SINAI Journal of Applied Sciences (ISSN: 2314-6079) Vol.:(4) Is.:(2), Aug. 2015 119-130

SINAI Journal of Applied Sciences

INFLUENCE OF STIRRED YOGHURT FORTIFICATION WITH *SPIRULINA PLATENSIS* AND *DICTYOTA DIVARICATA* ON ITS QUALITY.

Mona M.S.[1], Shahein, M.R.[1], Metwally, M.M.[1]

1. Dept. Food and Dairy Sciences, Faculty of Environ. Agri. Sc., EL- Arish, Suez Canal University, Egypt.

ABSTRACT

Functional foods are foods that have at least a certain nutritional high value in addition to their regular nutritional properties along with having confirmed medicinal outcome to the consumer. They are produced by adding at some a chemical or microbial ingredients to a food-base, such as milk and milk products. Probiotics and synbiotics are functional foods with microbial enrichment**.** The stirred yoghurt were prepared from Buffalo's milk (5.5% fat) with added (0.5 and 0.8 (w/w) %) *Spirulina platensis* and *Dictyota divaricata*. The samples were stored at 4-6°C and investigated on days 1, 7 and 14. The results showed that Fortification of stirred yoghurt with *Spirulina platensis* and *Dictyota divaricata* significantly increases proteins, fat, T.S and vitamin C. in comparison to unfortified stirred yoghurt, the sensory analysis was also performed. Sensory scores of 0.5% *Spirulina platensis* and *Dictyota divaricata* stirred yoghurt samples were better than 0.8%. According to final results, the stirred yoghurt samples containing 0.5% (w/w) *Spirulina platensis* and *Dictyota divaricata* were selected as the preferable treatment. The main purpose of this research was to monitor the influence of *Spirulina platensis* and *Dictyota divaricata* addition to stirred yoghurt on the chemical, bacteriological and sensory proparties during storage.

Key words: *Spirulina platensis*, *Dictyota divaricata*, stirred yoghurt, Functional foods.

INTRODUCTION

Choose of the right food to eat associated with a healthy life style can have important benefits in future life. Some of healthy diet could be on microalgae novel food products which could be important benefits for all age groups **(Gouveia *et al*., 2008).** The cultivation of microalgae is known to be the most profitable business in the biotechnological industry.

It is ecologically pure energy and resource saving process**. (Priyadarshani and Rath, 2012).** Seaweeds have been used since ancient times as food, fodder and fertilizer and also source of medicinal drugs. Seaweeds are one of the commercially important marine living and renewable resources. Certain seaweeds contain significant quantities of protein, lipids, minerals and vitamins, while although nutrient contents vary with species, geographical location, season and temperature **(Haroon, 2000).**

Microalgae have become popular as new source for both nutraceutical and pharmaceutical products.

They have less complex biological systems compared to higher organisms. Undoubtedly, viability of probiotic bacteria during the fermentation process and subsequent refrigerated storage is a major concern in the production of probiotic yoghurt or other milk products.

The addition of microalgae such as Spirulina and Dicatyota general could raise the viability of probiotics in fermented dairy products like yoghurt.

However, this addition adversely affects the sensory attributes of the final product, so it needs to some modefecations (**Beheshipour *et al.*, 2013)**.

MATERIALS AND METHODS

Starter cultures and ingredients:

Buffalo's milk (5.5% fat) was obtained from a private farm in North Sinai Governorate.Yoghurt culture (*Streptococcus thermophillus, Lactobacillus delbrueckii* ssp. *bulgaricus)* were obtained from DANISCO, Rue de clemencieres-BP 32, Sassenage, Denmark.

-The algae *Spirullina platensis* and *Dictyota divaricata* were obtained from the Laboratory of Prof. Dr. Islam M. EL-Manawy, Botany Departmenr, Faculty of Science, Suez Canal University.

-Fresh sample of algae were washed using seawater to remove of encrusting material then washed with distilled water after that it was dried in the shadow area till the wight was stabilited, and it grinded very well before sifting.

