation, Rayeb milk was divided into five parts. The first part was served as a control. The other parts were supplemented with fenugreek extract at level of 2.5, 5, 7.5 and 15% .The control and treatments were mixed in a mixer, filled into sterilized cups, stored in refrigerator (5 °C ±1) and analyzed at 0 , 1 and 2 weeks of storage. Three replicates were carried out for each treatment.

Chemical analysis:-

Total solids, total protein, fat and ash contents were determined according to the methods described by AOAC (2000). Total carbohydrates were calculated by difference to achieve 100g. Titratable acidity was determined according to (AOAC, 2000). pH was measured using a pH meter HANNA 213 (Italy). Acetaldehyde and diacetyl were measured using a Shimadzu (240-UV-Vis) spectrophotometer (Japan) as described by Lee and Jago (1970). The viscosity of Rayeb milk was measured using a rotary viscometer (Rheolest II50 Hz,) German.

Microbiological analysis:-

Total bacterial count was enumerated as described by Messer *et. al.* (1985) on standard plate count agar. Coliform, sporforms and yeasts and moulds were detected as described by (APHA, 1993). Starter bacterial count was determined according to Elikier *et. al.*, (1956). The results were expressed as log colony forming unit (log CFU/ml).

Sensory evaluation:-

Rayeb milk samples were sensory evaluated by a regular taste panel of 20 staff members of Dairy Department in Food Tech. Res. Institute. Rayeb samples were evaluated for sensory attributes according to El-Senaity(1999) using a Scheme of 15 points for appearance, 10 points for acidity, 30 points for body and texture and 45 points for flavor.

Statistical analysis:-

The mean values and standard deviations were determined for each treatment. Differences between samples were determined by T-test and were considered to be significant when $P \leq 0.05$ (Snedecor and Cochran (1989)).

RESULTS AND DISCUSSION

1. Chemical composition of raw materials used in Rayeb milk.

Data presented in Fig. (1) show the chemical composition of buffalo's milk and fenugreek extract. Fenugreek extract had higher carbohydrates (8.31%) content than the buffalo's milk (5.21%), however, it contained lower values of total solids, fat and ash. Protein of fenugreek extract was similar to buffalo's milk (4.19%).

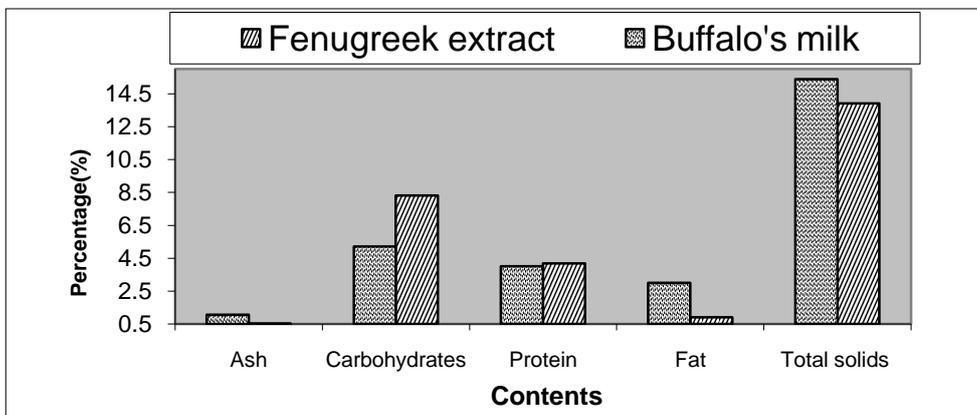


Fig. 1. Chemical composition of buffalo's milk and fenugreek extract.

