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Production of Functional Drinking Yoghurt Supplemented with Strawberry and Berry Fruits.

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ABSTRACT

Berry fruits are a rich source of phenolic compounds have health benefits against free radicals which are connected with the increased risk of certain diseases , especially cancers. Health promoting berry polyphenoles were add to drinking yoghurt post fermentation at ratios 5.0, 7.0, 9.0%. The addition of both strawberry or blackberry noticeably increased the free radicals scavenging (RSA) and total phenolic compound (TPC) of drinking yoghurt, this increase was declined up to the end of storage period either for control or strawberry and blackberry treatments.

INTRODUCTION

Many researchers have been carried out about production of functional foods for promotion of consumer healthy. Natural supplements containing berries or vegetables have become an interesting research objective of many researchers because of their high content of antioxidants. Those antioxidants are believed to be responsible of preventing many diseases such as diabetes, cancers and degenerative diseases, linked to free radicals.(Pimpao R.C., *et al*. 2013).

Berry fruits contain phenolic compound, flavonoids and tannins. These active ingredients are known for having antioxidant activity against oxidative stress induced by free radicals. Their major role is to protect human health against carcinogenic and diabetes diseases. (Chao M. Howard *et al*. 2004).

Fermented milks, especially yoghurt are very popular products consumed all over the world as nutritive and health promoting products. Owing to their bioactive peptides and basic chemical compositions yoghurt can be also produced as plain products as supplemented with bioactive ingredients, e.g. fruits, green tea extract dietary fiber and phytosrcals. (Cossu *et al*,. 2009). Many of these ingredients show strong antioxidant capacity, which results mainly from the high content of polyphenolic compounds and natural antioxidant vitamins.

There hare been many investigations performed which confirm that diet rich in antioxidants may improve the prophylactic effect of human health against the negative action of free radicals, and thins to decrease the risk of many diseases, including certain types of cancer and cardiovascular disorders (Cossu *et al*., 2009).

Berry fruits can be added to yoghurt via two approaches, via the pre – fermented (adding before fermentation as part of the yoghurt ingredient mixture), as via the post – fermentation (after fermentation as part of the usual practice for imparting flavor and color agents) Sun- water house and zhou *et al*. (2011).

In this study the Berry fruits namely strawberry and black berry under study were specked to yoghurt derived from buffalo's milk post fermentation to evaluate the effect of supplementation on chemical properties and antioxidant activity during the storage period up to 14 days. upon homogenization.

There are increasing interests in applying fruit processing wastes as functional food ingredients since they are rich source of dietary fiber, and most of the beneficial bioactive compounds are remained in those by-products (Balasundram *et al*., 2006).

MATERIALS AND METHODS

Materials:

Fresh buffalo's milk was obtained from the herd of the animal production department, faculty of Agriculture, Al-Azhar University.(Mostorod farm). Strawberry pulp and forest berry pulp were obtained from Stiffen Egypt Company. Skimmed milk powder was obtained from Fonterra, New Zealand. Freeze dried starter cultures YC-X11 (*Lactobacillus delbrueckii* subsp. *Bulgaricus* and *Streptococcus thermophilus*),.was obtained from Cairo Microbiological Resource Center (MIRCEN), Faculty of Agriculture, Ain Shams University.

Sucrose from local market.

Table 1. Chemical composition of Strawberry and Blackberry pulb

Treatment Parameters	Fruit solid	Sugar	water	pH	Viscosity	Specific gravity	Brix	* RSA%	** TPC
Strawberry pulb	28	44	19.3	3.8	10	1.23	51	82.90	206.20
Black berry pulb	28	44	19.3	3.8	10	1.23	51	88.97	448.55

*** RSA (free radicals scavenging).**
****TPC (total phenolic compound).**

Methods:-

Determination of total phenolic content (TPC) was determined according to Jayaprakasha *et al*. (2001) by using Folin-Ciocalteu reagent.