Stirred Yoghurt preparation:

Milk heated at 80°C for 10 minutes and cooled to 41±1°C. Starter culture was then added at 2.5 %. Algae were added as (0.5% and 0.8% (w/w)).

Yoghurt were then incubated at 41-43°C for 3-4 hours, then blended till a uniform mixture obtained, The stirred yoghurt was cold at 4-6°C and stored up to 14 days

Chemical analysis:

-Milk composition analysis:

The milk samples were analyzed for moisture, ash, fat, lactose, acidity and protein content according to the Association of Official Analytical Chemist (AOAC,2011).

All trails were conducted in triplicate ***Chemical analysis of algae:***All chemical analysis of the algae were carried out at the Faculty of Science, Suez Canal University**.**

Determination of Proteins:

The total proteins were measured as described by **Lowry *et al.*, (1951).**

Determination of Carbohydrates:

The method by **Hedge and Hofreiter, (1962)** was used to determine the total Carbohydrates.

The algae polysaccharides were converted into simple sugar by acid hydrolysis. One gram of dried algae sample was placed into boiling tube, allowed to be hydrolyzed through adding 5 ml of 2.5N HCL and kept in boiling water bath for 3 hours.

The sample was allowed to cool at the room temperature, neutralized by solid sodium carbonate, the volume was then made up to 100 ml and centrifuged. 0.2 ml of the sample solution was placed in a test tube and the volume was made up to 1 ml with distilled water. For each tube, 1 ml of 5% phenol and 5 ml of 96% H_2SO_4 were added.

After 10 min, the contents of all tubes were shaken and placed into water bath at 25-30^{o}C for 20 min. The absorbance of the solution was measured by using spectrophotometer (model 6505 UV/VIS, JENWAY, UK). at 490 nm.

Determination of Lipids:

The method of **AOAC (2011)** was conducted for lipid extraction from algae sample using chloroform/methanol (2:1 V/V).

The associated non-lipids were moved by washing lipid extract three times with CH_3OH/H_2O (1:1 V/V). The extracted lipids were dried into chloroform over anhydrous sodium sulfate and the solvent was then removed by heating at 80°C under vacum.

The lipids were measured and expressed as gm.100 gm^{-1} dry weight

Lipid (gm.100 gm-1) = (Weight "lipid"/ Wieght"sample") × 100

Determination of Ash content:

According to the method of **AOAC (2011),** 1 gm of the eash algae sample was heated in porcelain crucible at 100° C using oven (Fisher iso Temp oven, 200 series, Model 215G) till the water was expelled.

The sample was ignited into a muffle furnace (Blue M electrice co, Blue Island, Illnois, USA, Lab-Heat Box type) at about 550° C overnight.

The remaining ash was then reweighed and calculated as a percentage.

Determination of Moisture:

The fresh sample of eash algae species dried at 60° C in oven (Fisher iso Temp oven, 200 series, Model 215G).

The samples were then pulverized using a mill to pass through 0.5 mm- mish of the sieve and then stored in labled air-tight plastic bags for analysis. Moisture content was determined as triplicate for each 5 g of the samples, using an infrared moisture analyzer (Cenco moisture

balance, Central Sientific Co, Pat no 2.816.437) to the constant weight **AOAC (2011).** The loss in weight was calculated and reported as a percentage.

Stirred Yoghurt analysis:

Total solids, protein, Fat and vitamin c contents were determined according to **AOAC (2011)**. The pH values were measured using Jenway pH meter (Jenway limited, England).

Acetaldehyde and diacetyl content of yoghurt samples were estimated as described by **Lee and Jago** with some modification. One big petri dish with cover and another small one without cover instead of the Conway microdiffusion cell.

