Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, Egypt
27(4), 2155-2165, 2019
Website: http://ajs.journals.ekb.eg

PRODUCTION OF VEGETABLE YOGHURT LIKE FROM LUPINE MILK

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Shymaa[1*] A. Mohamed, Awad[2] R.A., El Batawy[2] O.I. and Wafaa M.Salama[1]

1- Dairy Research Dept., Food Technology Research Institute, Agric. Research Center, Giza, Egypt

2- Food Sci. Dept., Fac. of Agric., Ain Shams Univ., P.O. Box 68, Hadayek Shubra 11241, Cairo, Egypt

*Corresponding author: shymaa_mshmsh2000@yahoo.com

Received 5 August, 2019 Accepted 13 October, 2019

ABSTRACT

The objective of the present study was to produce vegetable milk from lupine seeds as an alternative to natural milk in the yogurt like production. Lupine yoghurt like was made from in-permeate lupine extract fortified with different levels of milk protein concentrate (MPC) powder in comparison with cow-milk yoghurt. Where lupine milk was extracted from soaked legume lupine *(Lupinus angustifolius)* seeds using milk permeate (1Kg beans / 5 Kg permeate) and divided into 4 equal portions and fortified with MPC powder at level of nil, 1, 2 or 3%. All treatments were converted into yoghurt using 3% bacterial starter culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii ssp. bulgaricus* (1:1).

The results showed that, the addition of MPC to lupine extract led to increase in the total solids content of resultant yoghourts like. Also, cow yoghourt had significantly higher fat content than lupine yoghurt like. Adding MPC to the lupine yoghurt milk resulted in lower fat content. Cow yoghurt had lowest protein content while lupine yoghurt with 3% MPC showed the highest protein content. Crude fiber content of lupine yoghurt without MPC was found to be highest than other yoghurt treatments. Values of viscosity were increased more with ascending ratios of MPC in Lupine milk. Hardness and springiness values of all lupine yoghurt treatments were increased during cold storage and the increase in these two texture parameters were positively correlated to the MPC level. *Str. theromphillus* or *Lb. delbrueckii ssp. bulgaricus* count in yoghurt made from cow milk showed higher counts than that of lupine-milk yoghurt like. All samples were free from any contamination either with yeast or fungi organism whether when fresh or after 7 days of cold storage while they appeared after 14 days.

All yoghurt were sensory acceptable especially that fortified with 3% MPC powder, which helped to beany flavor disappearing.

Keywords: Crude fiber, Rheological properties, Texture profile, Microbiological situation, Sensory quality.

INTRODUCTION

Yoghurt is one of the oldest dairy products and it has a high nutritive value. In recent years, there is an increase in the consumption of fermented dairy products. This is primarily explained by the diversity of products available and their healthy images. Yoghurt and other fermented dairy products made by fermentation of milk using a mixed culture of thermophilic lactic acid bacteria (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*) **(Holzapfel et al 1998)**.

The human foods take a large place of legumes. The animal proteins are more expensive especially in developing countries. They depend largely on plant to fulfill their protein requirements. Furthermore, it is also a good source of minerals. In addition to being a good source of nutrition, there is a considerable interest in the related between plant based diets and prevention of certain diseases, in which decreased levels of radicals. Legumes seem to be responsible for improving human health and can prevent chronic diseases. Legumes which free from cholesterol had low sodium content. it is a good food stuff for people living in developing countries and for those living in industrialized nations **(Sebastiá et al 2001)**.

In the past, lupin has been used as a source of protein. Recently, interest in a wider utilization of this legume seed is rising. This may be is mainly due to its similarity with soybeans as a high source of protein. Moreover; it economically is feasible. It is commonly consumed as a snack in the Middle East and is coming into use as a high protein soy substitute in the other parts of the world **(Kurzbaum et al 2008)**.

Lupin is one of the rich plants by alkaloid, amino acids, carbohydrates and proteins with moderate gelatin properties compared to soy proteins (**Wäsche et al 2001)**. It is a good source of nutrients, proteins, lipids, dietary fiber, minerals and vitamins (**Martínez-Villaluenga et al 2007, Torres et al 2005)**.

Lupine contains plant chemicals with antioxidant capacity, such as polyphenols, mainly tannins and flavonoids **(Oomah et al 2006)**. Increasing interest in the production of lupine, due to its potential as a source of protein, or for pharmaceutical purposes due to high alkaline content, as a natural component **(Gaultier et al 2003; Smart et al 2003** and **James et al 2004)**.

Lupin milk plays a key role in meeting this demand as an alternative to cow or human milk in areas where cow's milk is expensive or to feed infants who are allergic to animal milk. The production of non-dairy food products has been cited as a new trend in functional food production. Sweet lupin is used in the preparation of yoghurt like.