2. Chemical changes of Rayeb milk during storage.

Data presented in Fig. (2) show the effect of fenugreek extract addition on the chemical composition of Rayeb milk during the refrigerated storage. The data indicated that fenugreek extract had a slight effect on the total solids and protein as they ranged from 14.61 to 15.19% and 4.36 to 4.84%, respectively. The total solids slightly increased for each treatment as a result of cold storage. Fat and ash increased with increasing storage period for each treatment. As expected, total carbohydrates increased by increasing fenugreek extract level and decreased by progressing storage period, this decrease may be due to the fermentation by the starter or loss of some decomposed volatile compounds. The obtained results were in a harmony with those reported by Essawy *et. al.* (2005).

The pH and titratable acidity as affected by adding fenugreek extract are shown in Fig. (3). There were marked differences in pH values and acidity of different treatments. All treatments at zero time of storage had almost the same pH and acidity

values. During storage, Rayeb milk made without additives (control) showed higher acidity and lower pH than those made with adding fenugreek extract which being negatively related to fenugreek concentrations (Zedan *et al.*, 2006). The acidity increased by progressing the storage period due to the action of microorganisms in metabolizing milk components, particularly lactose and citrate into organic acids. Similar results were reported by Youssef *et al.* (1998) and El-Senaity (1999).

