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The Importance of Using Moringa Oleifera Extract on the Quality and Nutritive Value of Yoghurt

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ABSTRACT

Yoghurt like products containing probiotic bacteria (*B.bifidum* B612; *L. acidophilus* La -5 and *L.caseiol*) either as a single or mixed culture were flavored with Moringa oleifera.The acceptability, antioxidant activity, some other properties of prepared products and the survival of probiotic strains were examined.Yoghurt like products flavored with Moringa oleifera at concentration of 2,4,6,8 and 10% (w/w) compared with control were examined. Results revealed that protein, ash, and antioxidant capacity were increased with the increase of the aqueous extract of Moringa oleifera dry leaves. The 2 and 4% (w/w) levels of the extract did not affect any of the sensory, texture and chemical parameters compared to control but it increased the antioxidant capacity by up to 40%. It could be concluded that Moringa oleifera could be used at 2 and 4% (w/w) in the preparation of made yoghurt-like, which resulted in an increase in the health benefits and the acceptability sensory attributes

INTRODUCTION

Consumer is now more interested in healthy foods beyond basic nutrition and the food industry is trying to fulfill these requirements by developing products with specific health benefits. Dairy products are good sources of protein, minerals, vitamins and bioactive components. Yoghurt provides an excellent source of such nutrients and others that are necessary for good health. It provides an added advantage for all individuals who may have lactose deficiency. The lactic acid bacteria in yogurt produce lactose, the enzyme which breaks down lactase. However plain yoghurt has no fibers because milk does not contain fibers. Moringa oleifera (drumstick) would be suitable candidate to be incorporated in the production of functional yoghurt. All parts (leaves, flowers and fruits) of Moringa oleifera tree have significant range of phytonutrient components including protein, minerals, and antioxidants (*Singh et al,*2012).In addition, Moringa oleifera contains a range of fairly unique phytochemicals for example the simple sugarrhamnose, the glucosinolates, isothicoyanates (*Hsu et al,*2006;*Ashfagqu et al,* 2012), vitamins C, E, A caffeoylguinic acids, carotenoids (lutein, alpha- carotene and beta carotene), kaempferol, quercetin, rut in (*Ho,*1994;*Siddhuraju and Becker,*2003; *Aslam et al,*2005;*Abdull Razis et al,*2014), calcium, protein and arginine and histidine (*Ferrao and Ferrao*, 2005). Therefore, Moringa oleifera might be an important food additive to combat protein and energy malnutrition problem in many countries worldwide (*Makkar and Becker*, 1996;*Anwar et al,*2007*; EL Sohaimy et al,*2015). Considering the previous aspects, the objective of this investigation was to enhance the nutritional value of yoghurt through the addition of different consideration of aqueous extract of the leaves of Moringa oleifera.

MATERIALS AND METHODS

Fresh buffalo's milk (8.75 SNF-6.6%F) used in the present study was collected from the herds of Mehalet Moussa Experimental Station. Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. Milk was standardized to3% fat by partial cream separation. Moringa oleifera (Drumstick) leaves were obtained from an orchid of medicinal herbs (Al-Nubaryia, Albeheira Governorate, Egypt). Lacto sob stabilizer specified for liquid fermented milks was obtained from Masr Food Additives (MIFAD) Giza, Egypt. Yoghurt culture; pure lyophilized Direct Vat Set (DVS) culture of *L. acidophilus J. A.B. bifidum* Bb-12 and *L. casei* 01 were obtained from Chr. Hansen L. ab., Copenhagen, Denmark. Anacrogen saches for anaerobic condonations and all microbiological media were obtained from Oxid Divison of Oxiod LTD, London.

Leaf extract of Moringa oleifera was prepared as described by *Sreelatha andPadme*(2009) with some modification. About 10 kg of fresh leaves were washed carefully under running water, followed by distilled water, chopped to small piecas (0.5 cm. radius), oven-dried at 55- 60C^{o} for 48 h., and stored in air- tight plastic containers at 24C^{o} in dark place. The dried leaves were ground to a fine powder and passed through a sieve No.20. Approximately 2oog of dry powder were boiled in 600ml distilled water for 15 min. The extract was cooled to room temperature and the total volume was adjusted to 1000ml then centrifuged at 4000rpm for 15 min. The sup rant was collected and stored at 20C^{o} All analyses were carried out in triplicates. The aqueous extract of Moringa olifera leaves contained 4.5% total solids, 1.8%protein, 0.3% ash, and 106(mg/100ml garlic acid equivalent) total phenolic.