Milk permeate (MP) can be used as value added fortifying ingredients in other food including nutritional beverages. Although still viewed as a waste products of process, milk permeate may hold the key to future product innovation. There are no studies on the use of milk lupin extract in milk permeate as a source of lactose in the production of yoghurt like.

Therefore, the objective of the present study was to produce vegetable milk from lupin seeds as an alternative to natural milk and it's used in production yogurt like.

MATERIALS AND METHODS

1. Materials

Fresh cow's milk was obtained from the herd of the dairy cattle at faculty of agriculture, Cairo University, Giza, Egypt. Legume lupine *(Lupinus angustifolius)* was purchased from local market. Milk protein concentrate (MPC) powder, consisted 3.96% moisture, 1.82% fat, 80.51% protein, 5.87% lactose, 7.71% ash, was produced by Australian Dairy University. UF milk permeate (5.65% total solids, 0.10% fat, 0.03% non protein nitrogen, 5.02% lactose, and 0.48% ash) was obtained from Domty CO., 6 th October City, Egypt. Pure culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii ssp. bulgaricus* (1:1) was obtained from Hansen laboratory, Denmark.

2. Experimental procedure

Preparation of sweet lupine milk

Sweet lupine milk was prepared according to the method described by **Ikya et al (2013)**. Cereals of good quality were carefully selected and soaked overnight (18-24 h), at the room temperature in ultrapure water contained 0.5% $NaHCO_3$. Once soaked, water was discarded and the grains were re-soaked in boiling water for 15 min then, hulls were removed under running water by manual rubbing. The peeled Cereals were next rinned beans (1:5 beans: permeate ratios), about half was added at room temperature (23°C) and blended with the beans at high speed for 10 min. The remaining permeate was heated to 80°C and added to the slurry to enhance protein extraction. This mixture was blended for an additional 3 min. at high speed. The resultant slurry was filtered through 3 layers of cheese-cloth to remove coarse material (okara, which is mainly composed of insoluble fiber material). Thereafter, the isolated based milk was boiled on a low heat for 5 min. to destroy trypsin inhibitor and improving flavor then cooled down to 40°C.

Preparation of lupine yoghurt like

Lupine or cow milk was heat treated at 90°C for 10 min. and cold to 43°C prior to the fermentation step. Cow milk was used as control while lupine milk was divided into 4 equal portions. The first portion was served as another control without any addition, while milk protein concentrate (MPC) was added with ratios 1, 2, and 3% for the rest 3 portions respectively. These ratios were chosen after doing several trails by adding different ratios of MPC to lupine milk. The added milk protein (chosen ratios) was mixed properly in the lupine yoghurt milk before starter. Active yoghurt starter culture containing *Str. thermophiles* and *Lb. delbrueckii ssp. bulgaricus* (1:1) was added to the warm milk (43°C) at ratio of 3% and mixed properly. The inoculated milk was filled into plastic containers (100 ml capacity) then incubation at 43°C until pH 4.6 then cooling at 4°C overnight. Three replicates were carried out for each treatment.

3. Analytical methods

Chemical analyses

Contents of total solids (TS) fat, protein, ash, crude fiber and titratable acidity (TA) as well as pH value were determined according to the methods **A.O.A.C (2012)**. The obtained total nitrogen content was multiplied with the suitable factor, namely 6.38 for dairy products and 6.25 for legume lupine. Carbohydrates content was calculated by difference according to **(Pellet and Sossy, 1970)** as follows:

% Carbohydrates = % Total solids - (%fat + %protein + %ash +% fiber)

Microbiological analyses

Lb. delbrueckii ssp. *bulgaricus* count was enumerated using MRS agar according to **De Man et al (1960)** at 37ºC for 48 h. The plates were incubated at 37ºC for 48 h for. *Str. thermophilus* count was determined using M17 agar medium **(Terzaghi and Sandine, 1975)**. Yeasts and Moulds count was enumerated as described by **IDF, (1990),** The plates were incubated at 25ºC for 5-7 days. Colifrom bacteria were tested as suggested by the **APHA (1992).**

Rheological analyses

The apparent viscosity was measured according to **Petersen et al (2000)** using Brookfield Engineering Labs DV III ultrarheometer, Inc. Stoughton, MA, USA. Texture Profile Analyses (TPA) of yoghurt samples were determined BY **IDF (1991)** using the Texture Analyzer (QcTech A software for B/C indicator (Texture for any food) Taiwan No.110810.

Sensory evaluation

The sensory score of different yoghurt like samples made from different cereals were assessed by regular taste panel of the staff-member at Food Science Department, Faculty of Agriculture, Ain Shams University and Dairy Research Department, Food Technology Research Institute, Agricultural Research Center, Giza, Egypt. Yoghurt like samples were evaluated for appearance, body & texture, flavor and total score according to the scheme of **Tamime & Robinson (1999).** The score sheet was 10 points for appearance, 40 points for body & texture and 50 points for flavor.