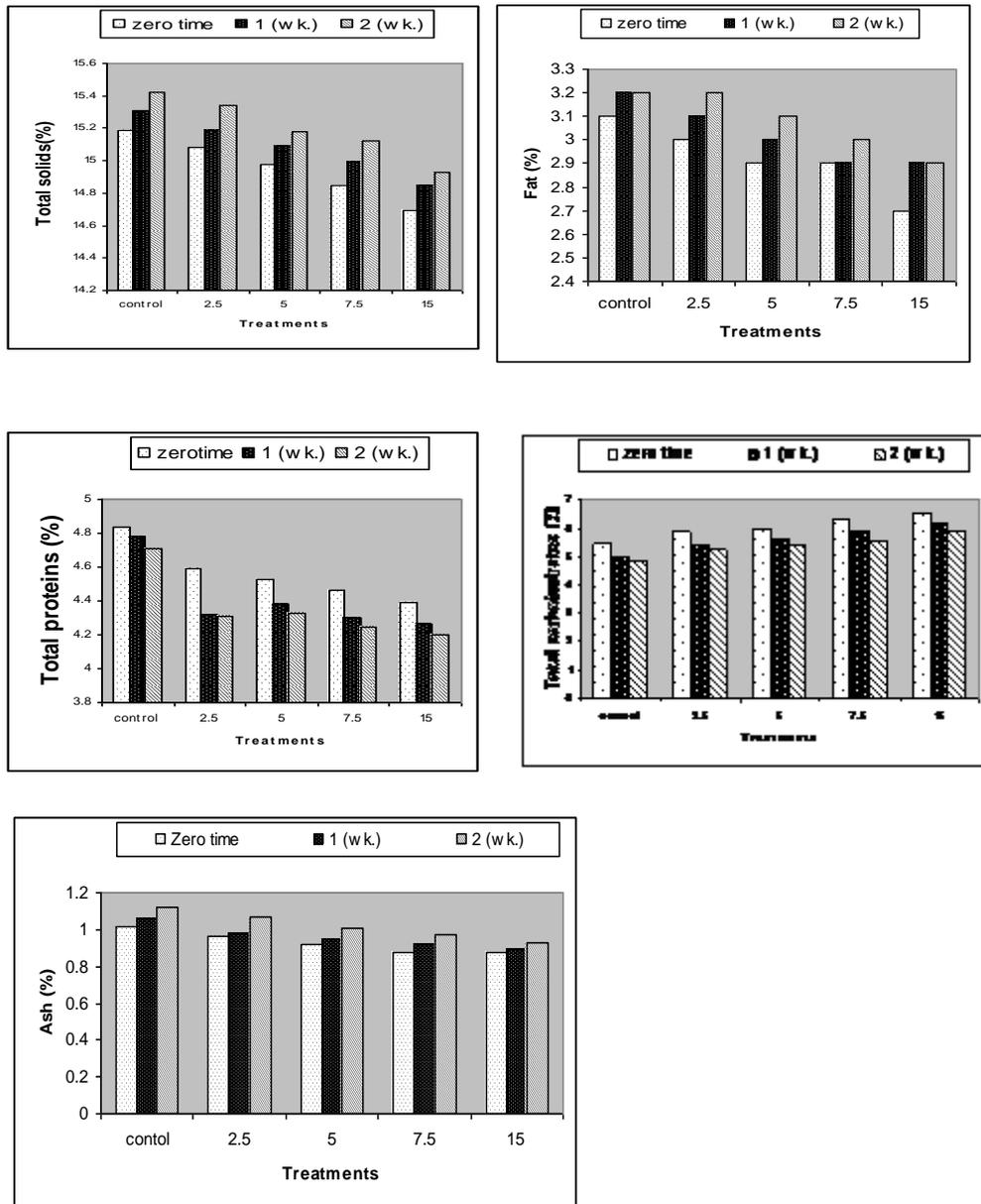


Fig.2. Chemical changes of Rayeb milk during cold storage period as affected by addi

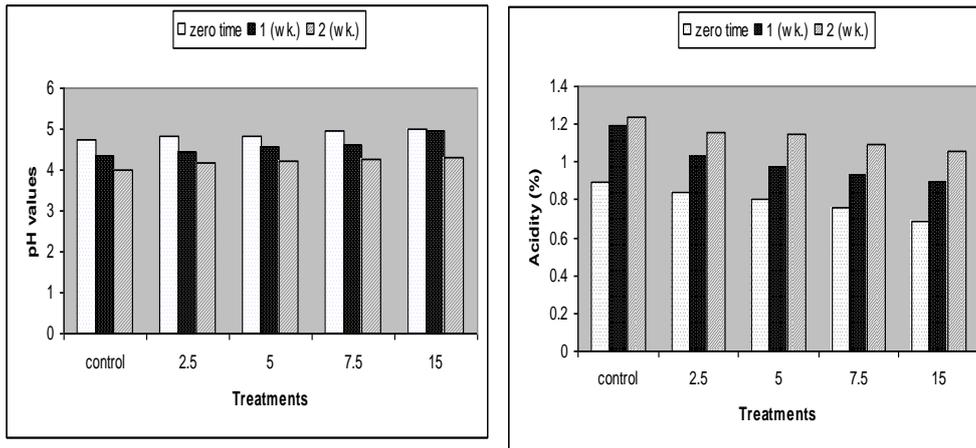


Fig. 3. Effect of addition of different levels of fenugreek extract on pH values and titratable acidity of Rayeb milk during cold storage period.

In regard to the acetaldehyde and diacetyl, Fig. (4) indicates that acetaldehyde and diacetyl contents were higher in control than all treatments during cold storage period, acetaldehyde content of Rayeb milk samples decreased, while diacetyl content increased through the first week of cold storage and then decreased. This might be due to the slow reduction of diacetyl to acetoin (Driessen and Puhan 1988). Acetaldehyde content gradually decreased during storage period, presumably this might be due to the demonstrated ability of numerous lactic organisms to reduce the acetaldehyde to ethanol or oxidize it to acetic acid Essawy *et. al.* (2005).