For making Yoghurt fresh whole buffalo,s milk (6.6 fat, 8.75SNF) was used. Moringa oleifera extract was individually added to the yoghurt milk at the rate of 2, 4, 6, 8 and 10% (w/w). The base mix was mixed thoroughly, and heat treated at 90C^{o} for 15 min. then cooled to approximately 45C^{o}. The mix was inoculated at the rate of 0.1g/L of yoghurt mix with thermophilic yoghurt culture. The inoculated Moringa oleifera supplemented yoghurt mixes were filled in 100ml plastic cups and incubated at 42C^{o}until complete coagulation, then cooled and stored at 4C^{o}for two weeks. Control was made from buffalo's milk without adding Moringa oleifera.

Total solids , protein, fat and ash contents were determined as described by the *AOAC,*(2007).The pH of the samples was measured using a pH- meter (Orion model 410A, Boston, MA, USA). Titratable acidity was estimated as percentage of lactic acid according to *Richardson* (1986). Curd cur tension was measured by the method of *Chandrashekhara et al.*(1957).

The rate of curd syneresis was determined in yoghurt samples after 10,30,60 and 120min at room temperature (25±C°) as described by *Mehanna and Mehanna*(1989).

The resultant fresh control and yoghurt supplemented with Moringa oleifera was microbiologically examined for total bacterial count (TBC), yeast & mould and coliform group as described in *Difco*(1985).

For extraction for antioxidant and total phenolic assays, samples were extracted using 70% methanol (1%HCL acidified) as described by *Mathaus*(2002), Approximately 5g of Yoghurt was mixed thoroughly in mortar with 20ml of 70% methanol. The suspension was shacked vigorously for 4h at room temperature and centrifuged at 10000g for 15 min at 10C°. The supernatant was collected and passed through filter paper (whatman No2) and the resultant filtrate was stored at 20C° until analyzed *(Arcan and Yemenicioglu* 2009*)*; for total phenolic and ferric reducing power.

For assaying the ferric reducing antioxidant power (FRAP), the method adopted by*Benzie and Strain*(1999) was used, by reducing the Fe+3 to Fe+2ion. In the presence of the blue color was reassured at 593nm.

Regarding the total phenolic (Pholin- Ciocalteu) assay, the soluble phenolic compounds (PC) were detected using the Folin- Ciocalteu reagent as described by *Nassar et al,*(2014)with slight modifications. The absorbance was read at 725nm, and the values were expressed in mg equivalents.

Yoghurt samples were examined for colour, flavor, texture and overall acceptability by 10 panelists from the staff Animal Production Research Institute, Agricultural Research Center, Ministry Of Agriculture . A hedonic scale of 1 (dislike extremely) to 10 (like extremely) was used. The panelists were asked to evaluate 2 weeks old samples. They were also given a further option of writing comments, if any were observed.As evaluation scheme proposed *Saldamli et al.(1991)*.

All determinations were statistically analyzed in triplicates. Analysis of variance (ANOVA) was performed using the Duncan,s multiple – range test to compare treatments. Significance was set at $P \leq 0.05$ (Version 9.3, Cary, NC USA, 2013).

RESULTS AND DISCUSSION

Table (1) shows the influence of supplementation of fresh yoghurt with different concentrations of aqueous extract of Moringa oleifera on the chemical composition and some properties of yoghurt compared to the control. Data showed slightly decrease in acidity and increase in pH values at the different levels of supplementation. The total solids (TS) also showed considerable increase at the same levels of supplementation. This decrease ranged from 2.81 to 4.81% compared to the this result may be as a results of increasing control of water binding capacity of the added the Moringa oleifiera that increase moisture content. These results agree with the work of *Lee et al,* 1987*, Hung and Zayas,* 1992*, and Wang et al,* 2003.