Statistical analyses

Statistical analysis was performed according to **SAS Institute (1990)** using General Linear Model (GLM) with main effect of treatments. Duncan's multiple range was used to separate among of three replicates at $P \leq 0.05$.

RESULT AND DISCUSSION

Chemical compositions of lupine and cow milks

Data given in **Table (1)** showed that lupine milk had high total solids (TS), protein and carbohydrate contents as compared with those of cow milk.

Chemical composition of fresh lupine yoghurt like

Table (2) showed chemical composition of fresh lupine yoghurt like. Although TS content of plain lupine yoghurt was higher than those of cow milk, addition of MPC powder to in-permeate lupine extract led to increase the TS content of resultant yoghourts like. The results indicate also that cow yoghourt had significantly higher fat content than lupine yoghurts. Moreover, the addition of MPC powder to the in-permeate lupine extract resulted in further reduction in the fat content of its yoghurt. Cow yoghurt had lowest protein content while lupine yoghurt with 3% MPC powder showed the highest one among all treatments. Resultant yoghurts of lupine milk fortified with MPC powder showed higher carbohydrate as well as ash contents than those of unfortified lupine yoghurt like, which contained the crude fiber content **(Table, 2)**.

Table 1. Chemical compositions of in-permeate lupine (5:1) extract and cow milk

Type of yoghurt source	Total solids %	Fat %	Protein %	Ash %	*Carbohydrate %	Crude fiber %
Cow milk	12.18	3.10	3.40	0.72	4.96	-
Lupine extract	14.96	0.95	4.93	0.44	7.54	1.10

*: By difference

Table 2. Chemical composition of fresh lupine yoghurt like fortified with milk protein concentrate (MPC) powder at different levels

Component %	Supply of yoghurt making				
	Cow milk (control)	In-permeate lupine extract fortified with MPC powder at the level of			
		Nil %	1%	2%	3%
Total solids	14.21^{E}	15.81^{D}	16.61^{C}	17.41^{B}	18.16^{A}
Fat	3.50^{A}	0.88^{B}	0.85^{B}	0.81^{C}	0.80^{C}
Protein	4.20^{D}	4.70^{C}	5.25^{B}	5.75^{AB}	6.35^{A}
Ash	0.91^{A}	0.45^{C}	0.47^{C}	0.49^{BC}	0.52^{B}
Crude Fiber	$N.D^{B}$	1.10^{A}	1.00^{A}	1.00^{A}	0.90^{A}
***Carbohydrate**	5.60^{D}	8.68^{D}	9.04^{C}	9.36^{B}	9.59^{A}

*: By difference
A,B,C : Means with the same letter among treatments are not significantly different

Acidity and pH values

The data in **Fig.(1)** indicated that the plain lupine yoghurt has the lowest titratable acidity (TA) content, while the highest TA content was noticed with cow yoghurt (control). **Karleskind et al (1991)** stated that some of the common problems in legume-based yogurts are a low acidity and a beany flavor. Likewise, **Martınez et al (2003)** noticed that yoghurt starter grew and produced more acid in cow milk than lupine milk.

Addition of MPC powder to lupine yoghurt milk increased the TA content. The TA content of yoghurt increased as the fortification level with MPC powder heightened or the cold storage period prolonged. Similar observation was recorded by **Awad (2003).** The trend of pH values were opposite to those of TA in cases.

Apparent Viscosity

It is clear from the data in **Fig. (2)** that, fresh cow yoghurt had the highest viscosity value. On the other hand, the fresh plain lupine yoghurt possessed the lowest one. Addition of MPC powder to lupine milk improved significantly the yoghurt like viscosity. Values of yoghurt viscosity were increased more as the fortification level with MPC powder raised. This could be due to the role of MPC powder to increase TS content and rather the protein content and hence increased the viscosity values. Viscosity values were increased with extending the storage period in all treatments including controls.