(RSA) radical scavenging activity:-

Free radical scavenging (RSA) of the samples were measured using the method of Brand-Williams *et al*.,(1995). The antioxidant activity was calculated using the following equation: Antioxidant activity (%) = [1– (Abs sample /Abs control)] × 100.

PH: was measured by an electrometric pH meter (model 68 ESD 19713), USA, fat, total solids were estimated according to Ling (1963).

Drinking yoghurt preparation:

Fresh buffalo's milk was standardized to 1.5 % fat, then turned to drinking yoghurt by official method using dried skimmed milk to raise the total solids to 13 % . The milk was heated to 80°C for 20 sec., cooled to 40°C and inculcated with starter, to reach pH 4.8. The set curd was stirred for 2 minutes. The strawberry or

blackberry was added, at the ratio 5.0, 7.0 and 9.0 %, mixed well and coaled to 5°C and kept in refrigerator for analyses.

RESULTS AND DISCUSSION

PH and Total solids

Table (2 and 3) shows the pH values of fortified yoghurt upon the different ratios. The obtained results during the comes of experiment and up to 14 days revealed that differences among the pH values were similar to that obtained at the initial time.

Table 2. PH of drinking yoghurt during storage period

Treatment		Drinking yoghurt Strawberry			Drinking yoghurt Black berry		
Storage period	Cont.	5 %	7 %	9 %	5 %	7 %	9 %
Fresh	4.8	4.75	4.7	4.65	4.75	4.7	4.65
After 7 days	4.7	4.65	4.6	4.60	4.65	4.6	4.60
After 14days	4.6	4.55	4.5	4.50	4.55	4.5	4.50

Table 3. Total solids of fresh drinking yoghurt

Treatment parameters	Drinking yoghurt Strawberry	Drinking yoghurt Black berry	Control
5 %	20.17	20.24	
7 %	23.11	23.13	13.1
9 %	26.27	26.32	

This finding indicates that supplemented yoghurt with berry fruits had no effect an pH values of the obtained products. On the other hand, the addition of berry fruits caused a significant increase in the total solids in comparison with control from 13.1% to 20.17, 23.11 and 26.27% upon the addition of strawberry at ratios 5,7 and 9% respectively.

Also similar trend of results was found to be 20.24, 23.13 and 26.32% upon the supplementation of blackberry ratio respectively.

RSA and TPC:-

Table (4) shows free radical scavenging activity (RSA) and total phenolic (TPC) of blak berry and strawberry. The obtained results show the high content of total phenolic compounds and free radical scavenging for both fruits by 448.55 , 206.20 (mg Gallic acid /g) 88.97 and 82.90 % respectively.

In the present study, the total phenolic compound in the following order blackberry > strawberry. On the other hand the RSA and TPC of yoghurt was lower than both blackberry and strawberry by 28.99% and 130.85 mg Gallic acid / g respectively. The results for the RSA and TPC in the supplemented yoghurt with strawberry during storge period up to 14 days one given in Table (4) and fig (1).

Table 4. Free radical scavenging (RSA) and total phenlic compounds (TPC) of Strawberry drinking yoghurt.

Conc.	RSA% Storage period(day)			TPC (mg Gallic acid/g) Storage period (day)		
	Fresh	7	14	Fresh	7	14
Control	28.99	23.49	17.08	130.85	129.65	129.50
5%	34.49	29.18	25.85	170.20	166.95	153.90
7%	40.92	39.90	27.45	191.85	178.10	157.40
9%	41.19	41.04	37.52	201.80	190.65	163.40