On the other hand, total protein (TP), total volatile fatty acids (TVFA), and ash revealed magnitude increase at the level of all treatment increase. Moringa oleifiera treatments showed the highest values for fibers and ash. While the treatment 8% Moringa oleifera extract showed the highest values for total protein (TP).

Table 1. Chemical composition of fresh yoghurt sup kmented with different concentrations of with aqueous extract of Moringa oleifera leaf (Average ± SE of 3 replicates)

Property	Treatments					
	Control	T1	T2	T3	T4	T5
Acidity%	0.90^{a}±0.05	0.86^{b}±0.06	0.87^{b}±0.05	0.88^{b}±0.05	0.89^{b}±0.05	0.89^{b}±0.05
pH	4.40^{c}±0.07	4.42^{bc}±0.07	4.41^{bc}±0.07	4.43^{ab}±0.07	4.43^{ab}±0.07	4.44^{a}±0.07
TS%	15.60^{cd}±0.15	15.75^{bc}±0.11	15.80^{b}±0.11	15.82^{ab}±0.11	15.85^{a}±0.11	15.86^{a}±0.10
TP%	3.92^{b}±0.11	3.95^{ab}±0.09	3.96^{ab}±0.09	3.97^{a}±0.09	3.99^{a}±0.10	3.98^{a}±0.11
Fat%	6.6^{a}±0.06	6.6^{a}±0.06	6.6^{a}±0.06	6.6^{a}±0.06	6.6^{a}±0.06	6.6^{a}±0.06
TVFA*	0.37^{b}±0.06	0.38^{b}±0.06	0.40^{ab}±0.07	0.41^{a}±0.07	0.43^{b}±0.07	0.42^{ab}±0.07
Ash%	0.83^{c}±0.02	0.85^{bc}±0.02	0.86^{b}±0.03	0.88^{ab}±0.03	0.89^{a}±0.03	0.90^{a}±0.03
Fibers%	0.42^{e}±0.04	0.51^{c}±0.04	0.57^{b}±0.04	0.45^{ab}±0.04	0.61^{a}±0.04	0.62^{a}±0.04
Acetaldehyde**	162.4^{d}±13.2	160.11^{ab}±11.85	161.33^{a}±11.51	161.75^{a}±11.33	165.55^{cd}±11.91	166.33^{bc}±12.31

T1: Yoghurt mixture and 2% Moringa oleifera extract. T2:Yoghurt mixture and 4% Moringa oleifera extract.
T3: Yoghurt mixture and 6% Moringa oleifera extract. T4: Yoghurt mixture and 8% Moringa oleifera extract.
T5: Yoghurt mixture and 10% Moringa olifera extract *0.1N- NaoH/10gYoghurt.
****u mole/100g Yoghurt. Averages with different superscripts differed significantly (P≤0.05).**

Table(2) demonstrates chemical composition and some properties of stored yoghurt as a result of fortifying by different concentration of aqueous extract of Moringa oleifera leaf presented data in this table showed a relatively great increase in acidity and decrease in pHvalues at the end of storage periods (5 days for the control and 10 days for treatment). Total solids (TS) revealed a considerable decrease with T1,T2 and little decrease with T4 and T5 ranged from 4.5% to 6.5% . Also acetaldehyde, TP, TVFA, fibers and ash increased during storage period the treatment 2% and 4%. On contrary, Fat showed slight decrease in the stored samples.

Table (3) shows the effect of supplementation of yogurt on curd tension and syneresis after 10, 30, 60 and 120 min. The treated yogurt appeared very low curd tension compared to the control. The latter achieved average value of 55.31 gram while the treatments did not achieve more than 48.51, 48.21 and 45.55 gm for the treatment T1 , T2 and T3 respectively

The same Table shows that all treatments appeared a magnitude increase in the amount of separated whey compared to the control after 10, 30, 60 and 120min. the same treatments showed larger amounts of separated whey and the all treatments . These results agree with those of *Velez Raiz*(2005).