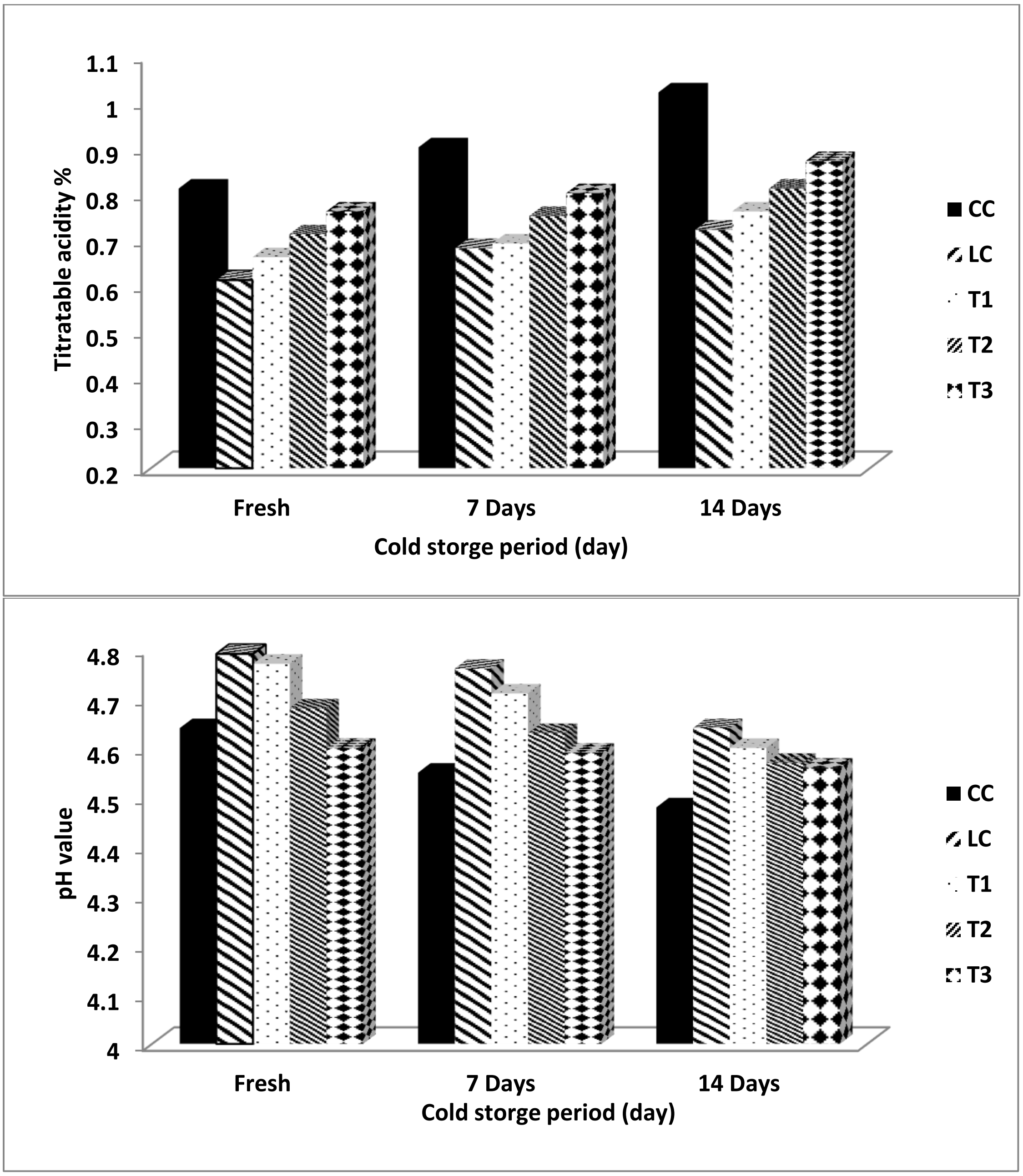

Fig. 1. Titratable acidity (%) and pH value of cow or lupine yoghurt like fortified with different levels of milk protein concentrate powder during storage at 5±2°C for 14 days

CC: control yoghurt made of cow milk.

LC: control yoghurt made from in-permeate lupine extract (5:1).

T1،T2 or T3: yoghurt like made from in-permeate lupine extract fortified with 1،2 or 3 % milk protein concentrate powder respectively.