The big dish was used instead of the outer compartment while the small dish instead of the inner wall of the Conway microdiffusion cell. Then destabilized into the centre of the biggest dish. The small was destabilized in the centre of the big one**.**

Rheological analysis (Apparent viscosity):

The viscosity of stirred yoghurt was determined by using Brookfield viscometer (spindle 3) at 20 rpm, Model HAT Brookfield Engineering .MA, 02072, USA**, (Acton and Saffle, 1971).**

Microbiological analysis: The samples were taken aseptically and a serial of dilutions were prepared with 0.1 % sterile peptone water. Plate – count agar was used to determined the total bacterial counts. The pH of the medium was 7.1. The inoculated plates were incubated at 37 °C for 48 h under aerobic conditions **American Public Health Association, (1992).**

Malt exteract agar medium (Oxoid) as recommended by the **American Public Health Association, (1992)** was used for enumerating mold and yeast in the milk samples. The plates were incubated at 25°C for 3 days. Coliform were detetminted using Mconkey medium

according to the **American Public Health Association, (1992).**

Organoleptic properties of stirred yoghurt:

Stirred yoghurt was evaluated according to the method of **(El-Samragy and Zall, (1988).** Stirred yoghurt was examined for flavour (50 points), body and texture (40 points) and appearance (10 points)

Statistical analyses

In this study, all of the results were expressed as means ± and standard deviation of three duplicates analysis using the **SPSS 19.0** statistical software. One-way analysis of variance (ANOVA) and Duncan's multiple range tests were implemented for observing the significant ($P<0.05$) differences among the results, that was implemented according to the protocol of **Mousa *et al.*, (2014)**.

RESULTS AND DISCUSSION

Chemical composition of algae:

The proximate nutritional composition of the two studied species are presented in Table **(1).** The results indicated that highest value of protein was for *Spirulina platensis*, while the lowest value found at *Dictyota divaricate* The greatest value in ash was recorded for *Dictyota divaricata*, while the lowest was for *Spirulina platensis*. *Dicty*ota *divaricata* had the greatest value of lipid content.

The highest value of carbohydrates were found in *Spirulina platensis*, while the lowest value was in *Dictyota divaricata*. The moisture contents of dried algal were ranged from 11.25g.100g-1d.wt in *Spirulina platensis* to 12.58g.100g-1d.wt in *Dictyota divaricata*. These results agree with **Osman (2011)**.

Chemical composition of the raw buffalo's milk and plain stirred yoghurt:

It was cleared from Table (2) that moisture content decreased from 85.46% to 81.67% in buffalo's milk and stirred yoghurt respectively, due to yoghurt preparation which reflected on increasing the values of pH, acidity, protein, fat, carbohydrate (lactose) and ash in plain stirred yoghurt. This completely agree with **Emmons and Tucky (1967).**

Chemical Analysis:

Data presented in Tables (3) shows the effect of Spirulina and Dicatyota fortification on total solids, fat content, protein content, and pH values of yoghurt during storage.

It was clrear that the increase of total solids, fat content, protein content in all treatments gradually increased as the ripening period progress.. The increase of total solids, fat content, protein content of all treatments during storage period was probably due to the loss of moisture of different stirred yoghurt treatments.

These results agree with that obtained with **Ragb (2000).** pH decreased in all treatments due to starter culture activity which produces lactic acid from lactose fermentation, **Osman and Ismail (2004).**

- Acetaldehyde and diacetyl: The typical yoghurt flavor is caused by lactic acid bacteria, which imparts an acidic and refreshing taste. Also, mixture of various carbonyl compounds like acetoin, diacetyl and acetaldehyde, the latter of which is considered the major flavor component, **Tamime and Deeth (1980). -Gallardo-Escamilla *et al.*, (2005)** reported that the volatile compounds such as acetaldehyde and diacetyle are a key compounds for typical yoghurt aroma. Acetaldehyde

Table (1): Chemical contents of some seaweed (g/100g) in Egypt collected from Red sea:

Algae	Protein	Fat	Ash	Carbohydrate	Moisture
Spirulina platensis	53.21±0.01[a]	5.05±0.05[b]	9.10±0.10 [e]	18.54±0.04[b]	11.25±0.25[e]
Dictyota divaricat	8.89±0.01[c]	10.51±0.40[a]	26.40±0.40[b]	14.63±0.02 [e]	12.58±0.02[d]

* a,b,c,d and e Values in the same column with the same alphabet do not differ significantly (p> 0.05).