Table 2. Chemical composition of stored yoghurt supplemented with different concentrations of aqueous extract of Moringa oleifera leaf (Average ±SE of 3 replicates)

Property	Treatments*					
	Control	T1	T2	T3	T4	T5
Acidity%	1.18^{a}±0.06	1.21^{ab}±0.06	1.25ab±0.05	1.28^{ab}±0.07	1.31^{ab}±0.06	1.33^{ab}±0.05
PH	4.0^{a}±0.06	4.10^{a}±0.06	4.05a±0.07	4.15^{a}±0.07	4.10^{a}±0.07	4.05^{a}±0.07
TS%	15.93^{bc}±0.10	16.51^{a}±0.10	16.47ab±0.11	16.39^{ab}±0.11	16.37^{b}±0.11	16.41^{a}±0.12
TP%	4.40^{ab}±0.10	4.50^{a}±0.08	4.48a±0.07	4.33^{b}±0.07	4.39a^{b}±0.08	4.42^{ab}±0.07
Fat%	6.50^{a}±0.05	6.40^{ab}±0.05	6.40ab±0.05	6.30^{b}±0.05	6.20b^{c}±0.05	6.20^{bc}±0.05
TVFA	0.45^{b}±0.06	0.44^{ab}±0.05	0.46ab±0.06	0.48^{a}±0.06	0.49^{ab}±0.07	0.51^{ab}±0.06
Ash%	1.05^{c}±0.04	1.15^{bc}±0.04	1.19ab±0.04	1.17^{b}±0.04	1.19^{ab}±0.04	1.21^{a}±0.04
Fibers%	0.61^{c}±0.04	0.65^{bc}±0.05	0.69b±0.05	0.73^{ab}±0.05	0.77^{a}±0.05	0.79^{a}±0.05
Acetaldehyde	211.5^{de}±13.11	215.5^{bc}±13.51	217.5^{ab}±13.77	205.3^{a}±12.86	208.3^{e}±12.70	210.3^{de}±12.97

***See legend to Table (1) for details**

Table 3. Curd tension (CT) and curd syneresis (CS) of fresh and stored yoghurt with different concentrations of aqueous extract of Morenga oleiferaleaf (Average ±SE of 3 replicates).

Property	Treatments*(Fresh yoghurt)					
	Control	T1	T2	T3	T4	T5
CT. g	55.31^{a}±0.51	48.51^{b}±0.41	48.21^{b}±0.39	45.55^{c}±0.31	42.31^{d}±0.33	39.31^{e}±0.35
CS: after						
10 min	3.85^{a}±0.33	3.89^{a}±0.31	3.92^{a}±0.33	4.05^{a}±0.35	4.25^{a}±0.37	4.45^{a}±0.45
30 min	3.97^{a}±0.25	4.10^{b}±0.33	4.21^{b}±0.31	4.85^{b}±0.32	4.95^{b}±0.35	5.56^{b}±0.05
60 min	4.15^{ab}±0.27	4.25^{b}±0.32	4.35^{b}±0.31	5.35^{b}±0.33	5.55^{b}±0.35	5.75^{b}±0.75
120 min	4.35^{a}±0.25	4.65^{b}±0.32	4.75^{b}±0.32	6.05^{b}±0.30	6.25^{b}±0.33	6.45^{b}±0.45
Property	Treatments (Stored yoghurt)					
	Control	T1	T2	T3	T4	T5
CT. g	57.22^{a}±0.55	50.12^{ab}±0.55	50.21^{a}±0.52	47.51^{bc}±0.42	45.11^{c}±0.37	43.12^{d}±0.38
CS: after						
10 min	3.31^{a}±0.31	4.01^{ab}±0.30	4.04^{ab}±0.32	4.25^{b}±0.33	4.45^{b}±0.36	4.65^{b}±0.38
30 min	4.05^{a}±0.30	4.31^{ab}±0.31	4.41^{b}±0.32	4.60^{b}±0.35	4.75^{b}±0.35	4.95^{ab}±0.37
60 min	4.18^{a}±0.30	4.95^{ab}±0.35	4.99^{ab}±0.33	5.89^{b}±0.35	5.01^{ab}±0.35	5.38^{ab}±0.37
120 min	4.32^{a}±0.31	5.05^{ab}±0.37	5.15^{b}±0.33	5.35^{b}±0.35	5.55^{a}±0.35	5.71^{a}±0.37

***See legend to Table (1) for details.**

Results presented in Table (4) indicated that supplementation of yoghurt of all treatments did not remarkably affect the total bacterial count of the resultant yoghurt. In concern with mould and yeast counts it could be noticed that supplementation of yoghurt.