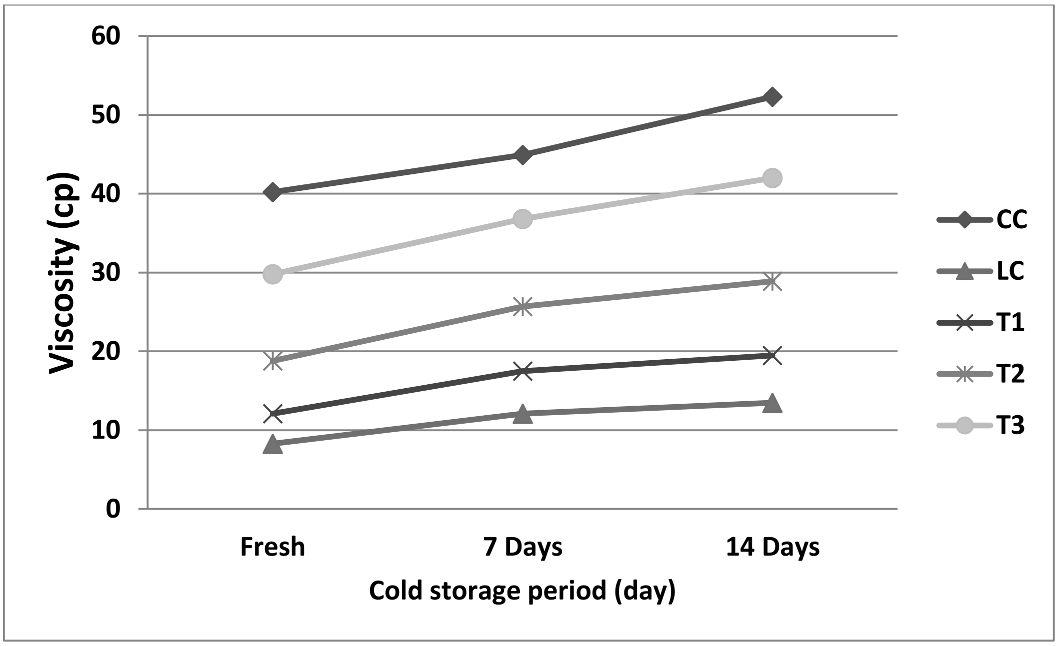

Fig. 2. Viscosity (cp) of cow or lupine yoghurt like fortified with different levels of milk protein concentrate powder during storage at 5±2°C for 14 days

CC: control yoghurt made of cow milk.

LC: control yoghurt made from in-permeate lupine extract (5:1).

T1،T2 or T3: yoghurt like made from in-permeate lupine extract fortified with 1،2 or 3 % milk protein concentrate powder respectively

Rheological properties

As shown from the results in **Table (3)**, hardness of cow yoghurt was the highest compared with all lupine yoghurt treatments. Addition of MPC powder to in-permeate lupine extract led to increase of hardness. This increase may be due to the increment in the TS and rather in the protein content of yoghurt occurred as the MPC powder was added. Between lupine yoghurt treatments, lupine yoghurt with 3% MPC powder (T_3) possessed the highest of adhesiveness followed by yoghurt with 2% MPC (T_2) and lupine yoghurt with 1% (T_1). Cow yoghurt control had the lowest value of cohesiveness while lupine yoghurt with 3 % MPC (T_3) had the highest one. Cow yoghurt had the lowest value of cohesiveness while lupine yoghurt with 3 % MPC (T_3) was distinguished with the highest one. Also, Hardness and springiness values of all lupine yoghurt treatments were increased during cold storage and the increase in these texture characteristics were in paralleled to the amount of MPC powder added. On the other hand adhesiveness, cohesiveness and gumminess values of lupine treatments were decreased by advancing the cold storage period.

Microbiological quality

As shown from the result in **Table (4)**, strains counts of t bacterial starter culture namely, *Str .theromphillus* and *lb. delbrueckii ssp. bulgaricus* of cow milk yoghurt (control) showed higher counts than those of all lupine-milk yoghurts. These observations are similar to those reported by **Shirai et al (1992)** and **Martınez et al (2003)** who found that the counts of yoghurt bacterial starter culture were higher in the cow yoghurt than in the lupine one. Adding MPC powder to lupine extract promoted the bacterial growth as the fortification level heightened. It could be observed that, there were significant differences in bacterial counts among lupine yoghurt samples during 14 days of cold storage.

Table 3. Texture profile of cow yoghurt and lupine yoghurt like fortified with milk protein concentrate (MPC) powder at different levels during storage at 5±2°C for 14 days

Property	Cold storage period (day)	Supply of yoghurt making				
		Cow milk (control)	In-permeate lupine extract fortified with MPC powder at the level of			
			Nil %	1%	2%	3%
Hardness (N)	Fresh	1.40	0.30	0.50	0.70	1.00
	7	1.60	0.40	0.60	0.80	1.10
	14	1.90	0.40	0.70	0.90	1.40
Adhesiveness (mj)	Fresh	0.403	N/A	0.612	0.979	1.243
	7	0.404	N/A	N/A	0.929	1.120
	14	0.405	N/A	N/A	N/A	1.028
Cohesiveness	Fresh	0.93	1.86	1.16	1.25	2.25
	7	0.93	0.99	1.55	1.03	1.98
	14	1.00	0.38	0.38	1.50	1.78
Springiness (mm)	Fresh	9.98	9.96	9.97	9.98	9.98
	7	9.99	9.99	9.99	9.99	9.99
	14	1.50	0.10	0.10	0.20	0.60
Gumminess (N)	Fresh	1.20	0.30	0.40	0.70	0.90
	7	1.50	0.10	0.20	0.30	0.90
	14	1.50	0.10	0.10	0.20	0.60

Table 4. Microbiological situation of cow yoghurt and lupine yoghurt like fortified with milk protein concentrate (MPC) powder at different levels during storage at 5±2°C for 14 days