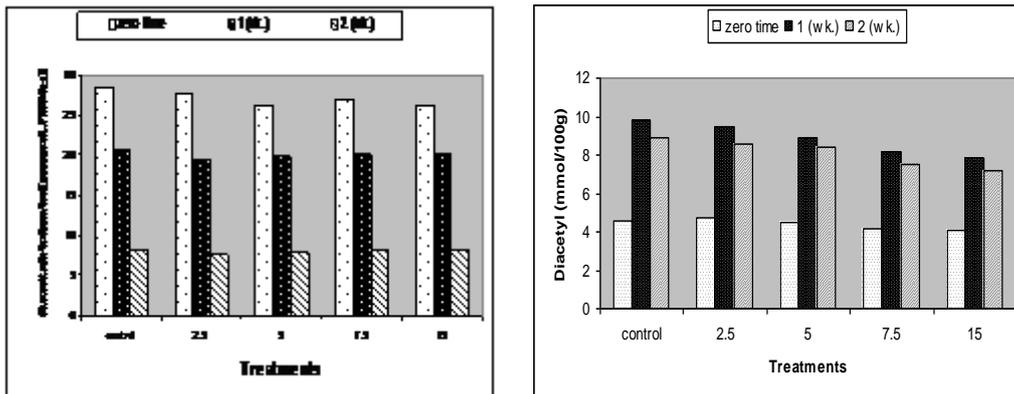


Fig.4. Effect of addition of different levels of fenugreek extract on acetaldehyde and diacetyl (mmol/100g) of Rayeb milk during cold storage period.

Addition of different levels of fenugreek extract decreased the apparent viscosity of Rayeb milk as compared with that made without additives (control) Fig. (5). Furthermore, the apparent viscosity of Rayeb milk samples increased during cold storage period. This may be attributed to the coagulated particles of the gel that became stronger or greater in numbers, particles became more hydrated (Abd El- Aziz *et. al.*, 2004).

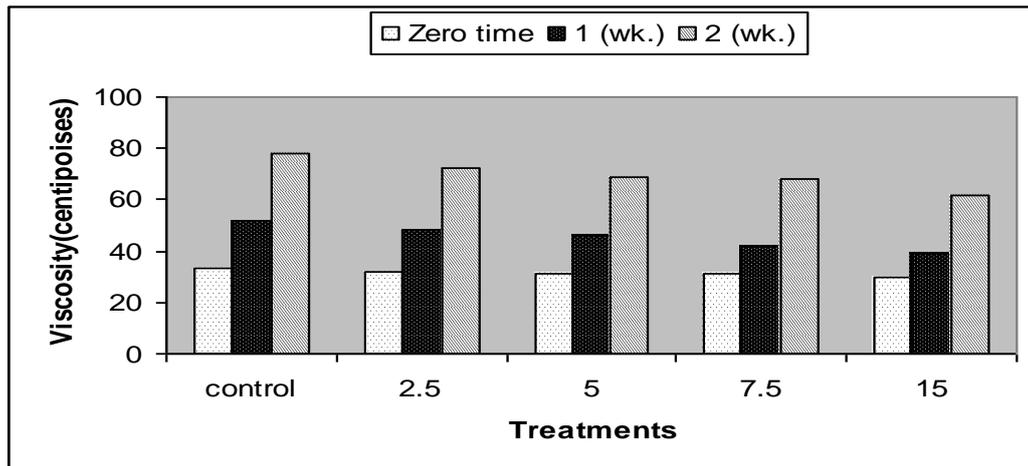


Fig. 5. Effect of addition of different levels of fenugreek extract on viscosity of Rayeb milk during cold storage period.

3. Microbiological analysis:-

Total bacterial count:

Fig. (6) illustrates total bacterial count as affected by adding the fenugreek extract to Rayeb. It could be seen that the total bacterial count of control treatment increased clearly as compared with other treatments by progressing the storage period. Also, it could be observed that the total bacterial count decreased with increasing the fenugreek extract level during the storage period. Rayeb with 15% fenugreek extract had the lowest total bacterial count at the end of the storage period.