Table (2): chemical composition % of the raw buffalo's milk and fresh plain stirred yoghurt:

Item	Acidity	Protein	Fat	Ash	lactose	Moisture
Buffalo's milk	0.14	3.5	5.5	0.670	4.79	85.46
Plain Stirred yoghurt	0.85	3.8	5.8	0.994	4.46	81.67

Table (3): Changes in Total solids (TS) %, Fat(%), protein and pH of stirred yoghurt fortified with algae during storage period up to 14 days at 4-6°C.

Storage period(days)	Treatment / Parameter	T1	T2	T3	T4	T5
0	T.S%	18.21±0.21[a]	19.76±0.66[a]	19.60±0.26[a]	19.84±0.26[a]	19.72±0.03[a]
	Fat%	5.60±0.36[b]	5.73±0.32[ab]	6.20±0.36[ab]	6.33±0.60[ab]	6.40±0.26[a]
	Protein%	3.61±0.08[c]	3.99±0.26[ab]	3.64±0.04[c]	4.19±0.10[a]	3.69±0.01[c]
	pH	4.66±0.04[c]	4.48±0.03[ef]	4.55±0.06[de]	4.40±0.06[f]	4.62±0.07[cd]
7	T.S%	18.22±0.22[c]	19.82±0.70[b]	19.70±0.06[b]	19.86±0.03[b]	19.79±0.05[b]
	Fat%	5.70±0.26[c]	5.80±0.20[c]	6.30±0.10[ab]	6.10±0.10[abc]	6.47±0.32[a]
	Protein%	3.73±0.15[d]	4.11±0.08[b]	3.72±0.07[d]	4.35±0.05[a]	4.52±0.06[bc]
	pH	4.54±0.05[bc]	4.37±0.04[de]	4.46±0.04[cd]	4.33±0.05[e]	4.52±0.06[bc]
14	T.S%	18.26±0.04[d]	19.83±0.03[c]	19.80±0.20[c]	19.91±0.04[c]	19.85±0.05[c]
	Fat%	5.90±0.10[b]	5.93±0.40[b]	6.50±0.10[a]	6.30±0.10[ab]	6.53±0.38[a]
	Protein%	3.79±0.03[d]	4.41±0.05[b]	3.82±0.04[d]	4.68±0.03[a]	3.86±0.04[d]
	pH	4.40±0.05[b]	4.30±0.08[c]	4.44±0.05[ab]	4.20±0.07[d]	4.46±0.04[ab]

*T1: Control, T2: *S. platensis*(0.5%), T3: *D. divaricata*(0.5%), T4: *S. platensis*(0.8%), T5: *D. divaricata*(0.8%).

**a,b,c,d and e Values in the same column with the same alphabet do not differ significantly(p> 0.05).

Table (4): Acetaldehyde Diacetyle values (mg/100g) of stirred yoghurt fortified with algae during storage period up to 14 days at 4-6°C:

Treatment*	Storage period(days)					
	0		7		14	
	Acetaldehyde	**Diacetyle**	**Acetaldehyde**	**Diacetyle**	**Acetaldehyde**	**Diacetyle**
T1	18.00±2.65^{a}	5.37±0.03^{a}	22.33±3.21^{a}	10.13±0.12^{a}	17.00±2.00^{a}	8.63±0.06^{a}
T2	13.00±2.00^{bc}	2.89±0.03^{f}	16.00±3.61^{b}	5.89±0.02^{d}	12.00±3.61^{a}	3.86±0.05^{e}
T3	15.00±1.37^{abc}	3.77±0.03^{d}	18.00±2.00^{ab}	6.57±0.04^{c}	14.00±3.61^{a}	4.27±0.03^{d}
T4	12.00±3.61^{c}	2.51±0.08^{g}	15.00±3.61^{b}	5.21±0.04^{e}	11.33±3.21^{a}	3.32±0.02^{f}
T5	14.00±2.00^{abc}	3.21±0.08^{e}	17.00±2.65^{b}	6.00±0.53^{d}	13.00±2.65^{a}	4.00±0.26^{e}

*T1: Control, T2: *S. platensis*(0.5%), T3: *D. divaricata*(0.5%), T4: *S. platensis*(0.8%), T5: *D. divaricata*(0.8%).