Microbial strain (log cfu /g)	Cold storage period (day)	Supply of yoghurt making				
		Cow milk (control)	In-permeate lupine extract fortified with MPC powder at the level of			
			Nil %	1%	2%	3%
Streptococcus thermophillus	Fresh	7.56^{Aa}	7.20^{Ba}	7.31^{Ba}	7.40^{ABa}	7.50^{Aa}
	7	7.22^{Ab}	6.52^{Bb}	$6,62^{Bb}$	6.74^{Bb}	6.91^{Ab}
	14	6.59^{Ac}	6.11^{Bc}	6.25^{Bc}	6.36^{Bc}	6.48^{Ac}
Lactobacillus delbrueckii ssp. bulgaricus	Fresh	8.22^{Aa}	7.61^{Ba}	7.71^{Ba}	7.88^{Ba}	8.01^{Aa}
	7	7.72^{Ab}	7.20^{Bb}	7.41^{Bb}	7.53^{ABb}	7.61^{Ab}
	14	6.47^{Ac}	6.05^{Bc}	6.10^{Bc}	6.21^{Bc}	6.38^{Ac}
Yeasts and moulds	Fresh	ND	ND	ND	ND	ND
	7	ND	ND	ND	ND	ND
	14	1.2^{C}	1.5^{B}	1.6^{B}	1.6^{B}	1.9^{A}

A, B, C : Means with the same letter among treatments are not significantly different.

a, b, c : Means with same letter for same treatment during storage periods are not significantly different.

Also, all samples were free of contamination by yeast and fungi organism at zero time and even after 7 days, while it appeared after 14 days. During cold storage there were slight differences in molds and yeasts counts between lupine yoghurt treatments *versus* cow yoghurt.

Coliform bacteria was not detected in all treatments without any exception whether when fresher or during the refrigerated storage. This due to the efficient heat treatment of the different yoghurt milks and lupine yoghurt like (90ºC for 10 min) and high sanitation conditions during manufacture and storage of yoghurt. In addition, it had been also referred to the effect of developed acidity in yoghurt samples, which plays an important role in reduction of growth rate for coliform bacteria. These results are in harmony with those of **Farahat and El-Batawy (2013).**

Sensory quality

It is also obvious from the data in **Table (5)** that the use of MPC powder especially at the level of 3% led significantly to improve the quality of resultant lupine yoghurt like including the disappearing of the beany flavor, from which the other lupine yoghurt was suffered due to the reduced fortification level than 3% MPC powder.

Table 5. Organoleptic score of cow yoghurt and lupine yoghurt like fortified with milk protein concentrate (MPC) powder at different levels during storage at 5±2°C for 14 days

Sensory score	Cold storage period (day)	Supply of yoghurt making				
		Cow milk (control)	In-permeate lupine extract fortified with MPC powder at the level of			
			Nil %	1%	2%	3%
Appearance (10)	Fresh	9.7	7.6	8.4	9	9.4
	7	9.5	7.4	7.8	8	9
	14	8.9	7	7.2	7.9	8.4
Body & texture (40)	Fresh	37.9	30.4	32	35.2	36.8
	7	38	27.2	28.8	33.6	36.5
	14	36	26.4	27.2	32	34.4
Flavor (50)	Fresh	48	36	40	45	46
	7	46	35	36	38	44
	14	45	34	34	36	42
Total (100)	Fresh	95.6^{Aa}	74^{Ee}	80^{Dd}	89.2^{Cb}	92.2^{Bab}
	7	93.5^{Aab}	69.6^{Dg}	72.6^{Df}	79.6^{Cd}	89.5^{Bb}
	14	89.9^{Ab}	67.4^{Dh}	68.4^{Dg}	75.9^{Ce}	84.8^{Bc}

A, B, C : Means with the same letter among treatments are not significantly different.

a, b, c : Means with same letter for same treatment during storage periods are not significantly different.

CONCLUSION

Therefore it can be conclude that, incorporation MPC up to 3% into lupine extracted with permeate improved the physic-chemical and sensory properties of lupine yoghurt like. Also, it enhanced nutritionally the resultant product.

REFERENCES

AOAC, 2012. Official methods of Analysis of Association of Official Analytical Chemists 19th ed., Published by AOAC Int., Gaithersburg, Maryland, USA.

APHA, 1992. Standard methods for the examination of dairy products. American Publ. Health Assoc. Inc. 16th ed., Washington DC, USA.

Awad R.A. 2003. Impact of potato puree as a cheese base replacement in the manufacture of processed cheese. **Egypt. J. Dairy Sci. 2, 375- 387.**

Cristian Jime´ nez-Mart´ınez, Humberto Herna´ ndez-Sa´ nchez, and Gloria Da´ vila-Ortiz 2003. Production of a yogurt-like product from Lupinus campestris seeds. **J. Sci. Food Agric., 83, 515-522**. (online: 2003) DOI: 10.1002/jsfa.1385.

