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PHYSICOCHEMICAL, RHEOLOGICAL AND SENSORY PROPERTIES OF LOW-FAT YOGHURT SUPPLEMENTED WITH DRIED MUSHROOM POWDER

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ABSTRACT: The effect of adding dried mushroom powder as a source of antioxidants and fiber at level 1.0, 2.0 and 3.0% on physiochemical and sensory properties of low-fat yoghurt was studied. The properties of yoghurt samples including pH values, titratable acidity, syneresis, viscosity, dietary fiber, total phenolic content, antioxidant activity and sensory properties were determined when fresh and during storage for 15 days at 5-7°C. Results showed gradual increase in pH values, dietary fiber, viscosity, phenolic content and antioxidant activity as mushroom powder ratio was increased. On the other hand, the acidity and synersis were decreased as the ratio of mushroom powder increased. Low-fat yoghurt supplemented with up to 2% dried mushroom powder had similar appearance, flavor, texture, and overall acceptability as control of full fat yoghurt.

Key words: Yoghurt, mushroom powder, physicochemical properties, phenolic content, antioxidant activity.

INTRODUCTION

Yoghurt is one of the most consumed healthy and nutritious foodstuff worldwide .Yoghurt has a better proteins digestibility than milk and many latent positive effects on health by providing the human body prebiotic and probiotic bacteria (**Dabija *et al*., 2018**).

Low fat dairy products including yoghurt have gained popularity because of consumer awareness about health concerns related to decreasing the risks connected with obesity and coronary heart diseases (**Sandoval *et al*., 2004**). However, the partial or total removal of fat from yoghurt decreases the overall quality perceived by the consumers (**Folkenberg and Martens, 2003**). It was reported that reduction of fat content in yoghurt resulted in lower gel strength and firmness than full fat yoghurt, as a consequence of lower number of fat globules embedded in the protein network (**Duboc and Mollet, 2003**). To improve textural and functional properties of low- fat yoghurt, the use of cereal fibers has been widely investigated (**Hasani *et al*., 2017 and Dabija *et al*., 2018**).

Dietary fiber (DF) is the indigestible portion of food which helps in fighting against several diseases mainly associated with the modern life-style. However, milk is a concentrated source of life-sustaining nutrients with high digestibility and is purely devoid of DF. The fortification of milk and milk products with DF has resulted from discussed reasons, enhancement of fiber content of the product, replacement of fat or for some technological benefits, prebiotic effect, bulking agent along with artificial sweeteners or micronutrient premixes, (**Arora *et al*, 2015**).

Mushrooms are valuable resources for food, medicine and nutraceuticals. Edible mushroom is considered as a novel source of dietary fiber. The dietary fiber content and composition in edible mushroom vary greatly with its morphological stages including fruit body, mycelium and sclerotium (**Cheung, 2013**).

The nutritional significance of mushrooms has been long recognized due to their high fiber,

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vitamins, minerals and protein, and low fat contents. Mushrooms are rich in bioactive compounds with antioxidant properties, attributed mostly to phenolic compounds **(Ma *et al*., 2018**).

The present study was planned to evaluate the effect of adding mushroom powder as a source of dietary fiber on physicochemical, rheological, and sensory properties of low-fat yoghurt.

MATERIALS AND METHODS

Materials

Standardized buffalo's milk (3% fat) was obtained from Dairy Technology Unit, Food Science Department, Faculty of Agriculture, Zagazig University, Egypt. Edible mushroom (*Pleurotus plumonarius*) was obtained from Agriculture Research Center, Giza, Egypt. The mushrooms were washed by clean water blanched with steam for 7 min and dried in a thermostatically controlled oven with air fan to 55±5° C for 120 min. The dried mushroom was ground into powder form to pass through a 20 mesh/inch sieve, amd saved at 4°C until using (**Deshpande and Tamhne, 1981; Ibrahium and Hegazy, 2014**).

ABT-5 culture containing *Streptococcus thermophilus*, *Lactobacillus acidophilus* and *Bifidobacterium bifidum* were obtained from Chr-Hansen's Laboratories, Copenhagen, Denmark.

Methods

Manufacture of yoghurt

Milk containing 3% fat was used in the preparation of yoghurt and served as a control (C). Low fat buffalo's milk (1% fat) was divided into 4 portions. The first portion was left without additive as a low-fat yoghurt control (C1), mushroom powder was added to the other three portions at the rate of 1, 2 and 3% (T1, T2 and, T3). All milk bases were homogenized and heated to 90˚C for 15 min., then, cooled to 42 ± 1°C, inoculated with 2% of activation ABT-5 culture, filled in plastic cups and incubated at 42° C until a uniform coagulation was obtained (**Kebary and Hussein, 1999**). The yoghurt samples were kept at 5 ± 1°C, analyzed after fresh, 5, 10 and 15 days of manufacturing. This experiment was triplicated.