**a,b,c,d and e Values in the same column with the same alphabet do not differ significantly(p> 0.05).

concentration in yoghurt varied from 2.5 to 68.00 mg/100g, **Mehnna and Hefnawy (1990).** It was clear that the acetaldehyde and diacetyle values of all treatments were increased and reached a maximum value at the 7th days of storage and then decreased to reach a minimum value at the 14th days. Similar observation was reported by **Shahein *et al.*, (2014).** Moreover, there were signification differences between all treatments. The highest value was obtained for control treatment, while the lowest value was obtained for stirred yoghurt with *Spirulina plateniss*.

Acetaldehyde decreased at the 7th of days storage probably due to its conversion into another organic compound which reduced such as ethanol, **EL-Loly and Hofi (1999).**

Vitamin C:

The results showed that the fresh stirred yoghurt fortified with algae marked with higher ratio than control. This effect attributed to that the algae contain higher content ratio of vitamin C. Also, it was cleared that the use of algae (0.8%) concentration raised vitamin C content in comparison with 0.5% concentration at all treatments. On the other hand *D. divaricata* had the highest value in vitamin C content. These data similar to that reported by **Black *et al.*, (1953) and Chandinis *et al.*, (2008).**

Rheological properties:

Table (6) indicate that the values of apparent viscosity of all treatments increased with increasing storage period up to 14 days.

The lowest values were in general reported with control (T1). Also, there was a proportional relationship between the algae concentration and the values of apparent viscosity.

On the other hand the data were according to the following orders at 0.5%: T3 > T2> >T1, at 0.8%: T5> T4 > >T1.

Moreover, the highest values of *D. divaricata* of 0.5% and0.8% at the end of storage period (14 days) were 3100 and 3200 cp respectively, while the lowest values found in control stirred yoghurt. The increasing of apparent viscosity during the storage period could be due to the high ratio of protein and fat.

These results are in agreement with that reported by **Sahan *et al.*, (2008).**

Table (5): Vitamin C content (mg/100g) of fresh stirred yoghurt fortified with algae:

Treatments	Concentration of algae %	
	0.5%	0.8%
Control	29.00± 4.00^{b}	29.00± 4.00^{b}
Spirulina platensis	38.00±8.00^{ab}	41.00±6.00^{a}
Dictyota divaricata	45.00±2.00^{a}	48.00±7.00^{a}

**a,b,c,d and e Values in the same column with the same alphabet do not differ significantly(p> 0.05).

Table (6): Changes in apparent viscosity (centipoises) of stirred yoghurt fortified with algae during storage period up to 14 days at 4-6°C.

Treatments	Storage period		
	0	7	14
T1	2700.00±264.58^{ab}	2816.67±20.82^{a}	2923.33±25.17^{c}
T2	2790.00±20.00^{ab}	2830.00±26.46^{a}	2960.00±20.00^{bc}
T3	2800.00±360.56^{ab}	2900.00±78.10^{a}	3100.00±50.00^{ab}
T4	2820.00±72.11^{ab}	2890.00±10.00^{a}	2990.00±10.00^{bc}
T5	2990.00±36.06^{a}	3150.00±132.29^{a}	3200.00±200.00^{a}

*T1: Control, T2: *S. platensis*(0.5%), T3: *D. divaricata*(0.5%), T4: *S. platensis*(0.8%), T5: *D. divaricata*(0.8%).

**a,b,c,d and e Values in the same column with the same alphabet do not differ significantly(p> 0.05).

Microbiological evaluation:

The total bacterial count of stirred yoghurt fortified with algae are shown in Table (6).

Fortification of stirred yoghurt with algae at different ratios had effect on the total viable bacterial count (TC), and there were significantly varied.