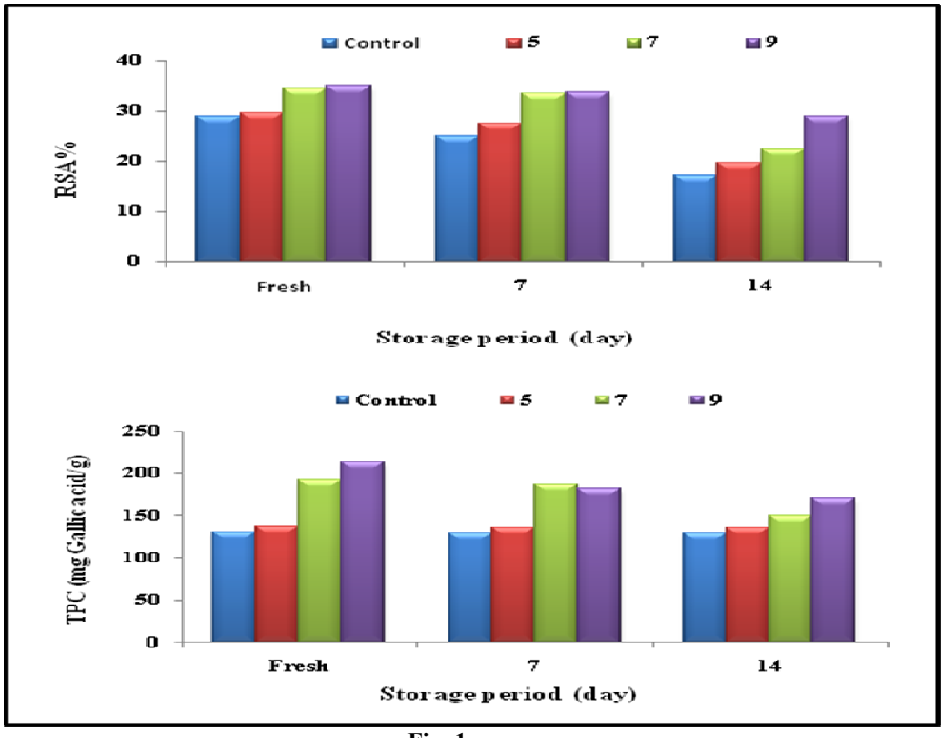

Fig. 1

It could be seen at t the highest value of RSA at the addition ratio 9 % by 29.08 % in comparison with control (without fortification) by 17.08. On the other hand, the RSA % was 19.70 and 22.41 at ratios 5% and

7 % supplementation. Similar trend of results was shown for TPC values in composition of control. At the end of treatment on increase in tested as samples were 136.25, 150.30, 170.40 (mg Gallic acid / g) against 129.50 mg Gallic acid / g for control.

Regardless, the supplemented yoghurt with blackberry table (5) and fig (2) show the effect of fortification of blackberry on both RSA % and TPC mg Gallic acid / g of yoghurt. It could be shown that an increase in RSA % was noticed by 25.85, 27.45 and 37.52 in comparison with control by 17.08 % at ratios 5, 7 and 9 % respectively. Concerning TPC values, the some trend of results was noticed, an increase in TPC values by 153.90 , 157.40 and 163.40 at ratios 5 , 7 and 9 % supplementation against 129.50 mg Gallic acid / g for control.

It can be concluded from the obtained data that the supplementation of both strawberry and blackberry play an important role as a modulator for the stability of the antioxidant activity of yoghurt, to an extent cowed an increase in RSA % and TPC concentration at the end of treatment upon the ratios understudy.

The best ratio of supplementation was 9 % for both strawberry and blackberry. In addition, it could be noticed that, a decrease in RSA % and TPC concentration during the course of treatment may be due to the affinity of milk protein to bind among the protein receptor with the active ingredients of both strawberry and blackberry.

Table 5. Free radical scavenging (RSA) and total phenlic compounds (TPC) of blackberry drinking yoghurt.