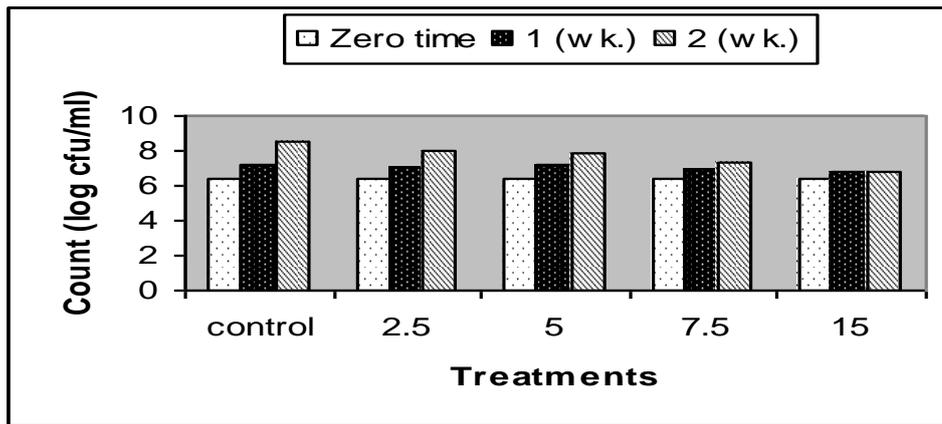


Fig. 6. Effect of using fenugreek extract in Rayeb production on total bacterial count.

It could be seen from Fig (7) that the sporformes were detected at zero time in the control and treatments and declined gradually in the control and (2.5%) treatment during the storage period. Also, it could be observed that, the sporformes were not detected in the (5%) treatment during the second week of storage period and in the (7.5 and 15%) treatments throughout the storage period.

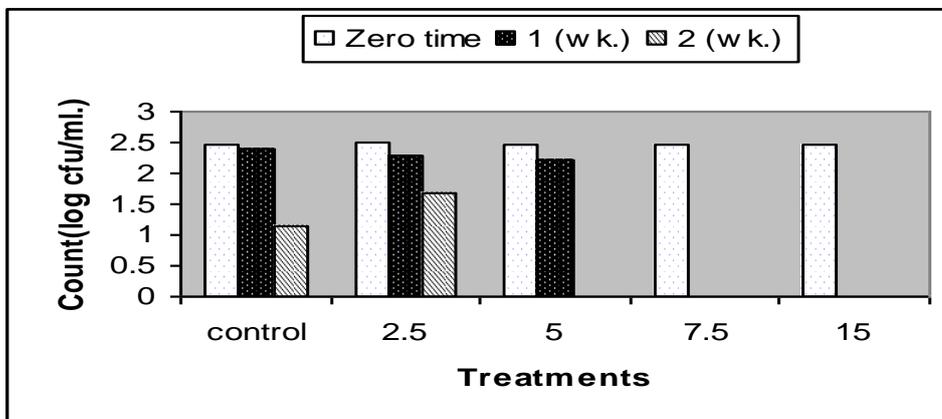


Fig.7. Effect of using fenugreek extract in Rayeb production on sporformes.

Changes in the starter population of control and treatments as affected by adding fenugreek extract for Rayeb milk are shown in Fig. (8). It could be seen that the starter population of control increased considerably as compared with other treatments with increasing storage period. The (15%) treatment with the highest fenugreek extract showed the lowest starter count at the end of the storage period. The yeasts and moulds were not detected in control and treatments at zero time but were detected throughout the first week (2.98 (log CFU/ml)) and increased during the second week (3.30 (log CFU/ml)) of storage period for control. The yeasts and moulds were not detected throughout the storage period for all fenugreek extract Rayeb milk. The coliforms were not detected in control and all treatments throughout the storage period.