The highest value of total bacterial was reported in control treatment(T1) all over the storage period up to 14 days, while the lowest value found in stirred yoghurt obtained from *Spirulina platensis* 0.08% **(**T4) over the same period**.** The lower total viable bacterial count (TC) in stirred yoghurt fortified with algae could be attributed to the effect of algae on the starter culture whish reflected on the total viable bacterial count.

These results are in agreement with those reported by **Gonzalez Del Val *et al*., (2001),** whom reported that the marine algae had antibacterial activities.

Both of Coliform and Molds & Yeast were absent in all treatments either when fresh or during storage period up to 14 days at 4-6°C, this indicated that the processing of stirred yoghurt were in good and clean condition

Sensory evaluation:

Total acceptance scores for all treatments gradually decreased along the storage period. However the highest scores and at the end of storage period (14 days) were according to the following order 89 > 83 > 82 > 74 >71 for the treatments **(T1)** > **(T5)** > **(T2)** > **(T4)** > **(T3*b*)** respectively. All the results of

Table (7): The change of the total bacterial count (cfu×10^5 / ml) in stirred yoghurt fortified with algae during storage period up 14 days at 4-6°C

Treatment*	Storage period		
	0	7	14
T1	31.60±0.10^{b}	22.40±0.10^{c}	14.30±1.00^{a}
T2	18.40±0.40^{f}	12.30±0.30^{e}	6.10±0.30^{e}
T3	20.10±0.40^{d}	16.30±0.30^{d}	8.30±0.20^{d}
T4	16.40±0.50^{g}	10.20±0.10^{f}	5.10±0.10^{f}
T5	19.20±0.20^{e}	12.10±0.10^{e}	7.40±0.30^{d}

*T1: Control, T2: *S. platensis*(0.5%), T3: *D. divaricata*(0.5%), T4: *S. platensis*(0.8%), T5: *D. divaricata*(0.8%).

**a,b,c,d and e Values in the same column with the same alphabet do not differ significantly(p> 0.05).

Table (8): Sensory evaluation of stirred yoghurt fortified with algae during storage period up to 14 days at 4-6°C:

Treatment	Storage Period		
	0	7	14
	Flavors(50)		
T1	49.00±3.51^{ab}	47.00±3.00^{a}	**45.00±3.00^{a}**
T2	40.00±1.00^{cd}	37.00±1.53^{bc}	**35.00±2.52^{b}**
T3	48.00±3.51^{a}	46.00±3.00^{a}	**44.00±3.00^{a}**
T4	38.00±3.06^{d}	35.00±4.58^{c}	**31.00±1.53^{b}**
T5	47.00±3.00^{ab}	45.00±3.51^{a}	**43.00±03.00^{a}**
	Body & Texture(40)		
T1	39.00±1.00^{a}	38.00±2.00^{a}	**36.00±2.00^{a}**
T2	35.00±2.00^{bcd}	34.00±2.00^{bcd}	**33.00±2.00^{abc}**
T3	38.00±1.15^{ab}	36.00±2.00^{abc}	**34.00±2.00^{ab}**
T4	36.00±2.00^{abc}	35.00±2.00^{abc}	**34.00±2.00^{ab}**
T5	39.00±2.65^{a}	37.00±2.00^{ab}	**35.00±2.00^{ab}**
	Appearance(10)		
T1	10.00±1.53^{a}	9.00±1.00^{a}	**8.00±1.00^{a}**
T2	8.00±1.00b^{c}	7.00±1.00^{bc}	**6.00±1.00^{bc}**
T3	7.00±1.00^{c}	6.00±1.00^{cd}	**5.00±1.00^{cd}**
T4	7.00±1.00^{c}	6.00±1.00^{cd}	**6.00±1.00^{bc}**
T5	6.00±1.00^{c}	5.00±1.00^{d}	**4.00±1.00^{d}**
	Total acceptance (100)		
T1	98.00±2.00^{a}	94.00±6.00^{a}	**89.00±6.00^{a}**
T2	83.00±6.00^{b}	82.00±5.51^{ab}	**74.00±6.00^{a}**
T3	93.00±6.00^{ab}	88.00±6.00^{ab}	**83.00±6.00^{a}**
T4	81.00±6.00^{b}	76.00±6.00^{b}	**71.00±6.00^{a}**
T5	92.00±6.00^{ab}	87.00±7.02^{ab}	**82.00±6.00^{a}**

sensory evaluation in agreement with those reported by **Shahein *et al*., (2014).**following order 89 > 83 > 82 > 74> 71 for the treatments **(T1)** > **(T5)** > **(T2)** > **(T4)** > **(T3*b*)** respectively. All the results of sensory evaluation in agreement with those reported by **Shahein *et al*., (2014).**