Chemical analysis

Total solids, fat, total protein contents, titratable acidity and dietary fiber of yoghurt samples were determined according to **AOAC (2007)**. pH values were measured using a laboratory pH meter with glass electrode (HANNA, Instrument, Portugal).

Rheological measurements

The syneresis and viscosity of yoghurt samples was measured according to **Aryana (2003)**. The quantity of whey collected from every sample in graduated cylinder after 2 h of drainage at 20° C was used as index of syneresis. Viscosity of yoghurt samples was determined using Rotational Viscometer Type Lab. Line Model 5437. Results expressed as Centipoise (CPS).

Determination of total phenolic content:

Total phenolic content was measured by a UV spectrophotometer (Jenway-UV–VIS Spectrophotometer), based on a colorimetric oxidation/reduction reaction, as described by **Skerget *et al*. (2005)**.

Radical scavenging activity (Scavenging DPPH)

Radical scavenging activity was measured by bleaching of the purple- colored solution of the 2, 2-diphenyl-1-picrylhydrazyl radical (DPPH) according to the method of **Hanato *et al*. (1988)** and modified by **Gulcin *et al*. (2004**).

Microbiological analysis:

Total bacterial count was determined according to **Houghtby *et al*. (1992)**, coliform bacteria, yeast and mould counts were determined according to **Marshall (1992)**.

Sensory evaluation

The sensory properties of yoghurt samples were assessed by 10 panel members at the Food Sci., Dep., Fac. Agric., Zagazig, Univ. for flavour (60) body and texture (30) and appearance (10) as reported in **Nelson and Trout (1981)**.

Statistical analysis

The obtained results were evaluated statistically using analysis of variance as reported by **McClave and Benson (1991)**. In addition the other reported values were expressed as mean ± SD and ± SE, two – tailed Student's t test was used to compare between different groups. P value less than 0.05 was considered statistically significant. SPSS (Chicago, IL, USA) software window Version 16 was used.

RESULTS AND DISCUSSION

Chemical Composition and Antioxidant Properties of Mushroom Powder

The Chemical composition of mushroom powder is presented in Table 1. Moisture, protein, fat, ash and dietary fiber contents of mushroom powder were (7.40, 18.25, 2.10, 8.34 and 51.20 g/100g respectively. These results are in agreement with the data obtained by **Han *et al*. (2016), Salehi (2019) and Tolera and Abera (2020)**.

Total phenolic content (TPC) of ethanolic mushroom powder was 620.14 mg/100g, while the radical scavenging activity RSA (%) was 78.50%. These results agree with that previously reported by **Rashidi and Yang (2016) and Sezer *et al*. (2017)**.

Chemical Composition of Low-Fat Yoghurt Supplemented with Mushroom Powder

Table 2 shows that full fat yoghurt (3% fat) had the highest total solids (TS) and it was significantly (p=0.05) different from all yoghurt treatments, while low- fat yoghurt treatments exhibited lower (TS) content. This decrease in TS was due to the fat separation from milk yoghurt treatments. The TS content of low- fat yoghurt supplemented with mushroom powder increased gradually by increasing the percentage added. The TS content of all yoghurt treatments slightly increased with storage period progressed.

Low-fat yoghurt treatments showed higher total protein compared with full fat yoghurt (C). This increase in total protein in parallel with increasing the level of supplementation. The total protein of all yoghurt treatments slightly increased with storage period progressed.

Supplementation of low fat milk with mushroom powder did not affect the fat content of the resultant low- fat yoghurt.

Dietary fiber content increased in low- fat yoghurt treatments with increasing the level of mushroom powder supplementation.

These results are in agreement with those reported by **Pappa *et al*. (2018)**, who found that addition of β-glucans, isolated from mushroom enhanced chemical characteristics of low-fat yoghurt. Also, **Salama *et al*. (2009)** found that addition of mushroom to buffalo milk could be achieved successfully in yoghurt making.

Acidity and pH Values of Low-Fat Yoghurt Supplemented with Mushroom Powder

Data presented in Table 3 showed that slight differences were observed in acidity of all yoghurt treatments. Fortification of low- fat yoghurt milk with MP decreased the acidity of low- fat yoghurt in parallel with increasing the level of supplementation. The acidity of all yoghurt treatments slightly increased as storage period progressed.