Table 4. Microbiological analysis of yoghurt produced with different concentrations of aqueous extract of Moringa oleifera leaf (Average ±SE of 3 replicates).

Treatments*	Total bacterial count(cfu/g)	Mould and yeast (cfu/g)	Coliform group (cfu/g)
Control	8850^{ab}	3150^{ab}	ND^{a}**
T1	8930^{b}	2970^{a}	ND^{a}
T2	8795^{a}	3050^{ab}	ND^{a}
T3	8800^{bc}	3350^{ab}	ND^{a}
T4	9100^{c}	3400^{bc}	ND^{a}
T5	9250^{cd}	3430^{c}	ND^{a}

***See legend to Table (1) for details. **ND: Not detected.**

Antioxidant capacity and total phenolic compounds

Data presented in Table (5) show that yoghurt made with Moringa oleifera extract had the higher values of antioxidant scavenging activity compared to control. In addition, antioxidant capacity increased with the increasing levels of Moringa oleifra extract. This variation could be attributed to the high antioxidant capacity of Moringa oleifra. This result is in line with those reported by *Sreelatha and Pedma*(2009) and *Ashfagqu et al,*(2012), who reported that the extract of Moringa oleifra leaves had potent antioxidants. From the data in Table (5) it was noticed that addition of Moringa oleifra leaves extract to yoghurt was accompanied by high levels of total phenolis. Therefore, yoghurt made with Moringa oleifra could be considered as a good source of total phenolis. Total phenolis increased by 32.8%, 66%, 105.9%, 135.5% and 176% for T1,T2,T3,T4 and T5, respectively.

Table 5. Antioxidant scavenging activity (FRAP) and total phenolis of yoghurt madewith different concentrations of aqueous extract of Moringa oleifra (Average ±SE of 3 replicates).

Treatments*	FRAP (mg Fe2So4 Eq/100g)	Total phenols (mg GAE**/100g FW)
Control	70.55^{f}± 0.04	4.98^{f} ± 0.03
T1	72.35^{e} ± 0.03	6.90^{e} ± 0.04
T2	72.60^{d} ± 0.03	8.50^{d} ± 0.04
T3	75.12^{c} ± 0.05	11.03^{c} ± 0.04
T4	76.87^{b} ± 0.05	13.55^{b} ± 0.04
T5	77.01^{a} ± 0.05	15.05^{a} ± 0.04

***See legend to Table (1) for details. **GAE gallic acid equivalent.**

Texture properties:

Results of texture parameters including hardness, springiness, adhesiveness, cohesiveness, resilience, gumminess, and chewiness of yoghurt are shown in Table (6). Hardness and adhesiveness increased while springiness, cohesiveness, resilience and chewiness were decreased after the addition of the aqueous leaf extract of Morigna oleifera. No significant was noticed on the gumminess parameter. Percentages of increase of hardness compared to control reached 4% while of adhesiveness reached 29%. Leaf extract of Moringa oleifera decreased the springiness, which reflects the

rubbery property unfavorable character of the produced yoghurt. The decrease reached up to 4% compared to control. Cohesiveness, the ability of yoghurt particles to adhere with each other, decreased with percentages of to 6, 11, 14, 18 and 21 after the addition of 2, 4, 6, 8 and 10% respectively. Resilience, the ability of a product to recover its shape, was decreased with 2, 4, 6, 8, and 10% Moringa oleifera. The percentages of decrease of resilience compared to control were 5, 7, 11, 12, and14 respectively. Varus of resilience, chewiness and gumminess were consistent with those of cohesiveness.

Table 6. Textural parameters of yoghurt made with different concentrations of aqueous extract of Moringa oleifera leaf (Average ±SE of 3 replicates).