De Man J.D., Rogosa M. and Sharpe V. 1960. A medium for the cultivation of lactobacilli. **J. Appl. Bacteriol. 23, 130-135.**

Farahat A.M. and El-Batawy O.I. 2013. Proteolytic Activity and Some Properties of Stirred Fruit Yoghurt Made Using Some Fruits Containing Proteolytic Enzymes. **World J. of Dairy & Food Sci., 8(1), 38-44.**

Gaultier F., Foucault-Bertaud A., Lamy E., Ejeil A.L., Dridi S.M. and Piccardi N. 2003. Effects of a vegetable extract from Lupinus albus (LU105) on the production of matrix metalloproteinase (MMP1, MMP2, MMP9) and tissue inhibitor of metalloproteinases (TIMP1, TIMP2) by human gingival fi broblasts in culture. **Clin. Oral Invest. 7(4), 198-205.**

Holzapfel W.H., Haberer P., Snel J., Schillinger U., Huis in't Veld, J.H.J. 1998. Overview of gut flora and probiotics. **Intl. J. Food Microbiol. 41, 85-101.**

Ikya J.K., Gernah D.I., Ojobo H.E. and Oni O.K. 2013. Effect of cooking temperature on some Quality characteristies of soy milk. **Advance J. of Food Sci. and Technology 5(5), 543-546.**

International Dairy Federation 1990. Milk and milk products: Enumeration of Yeasts and Moulds (Colony count technique at 25ºC). IDF: 94B.

International Dairy Federation 1991. Butter, fermented milks and fresh cheese. Enumeration of contaminating microorganisms. Colony count technique at 30°C. **International Dairy Federation Standard, 153 p.**

James L.F., Panter K.E., Gaffi eld W., Molyneux R.J. 2004. Biomedical applications of poisonous plant research. **J. Agric. Food Chem. 52, 3211-3230.**

Karleskind I., Laye E., Halpin E. and Morr C.V. 1991. Improving acid production in soy-based yogurt by adding cheese whey proteins and mineral salts. **J. Food Sci., 56, 999–1001.**

Kurzbaum A., Safori G., Monir M. and Simsolo C. 2008. Anticholinergic Syndrome in Response to Lupine Seed Toxicity. **Israeli J. of Emergency Medicine, 8, 20-22.**

Martínez-Villaluenga C., Urbano G., Porres J.M. and Frias J., Vidal-Valver 2007. Improvement in food intake and nutritive utilization of protein from *Lupinus albus* var. multolupa protein isolates supplemented with ascorbic acid. **Food Che 103(3), 944-51.**
DOI: http://dx.doi.org/10.1016/j.foodchem.2006.09.048.

Oomah B.D., Tiger N., Olson M. and Balasubramanian P. 2006. Phenolics and antioxidative activities in narrow-leafe lupine (Lupinus angustifolius L.). **Plant Foods Hum. Nutr. 61, 91-97.**

Pellet P.I. and Sossy S. 1970. Food Composition Tables for Use in the Middle East. American University of Beirut. Beirut-Lebanon.

Petersen B.L., Dave R.I., McMahon D.J., Oberg C.J. and Broadbent J.R. 2000. Influence of capsular and ropy exopolysaccharide-producing *Streptococcus thermophilus* on mozzarella cheese and cheese whey. **J. Dairy Sci., 83(9), 1952-1956.**

SAS 1990. SAS User's Guide/STAT ver. 6.04. SAS Inst. Cary, NG.

Sebastiá V., Barberá R., Farré R. and Lagarda M.J. 2001. Effects of Legume Processing on Calcium, Iron and Zinc Contents and Dialy sabilities. **J. of the Sci. of Food and Agric., 81, 1180-1185.**

Shirai K., Gutierrez-Dur´an M., Marshal V.M.E., Revah-Moiseev S. and Garc´ıa-Garibay M, 1992. Production of yogurt-like product from plant foodstuffs and whey. Substrate preparation and fermentation. **J. Sci. Food Agric. 59, 199-204.**

Smart V., Foster P.S., Rothenberg M.E., Higgins T.J. and Hogan S.P. 2003. A plant-based allergy vaccine ssuppresses experimental asthma via an IFN-gamma and CD4 + CD45R Blow T cell-dependent mechanism. **J. Immunol. 171(4), 2116-2120.**

Stoon A.E. 2002. The top 10 functional food trends. The next generation. **Food Technol. 56, 32-37.**

Tamime A.Y. and Robinson R.K. 1999. Yoghurt: Science and Technology, 2nd ed., CRC Press LLC, Washington, DC, USA.