CONCLUSION

The results demonstrated that the *S. platensis* and *D. divaricata* positively affected the proparties of stirred yoghurt during storage period. Stirred yoghurt samples containing 0.5 % (w/w) *Spirulina platensis* and *Dictyota divaricata* were selected as the preferable treatment.

REFERENCES

Acton, J. C. and Saffle, R. L. (1971). Stability of oil-in water emusions and Effect of oils phase volume, stability test, type of oil and protein additives. J. Food Sci., 36: 1118.

American Public Health Association (1992). Standard Methods for the Examination of Dairy products. Broadway, New York, N. Y., U.S.A.

AOAC (2011). Association of Official Analytical Chemists. Official Methods of Analysis. 17th Ed., Gaithersburg, M D, USA.

Beheshtipour, H.; Mortazavian, A. M.; Mohammadi, R.; Sohrabvandi, S. and Khosravi-Darani, K. (2013). Supplementation of *Spirulina platensis* and *Chlorella vulgaris* Algae into Probiotic Fermented Milks. Comprehensive Reviews in Food Science and Food Safety, 12:144–154.

Black, W.A.P.; Dewar, E.T. and Woodword, F.N. (1953). Manufacture of algal chemicals. Laboratory scale isolation of fucoidin from brown marine algae. J. Sci. Fd. Agr., 3: 122-129

Chandini, S.K.; Ganesan. P. and Bhaskar, N. (2008). *In vitro* anti oxidant activities of three selected brown seaweeds of India. Food chemistry, 107: 707-713.

EL-Loly, M. M. and EL-Hofi, M. A. (1999). Effect of zinc and iron on the properties of buffalo's acidophilus milk. Journal of Agriculture of Science Mansoura University, 24:5757-5767.

El-Samragy, Y. and Zall, R. R. (1988). Organoleptic peoperties of the yoghurt-Cheese labneh manufactured using ultrafiltration. J. Dairy Industries. Int., 53.

Emmons, D. B. and Tucky, S. L. (1967). Cotage cheese and cultured milk products Pfizer Cheese Monographs, Chas. Pfizer& Co. Inc., New York, USA, 3:130-141**.**

Gallardo-Escamilla, F. J.; Kwlley, A. L. and Delahunty, C. M. (2005). Influence of starter culture on flavore and headspace volatile profiles of fermented whey and whey produced from fermented milk. Journal of Dairy Science, 88:3745-3753.

Gonzalez del Val, A.; Platas, G. and Basilio, A. (2001). Screening of antimicrobial activities in red, green and brown macro algae from Gran Canaria (Canary Islands, Spain). Int. Microbiol., 4:35-40. **Gouveia, L.;**

Batista, A. P. and Sousa, A. (2008). Microalgae in Novel Food Products. Nova Science Publishers, 7: 21-27.

Haroon, A. (2000). The biochemical composition of *Enteromorpha spp*. From the Gulf of Gdansk coast on the southern Baltic Sea. Oceanologia, 116/117: 513-516.

Hedge, J.E. and Hofreiter, B.T (1962). Methods in Carbohydrate Chemistry. Academic Press, New York,17: .8 -10

Lee, G. J. and Jago, G. R. (1969). Methods for estimation of acetaldehyde in culture dairy product. Australian J. Dairy Sci. Technology, 24:181-190.

Lowry, O, H.; Rosebrough, N. J.; Farr, A. L. and Randall. R. J. (1951). Protein measurement with the Folin phenol reagent. J. Biol. Chem. 193:265-275.