Treatments*	Hardness (g)	Springiness (mm)	Adhesiveness (g sec)	Cohesiveness (g/cm)	Resilience	Gumminess (g/cm)	Chewiness (g/cm)
Control	887^{c}±4.75	0.79^{a}±0.003	-565^{f}±1.12	0.39^{a}±0.002	0.12^{a}±0.002	451^{a}±29	486.5^{a}±4.92
T1	897^{bc}±4.75	0.76^{a}±0.003	-501^{e}±1.12	0.31^{b}±0.002	0.10^{ab}±0.002	475^{a}±28	466.1^{ab}±4.92
T2	915^{b}±4.75	0.72^{b}±0.003	-471^{d}±1.12	0.24^{c}±0.002	0.09^{abc}±0.002	488^{a}±28	432^{bc}±4.92
T3	932^{ab}±4.75	0.69^{bc}±0.003	-442^{c}±1.12	0.20^{d}±0.002	0.08bc±0.002	498^{a}±28	411^{c}±4.92
T4	945^{ab}±4.75	0.65^{bc}±0.003	-412^{b}±1.12	0.17^{e}±0.002	0.08^{bc}±0.002	521^{a}±28	398.5^{c}±4.92
T5	959^{a}±4.75	0.62^{c}±0.003	-389^{a}±1.12	0.15^{f}±0.002	0.08^{c}±0.002	542^{a}±28	377.4^{c}±4.92

***See legend to Table (1) for details.**

Sensory evaluation of yoghurt:

Sensory evaluation of yoghurt made with different concentrations of Moringa oleifera is presented in Table (7).Moringa oleifera showed effect in the Yoghurt texture at different concentrations compared to control.

During cold storage, Table (8) the scores for organoleptic quality increased for all samples but the end of storage no significant reduction was observed for all products except that flavored with Moringa oleifera. No observable changes were detected during the cold storage of flavored products.

Table 7. Sensory evaluation of fresh yoghurt made with different concentrations of Moringa oleifera (Average ±SE of 3 replicates).

Treatments*	Colour (10)	Taste (10)	Odor (10)	Texture (10)	Appearance (10)
Control	9.10^{a} ± 0.06	8.70^{a} ± 0.06	8.80^{a} ± 0.06	8.50^{a} ± 0.07	8.30^{a} ± 0.07
T1	9.00^{a} ± 0.06	8.50^{a} ± 0.06	8.70^{a} ± 0.06	8.30^{a} ± 0.07	8.20^{a} ± 0.07
T2	9.20^{a} ± 0.06	8.40^{ab} ± 0.06	8.60^{a} ± 0.06	8.30^{a} ± 0.06	8.30^{a} ± 0.07
T3	8.50^{ab} ± 0.05	8.10^{ab} ± 0.06	8.30^{ab} ± 0.06	8.10^{ab} ± 0.05	7.95^{b} ± 0.06
T4	8.70^{ab} ± 0.05	7.90^{b} ± 0.06	8.00^{b} ± 0.06	7.95^{b} ± 0.05	7.70^{bc} ± 0.06
T5	8.40^{b} ± 0.05	7.60^{c} ± 0.06	7.70^{bc} ± 0.05	7.75^{c} ± 0.05	7.40b ± 0.05

***See legend to Table (1) for details.**

Table 8. Sensory evaluation of stored yoghurt made with different concentrations of Moringa oleifera (Average ±SE of 3 replicates).

Treatments*	Colour (10)	Taste (10)	Odor (10)	Texture (10)	Appearance (10)
Control	9.40^{a} ± 0.05	9.20^{a} ± 0.05	9.20^{a} ± 0.05	8.70^{a} ± 0.06	8.70^{a} ± 0.07
T1	9.70^{a} ± 0.05	9.10^{a} ± 0.05	9.20^{a} ± 0.05	8.60^{a} ± 0.06	8.60^{a} ± 0.07
T2	9.60^{a} ± 0.05	9.00^{a} ± 0.05	9.10^{a} ± 0.05	8.70^{a} ± 0.06	8.80^{a} ± 0.07
T3	8.70^{b} ± 0.05	8.20^{b} ± 0.05	8.30^{b} ± 0.05	8.40^{ab} ± 0.05	8.40^{ab} ± 0.06
T4	8.40^{bc} ± 0.05	7.30^{bc} ± 0.05	8.20^{b} ± 0.05	8.20^{b} ± 0.05	8.20^{b} ± 0.06
T5	8.10^{c} ± 0.05	7.20c ± 0.05	8.10^{bc} ± 0.05	8.10^{c} ± 0.05	7.90^{bc} ± 0.05