Terzaghi B.E. and Sandine W.E. 1975. Improve medium for lactic streptococci and their bacteriophages. **Appl. Microbiol., 29, 807.**

Torres A., Frias J., Vidal-Valverde C. 2005. Changes in chemical composition of lupin seeds (Lupinus angustifolius) after a-galactoside extraction. **J. Sci. Food Agri. 85, 2468-2474.**

Vogdo C.D., Leandro E.D., Zandonadi R.P., Alencar E.R., Ginani V.C. and Nakano E.Y. 2018. Enrichment of probiotic fermented milk with green banana pulp: Characterization microbiological, physicochemical and sensory. **Nutrients, 10, 427.**

Wäsche A., Müller K. and Knauf U. 2001. New processing of lupin protein isolates and functional properties. **Food/Nahrung, 45(6), 393-395.**

مجلة اتحاد الجامعات العربية للعلوم الزراعية، جامعة عين شمس، القاهرة، مصر
مجلد(27)، عدد(4)، 2155-2165، 2019
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إنتاج مشابه يوجهورت نباتي من لبن الترمس

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شيماء عبد المنعم محمد[1*] – رزق عزب عواد[2] – أسامة إبراهيم البطاوي[2] – وفاء محمود سلامة[1]

1- قسم بحوث الألبان- معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - الجيزة - مصر
2- قسم علوم الأغذية - كلية الزراعة - جامعة عين شمس - ص.ب 68 - حدائق شبرا 11241- القاهرة - مصر

*Corresponding author: shymaa_mshmsh2000@yahoo.com

Received 5 August, 2019 Accepted 13 October, 2019

الموجـــــــز

الهدف من البحث هو إنتاج لبن نباتى من حبوب الترمس كبديل للبن الطبيعى فى إنتاج مشابه الزبادي. تم صناعة مشابه الزبادي من مستخلص الترمس في راشح اللبن والذي تم صناعته بمستويات مختلفة من مركز بروتين اللبن المجفف بالمقارنة مع الزبادي المصنوع من اللبن البقري. حيث تم إستخلاص لبن الترمس من خلط حبوب الترمس المنقوعه والمقشورة مع الراشح بنسبة (1كجم حبوب : 5 كجم راشح) وتم تقسيمه إلى 4 اقسام مع تدعيمه بنسب صفر, 1، 2، 3% من مركز بروتين اللبن المجفف ، وكل المعاملات تم تحويلها إلى زبادي بإستخدام 3% من من بكتريا بادئ *Streptococcus thermophiles* و *Lactobacillus delbrueckii ssp. Bulgaricu*.

وقد أظهرت النتائج أظهرت ان إضافة مركز بروتين اللبن المجفف إلى مستخلص الترمس أدى إلى زيادة محتوى المواد الصلبة الكلية لمنتج مشابه الزبادى، وايضا كان هناك زيادة معنوية فى محتوى الدهن لزبادى اللبن البقرى عنه في مشابه زبادي الترمس، وقد أدت إضافة مركز بروتين اللبن المجفف إلى مشابه زبادى الترمس إلى إنخفاض محتواه من الدهن، وكان الزبادى المصنوع من اللبن البقرى الاقل فى محتواه من البروتين، بينما مشابه زبادى الترمس والمدعم بـ 3% مركز بروتين اللبن المجفف الأعلى فى نسبة محتواه من البروتين، وكان هناك محتوى من الألياف فى زبادى الترمس وغير المعامل بمركز بروتين اللبن المجفف أعلى من الموجودة فى كل المعاملات، وكانت قيم اللزوجه فى تزايد بزيادة إضافة مركز بروتين اللبن المجفف إلى مستخلص لبن الترمس، وكانت قيم الصلابة وقوى الإلتصاق بين الجزيئات وبعضها تتزايد فى كل معاملات زبادى الترمس بزيادة طول فترة التخزين وكانت الزيادة فى هاتين المعاملتان مرتبطة ايضا بزيادة نسب مركز بروتين اللبن المجفف المضاف، وكانت أعداد بكتريا البادئ فى الزبادى المصنوع من اللبن البقرى أعلى من الموجودة فى مشابه الزبادى من لبن الترمس، وكانت كل العينات خالية تماما من التلوث بأى فطريات أو خمائر وهى طازجة حتى الاسبوع الاول من التخزين بالثلاجة ثم بدأت فى الظهور بعد اليوم الرابع عشر. وكانت كل المعاملات مقبولة حسيا وخاصة تلك التى كانت مدعمة بـ 3% بروتينات اللبن المجفف .

الكلمات الدالة: الألياف, الخواص الريولوجية, خواص القوام والتركيب, الحالة الميكروبيولوجية, الخواص الحسية

تحكيم: ا.د عاطف السيد فايد
ا.د على ابراهيم على منصور