Conc.	RSA% Storage period(day)			TPC (mg Gallic acid/g) Storage period (day)		
	Fresh	7	14	Fresh	7	14
Control	28.99	25.08	17.08	130.85	129.65	129.50
5%	29.81	27.71	19.70	136.95	136.60	136.25
7%	34.52	33.67	22.41	191.85	187.20	150.30
9%	35.02	33.90	29.08	213.00	182.05	170.40

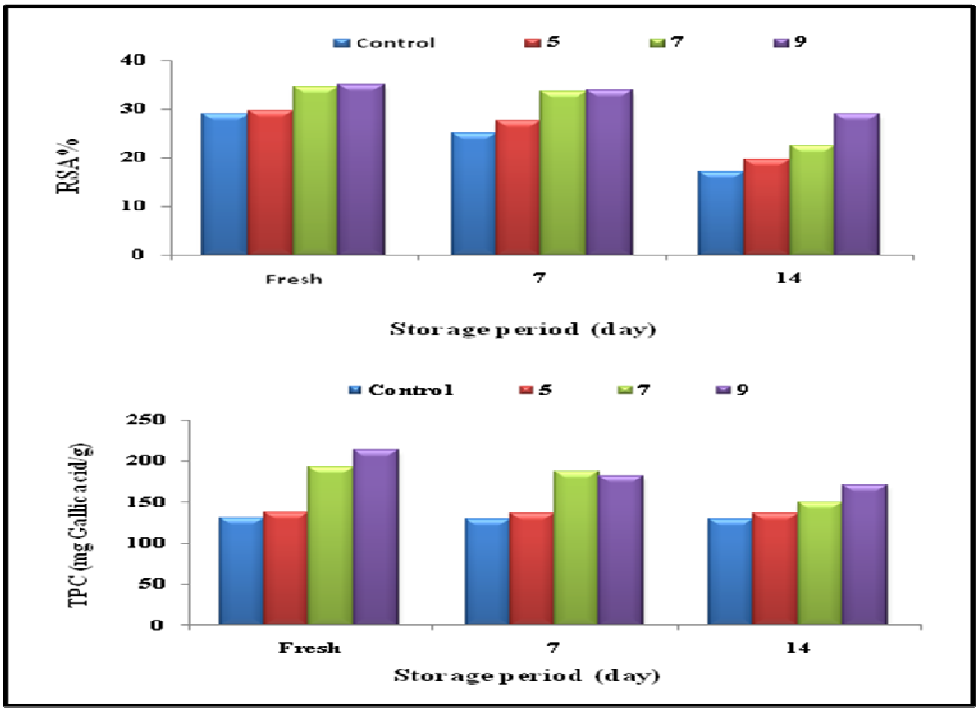

Fig. 2

Also, this finding may be due to the effect of Lactic acid on the bioactive compound in fortified yoghurt. Finally these results indicate that (an increasing order) in both RSA % and TPC concentration were correlated with the supplemented ratio of fruits to yoghurt.

CONCLUSION

The berry fruits containing a relatively polyphenol concentration can be successfully in incorporated into drinking yoghurt either a pre- or post fermentation. The obtained data are in agreement with data reported by (Carlsen *et al* 2010) who mentioned that the fortification of strawberry causes a lowering in the antioxidant activity of the fortified yoghurt. Also, with that mentioned by (Halvarsen *et al,* 2006) who found that strawberry among so foods products with the highest antioxidant capacity. So, strong antioxidant properties of these fruits from the considerable content of polyphenols.

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إنتاج مشروب زبادي وظيفي بثمار الفراولة والتوت الأسود

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تعتبر ثمار الفراولة والتوت الأسود البري مصدر غني بالمركبات الفينولية ومضادات الأكسدة ولها فوائد صحية عديدة ضد الأصول الحرة التي لها علاقة بزيادة خطر الإصابة ببعض الأمراض خاصة مرض السرطان ، ويتم الإضافة بعد عملية التخمير بنسبة ٥ ، ٧ ، ٩ % لكلا منهما ، وتشير النتائج أن إضافة ثمار الفراولة أو التوت الأسود تؤدي إلي زيادة كلا من مضادات الأكسدة والمركبات الفينولية في مشروب الزبادي وهذة الزيادة تنخفض حتي نهاية مدة التخزين سواء في عينات المقارنة أو العينات المستخدم فيها ثمار الفراولة أو التوت الأسود البري

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