Mehanna, A. S. and Hefnawy, S. H. A. (1990). A study to follow the changes during processing and storage of Zabady. Egyptian Journal of Dairy Science, 18:425

Mousa, A.; Liu, X. M.; Chen, Y. Q.; Zhang, H., and Chen, W. (2014). Evaluation of physiochemical, textural, microbiological and sensory characteristics in set yogurt reinforced by microencapsulated Bifidobacterium bifidum. International Journal of Food Science & Technology, 49(7):1673-1679.

Osman, N. M. (2011). Evaluation of the nutritional composition and antioxidants of some seaweeds from Red sea. India Journal of Food Composition and Analysis, 24:270–278.

Osman, M. M. and Ismail, M. M. (2004). Effect of fortification with Zinc; iron and ascorbic acid on the chemical; microbiological and organoleptic properties of buffaloes bio-yoghurt. Journal of Agriculture of Science Mansoura University, 29:237-251.

Priyadarshani, I. and Rath, B. (2012). Commercial and industrial applications of micro algae – A review. Journal of Algal Biomass Utilization , 3(4): 89–100.

Ragb, J. M. (2000). Technological studies on some fermented milk. M.Sc Thesis. Fac. of Argic., Zagazig Univ., Egypt.

Sahan, N. Yaser; K. and Hayalodlu; A. A. (2008). Physical and flavour quality of non-fat yoghurt as affected by a B-glucan hydrocolloids.International journal of Dairy Technology, 22:1291.

Shahein, M. R; Naser, W.I. and Eman L. Moustafa. **(2014).** Chemical; Bacteriological and Organoleptic properties of concentrated yoghurt (Labneh) fortified with some algae. J. of Biol. Chem. and Environ. Sci., 9(3):217-237.

Tamime, A. Y. and Deeth, H. C. (1980). Yoghurt technology and biochemistry. Journal of Food Protection, 43: 939-977.

الملخص العربى

تأثير *Spirulina platensis* و*Dictyota divaricate* على الخصائص الكيميائية والبكتريولوجية والحسية لليوجورت المخفوق

منى محمد سلامة[١]، مجدى رمضان شاهين[١]، ممدوح مصطفى كمال[١]

١ - قسم تكنولوجيا علوم الألبان، كلية العلوم الزراعية البيئية بالعريش، جامعة قناة السويس.

٢ - قسم تكنولوجيا علوم الألبان، كلية الزراعة بالإسماعيلية، جامعة قناة السويس.

أوضحت نتائج هذا البحث التأثير الايجابى لاستخدام كل من طحلبى *S. platensis* و*D. divaricata* على خصائص اليوجورت المخفوق اثناء فترة التخزين (١٤يوم). فقد ارتفع محتوى اليوجورت المخفوق والمدعم بالطحالب من البروتين والدهن ونسبة المواد الصلبة الكلية وايضا فيتامين ج بالمقارنة بعينة المقارنة، ونفس الشيء بالنسبة للزوجة الظاهرية، ظهر تأثير الطحالب بصورة ملحوظة على العدد الكلى للبكتريا حيث قلت في العينات المدعمة بالطحالب عن عينة المقارنة حتى اليوم السابع من التخزين ثم انخفضت تدريجيا مع تقدم التخزين حتى اليوم ١٤. وبصورة عامة فان هذا البحث يوصى باستخدام هذه الطحالب بنسبة ٥% لتدعيم اليوجورت المخفوق لرفع قيمتها التغذوية.

الكلمات الاسترشادية: اليوجورت المخفوق، المواد الصلبة الكلية، فيتامين C، طحلبى *S. platensis* و*D.divaricata*.

المحكمون:

١.أ.د. عاطف محمد أبو النـــور أستاذ تكنولوجيا علوم الألبان، كلية الزراعة بالإسماعيلية، جامعة قناة السويس.

٢.أ.د. محمد عبد الرازق النواوى أستاذ تكنولوجيا علوم الألبان، كلية الزراعة، جامعة عين شمس.