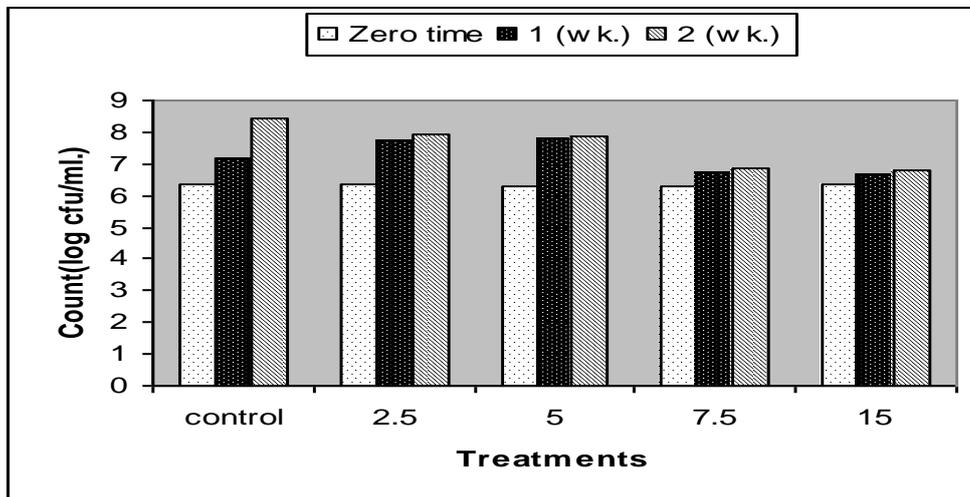


Fig.8. Starter as affected by adding fenugreek extract for Rayeb milk.

Microbiological quality criteria of Rayeb milk samples containing fenugreek extract were affected by increasing level of fenugreek extract throughout the storage period. Results indicated that the level of increase in starter and total bacterial counts decreased with increasing of fenugreek extract level during storage period compared with the control. Also, the coliform bacteria group and yeast and mould were not detected in all Rayeb milk containing fenugreek extract, but sporformes were not detected in 5(second week), 7.5 and 15% treatments. These results provide evidence for the presence of antimicrobial compounds in fenugreek extract. These compounds can degrade the cell wall, disrupt the cytoplasmic membrane – integrated enzymes, which may eventually lead to cell death (Shan *et. al.*, 2007).

4. Sensory evaluation:-

Scores of sensory evaluation of Rayeb milk were presented in Fig. (9). The fenugreek extract Rayeb milk treatments gained the highest score either when fresh or throughout the storage periods compared with the control. Scores of sensory evaluation decreased by progressing the storage period. The texture of Rayeb milk with 15% fenugreek extract became softer and smoother at the end of the storage period.