***See legend to Table (1) for details.**

CONCLUSION

Supplementation of yoghurt with 6, 8, and 10% extract of Moringa oleifera increased slightly its protein, ash, and total solid contents but significantly increased its antioxidant activity and total phenolic compounds. Addition of aqueous extract of leaves ofMoringa oleifera up to 8% did not alter the colored, taste and overall acceptability scores of Yoghurt while the 10% concentration of the extract revealed the lowest overall acceptability among. Hence yoghurt can be made with aqueous extract ofMoringa oleifera up to 8% level with satisfactory sensory attributes.

REFERENCES

Abdull Razis, A. F., Ibrahim, M. D. and Kntayya, S. B. (2014). Health benefits of Moringa oleifera. Asian pacific. J. cancer prevention, 158571-8576.

Anwar, F., Latif S.; Ashraf, M. and Gilani, A. H. (2007). Moringaoleifera A food plant withmultiple medicinal vases. Phytotheapy Research, 21:17.

AOAC (2007). Official Methods of Analysis, 18th Ed. Washington, DC,UAS: AssociationOfficial AgriculturalChemists, Ch 34: 72.

Arcan, I. and Yemenicioglu, A. (2009). Antioxidant activity and phenolic content of fresh and dry nuts with and without the seed coat. J. Food Comp. Anal, 22:184-188.

Ashfagqu, M., Masra, S. M. and Ashfaqu. (2012).Moringa olifera Miracle plant for agro and forestry; Review Article, J. Agric and Social Sci. 8: 115.

Aslam, M. F.; Anwar, R.; Nadeem, U., Rashid, T. G.; Kazi, A. andNadeem, M.(2005). Mineral composition of Moringa oleiferaleaves and pods from different regions of Punjab, Pakistan.Asian J. Plant Sci., 4: 417.

Benzie, Iris, F. F. and Strain, J. J. (1999). Ferric reducing / anti- oxidantpower assay: directmeasure of total antioxidant activity of biological fluids and modified version for simultaneous of totalantioxidant power and ascorbic acid concentration. Methods;in Enzymology,299: 15.

Chandrashekhara, M R.,Swaminathan, M. Bhatia, D S. and Subramanayam; V. (1957).Infantfood frombuffalo milk.1Effect of different treatments on curd tension. Food Sci.,6:226-228

Difco (1985).Difco menual: Dehydrated Culture Media and Reagents for Microbiological andclinical Laboratory procedures, 10th ed.Difco Laboratory. Detroit. Michigan, USA.

El-Sohaimy, S. A.; Hamed, G. M.; Mohamed, S. M.; Amar, M. H. andAl-Hindi, R. R.(2015). Biochemical and Functional Properties ofMoringa oleifera Leaves and their Potential as FunctionalFood. Global Adv. Res. J. Agric. Sci., 4: 188.

Ferrao, A. M. B. and Ferrao, J. E. M.(2005). Potential ofMoringa oleifera AgronomicAngolan (Luanda) 30: 3.

Ho, C. T. (1994). Food Phytochemicals and cancer Prevention. ACS Symposium Series 547. American Chemical Society.

Hsu, R.; Midcap, S. and Lucienne, de witte, A. L.(2006). Moringa oleifera Medicinal and Socio-Economic uses. Int. J. Economic Botany, I.

Hung, S. C. and J.F. Zayas (1992). Protein solubility, were retention and fat binding

of comgerm protein flour compared with milk protein. J. Food Sci., 57: 372- 379.

Lee, C. M., Whiting,R. C. and Jenkins,R. K. (1987). Texture and sensory evaluation of frankfurters made with different formulations and process. J. Food Sci., 52P 896- 901.

Makkar, H. P. S and Becker, K. (1996). Nutritional value and antinutritional components of whole and ethanol extracted Moringa oleifera leaves. Anim. Feed Sci. Technol., 63:211.

Mathaus, B. (2002). Antioxidant activity of extracts obtained from residues of different oilseeds. J. Agri. Food Chem., 50: 3444.

Mehann, N. M. and Mehann,A. S. (1989). On the use of stabilizer forimproving someproperties of cows yoghurt. Egyption J. Dairy Sci. 17: 289-299.

Nassar, A. M. K.; Kubow, S.; Leclerc, Y. and Donnelly, D. J (2014). Somatic mining for phytonutrient improvement of (Russet Burbank) potato. American J Potato Research, 91: 89.

Richardson, H. G. (1986). Standard Methods for the Examination of Dairy Products. 15th Ed.American Public Health Assosiation, Inc., Washington. USA.

Saldamli, I.Vrijhoef, A. and Temiz, A.(1991). The stability of aspartame in yoghurt. J. Dairy Sci., 19: 249- 255.

SAS. (2013).Statistical Analysis: System User Guide, Version 9.3 SAS Institute Inc., Cary,NC., USA.

Siddhuraju, P. and Becker, K. (2003).Antioxidant properties of variou solvent extracts of totalphenolic constituents from three different agro- climatic origins of drumstick tree (Moringa oleifera) Leaves. J Agric. Food Chem., 51: 2144.

Singh, Y.; Jale, R., Prasad, K. K.; Sharma, R. K. and Prasad K. (2012). Moringa oleifera AMiracle Tree, Proceeding, International Seminar On Renewable

Energy for Institutionsand Communitie in urban and Rural Settings. Manav Institute, Jevra, India, 73-81.

Sreelathatha, S. and Padma, P. R. (2009). Antioxidant activity and totalphenoli content of Moringa oleifera leaves in two stages of maturity. Plant Foods Human Nitr,64: 303.

Velez-Raiz,J. F. (2005). Physicochemical and rheological characterization of a yoghurt with low- level of added with fiber and calcium. IFT Annals Meeting New Drleans, douisiane USA.

Wang, S.T.; S. A. Baringex and P. M. T.Hansen (2003). Effect of agar and starch on the chemical and microbiological properties of fat free Yoghurt . J. Dairy Sci.,57: 321.

Wedad, A. Metry; A. L. Nagib and E. M. El-Hadidy (2003). Some chemical, physical,

microbiological and organoleptical properties of ice cream produced by using somelegumes or their derivatives, J. Home Economics. Minufiya univ.; 13 : 115- 135.

تأثير اضافة مستخلص أوراق المورينجا 10 اوليفيرا على الجودة و القيمة الغذائية لليوغورت

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اهتم هذا البحث بدراسة استخدام المورينجا اوليفيرا كأحد المصادر الطبيعية للحديد و ذلك بدلا من اضافة الحديد فى صورة مستحضرات كيميائية فى صناعة الزبادي .والمورينجا غنية بالبروتينات و الكالسيوم و حمض الاوكساليك و كذلك نسبة من الفيتامينات والاملاح المعدنية ذات الاهمية الغذائية و الصحية .و فى هذه الدراسة تم استخدام المستخلص المائي للمورينجا بتركيزات2 ، 4، 6، 8، % 10 (وزن/ وزن) فى تصنيع الزبادي مقارنة بالكنترول بدون اضافة مستخلص المورينجا. وقد اوضحت النتائج المتحصل عليها من هذه الدراسة ان محتوى الزبادي من البروتين و الرماد و مضادات الاكسدة زادت مع زيادة اضافة المستخلص المائي للمورينجا ولم تكن هناك فروق معنوية بين المعاملة الثانية و الرابعة (2% ، 4%) و الكنترول من حيث التأثير على خواص الزبادي الحسية و القوام و التركيب الكيماوي للزبادي المنتج و لكنه زاد من محتوي الزبادي من مضادات الاكسدة بنسبة قد تصل الى 40% مقارنة بالكنترول. ومن هنا توضح الدراسة ان استخدام المستخلص المائي بتركيز 2، 4% (وزن/وزن) فى تصنيع الزبادي يؤدى الى زيادة الفوائد الصحية للمنتج.