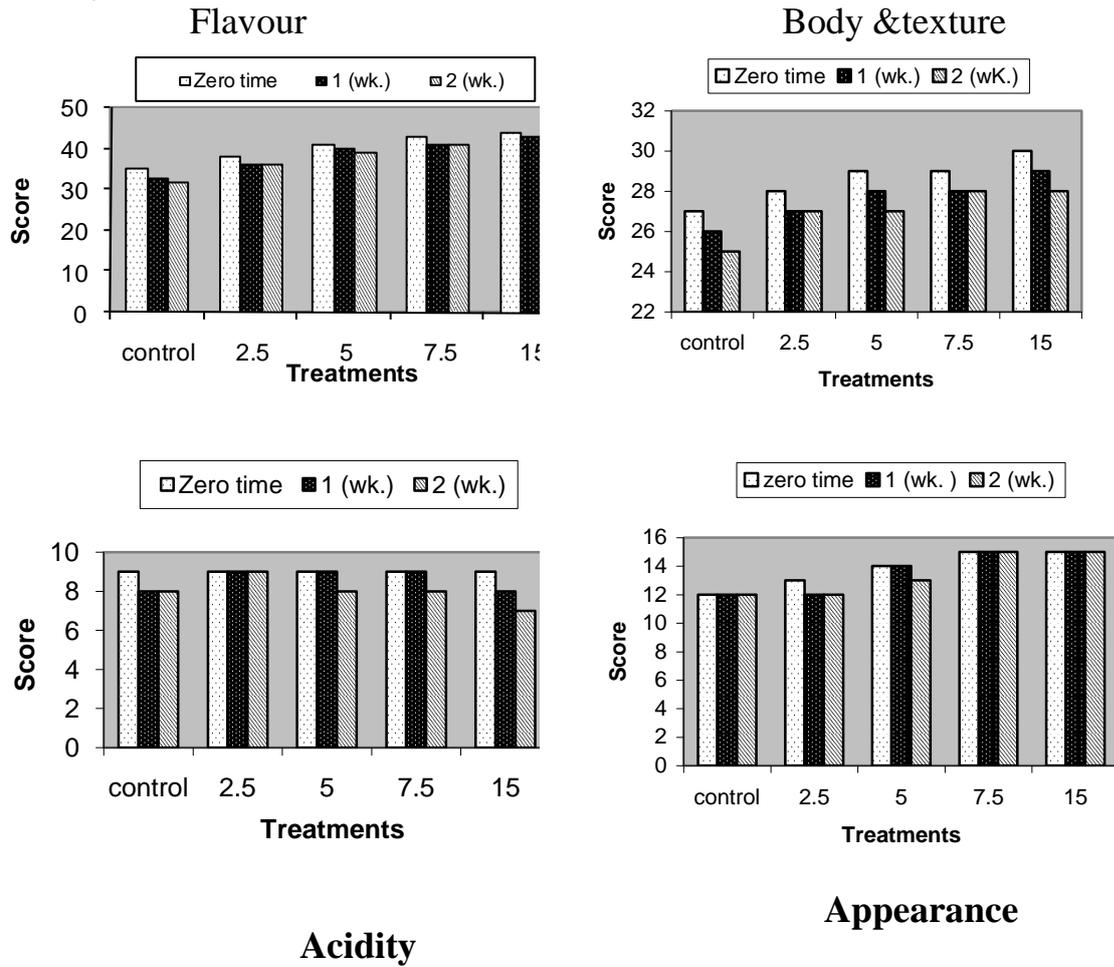


Fig. 9. Effect of addition of different levels of fenugreek extract on organoleptic properties of Rayeb milk during cold storage period.

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استخدام مستخلص الحلبة فى انتاج اللبن الرايب

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قسم بحوث الألبان- معهد بحوث تكنولوجيا الأغذية-مركز البحوث الزراعية

تم دراسة تأثير تدعيم اللبن الرايب بمستخلص الحلبة (بتركيزات 2.5, 5.0, 7.5 and 15%) على الخواص الكيماوية, الميكروبيولوجية والحسية. وقد أشارت النتائج الى أن استخدام مستخلص الحلبة فى انتاج اللبن الرايب أدى الى زيادة كل من الجوامد الكلية , الدهن, الرماد,الداى اسيتيل و الكربوهيدرات بزيادة النسبة المضافة من مستخلص الحلبة . وجدأن لزوجة المعاملة الكنترول (لبن رايب بدون مستخلص حلبة) زادت بدرجة أكبر من الزيادة الملحوظة فى اللبن الرايب المدعم بمستخلص الحلبة. وقد أوضحت النتائج الميكروبيولوجية أن المعاملة الكنترول أظهرت أعلى عدد كلى للبكتريا . لم تظهر الخمائر والفطريات طوال فترة التخزين فى معاملات الرايب المدعمة بمستخلص الحلبة كما لم تظهر البكتريا المتجرثمة فى معاملات اللبن الرايب المدعمة ب 7.5 او 15% مستخلص حلبة. وبالنسبة لنتائج التقييم الحسى وجد أن معاملات اللبن الرايب المدعمة بمستخلص الحلبة أخذت درجات أعلى من الكنترول ولكن هذه الدرجات تقل بتقدم فترة التخزين ولكن تظل اعلى من الكنترول. معاملة اللبن الرايب المدعمة ب 15% مستخلص حلبة كان تركيبها أكثر طرؤة ونعومة فى نهاية فترة التخزين. ومن النتائج يمكن أن نستنتج أن معاملة اللبن الرايب المدعم ب 7.5% مستخلص حلبة كانت افضل معاملة