Changes in pH value of yoghurt from different treatments as affected by adding MP followed almost opposite trend to acidity .These results are in agreement with those reported by **Al-hamdani *et al.* (2015) and Hasani *et al*. (2017),** who found that addition of barley or lupine flour decreased the acidity of low-fat yoghurt. Also**, Pappa *et al*. (2018)** found that addition of β-glucans, isolated from mushroom decreased the acidity of low- fat yoghurt.

Total Phenolic Content and Radical Scavenging Activity of Low Fat Yoghurt Supplemented with Mushroom Powder

Data illustrated in Table 4 revealed that total phenolic content (TPC) and radical scavenging activity (RSA) of low fat yoghurt supplemented with mushroom powder were increased by mushroom powder increasing in the yoghurt product. The TPC and RSA% of all yoghurt treatments were decreased as storage period progressed.

These results are in agreement with those reported by **Mohamed *et al*. (2014) and Atwaa *et al*. (2020)** who found that adding different levels of dried grape pomace or mango pulp fiber waste powder as a source of antioxidants dietary fiber at level 1.0 to 5.0% or 1 to 3% increased the total phenolic content and radical scavenging activity of yoghurt treatments.

Table 1. Chemical composition and antioxidant properties of mushroom powder

Components	Concentrate
Chemical composition (g/100g)	
Moisture	7.40 ±0.94
Crude protein	18.25 ±1.32
Crude Fat	2.10± 0.36
Ash	8.34 ±0.86
Dietary fiber	51.20 ±1.30
Antioxidant properties	
Total phenolic compounds (mg/100g)	620.14±18.30
Radical scavenging activity (RSA) %	78.50 ±1.30

Table 2. Chemical composition of low-fat yoghurt supplemented with mushroom powder during storage at 5-7 °C for 15 days

Parameters	Storage period (day)	Treatment				
		C	**C1**	**T1**	**T2**	**T3**
TS%	**Fresh**	11.84±0.32a	10.0±0.36d	10.14±0.40cd	10.42±0.42c	10.94±0.45b
	5	12.00±0.35a	10.74±0.38d	10.92±0.33cd	11.18±0.44c	11.52±0.42b
	10	12.84±0.40a	11.02±0.33d	11.28±0.42cd	11.84±0.35c	12.08±0.32b
	15	13.04±0.42a	11.26±0.36d	11.88±0.33cd	12.42±0.42c	12.94±0.35b
Fat %	**Fresh**	3.05±0.22a	1.12±0.12b	1.20±0.12b	1.28±0.16b	1.36±0.18b
	5	3.18±0.20a	1.20±0.14b	1.24±0.14b	1.34±0.12b	1.40±0.14b
	10	3.26±0.18a	1.32±0.18b	1.40±0.12b	1.48±0.14b	1.54±0.12b
	15	3.32±0.22a	1.44±0.14b	1.48±0.22b	1.54±0.18b	1.60±0.16b
Protein %	**Fresh**	3.36±0.45bc	3.80±0.32b	4.12±0.24ab	4.28±0.36ab	4.36±0.40a
	5	3.54±0.33bc	3.98±0.21b	4.32±0.32ab	4.62±0.28ab	4. 70±0.36a
	10	3.72±0.40bc	4. 24±0.34b	4.60±0.28ab	4.66±0.36ab	5.08±0.33a
	15	4.00±0.30bc	4.38±0.36b	5.12±0.42c	5. 28±0.33ab	5.44±0.28a
Dietary fiber %	**Fresh**	0.00	0.00	0.06±0.01c	0.11±0.02b	0. 23±0.06a
	5	0.00	0.00	0.72±0.04c	1.46±0.04b	2.54±0.04a
	10	0.00	0.00	0.80±0.06c	1 .55±0.03b	2.66±0.06a
	15	0.00	0.00	0.94±0.02c	1.80±0.05b	3.28±0.02a

* Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$).
C: control yoghurt C_1: Low- fat yoghurt (1% fat).
T_1: Low- fat yoghurt treated with 1% mushroom powder
T_2: Low- fat yoghurt treated with 2% mushroom powder
T_3: Low- fat yoghurt treated with 3% mushroom powder

Table 3. Acidity and pH of low-fat yoghurt supplemented with mushroom powder during storage at 5-7°C for 15 day

Parameters	Storage period (day)	Treatment				
		C	C1	T1	T2	T3
Acidity %	Fresh	0.77±0.02[e]	0.86±0.02[a]	0.84±0.03[b]	0.82±0.01[c]	0.80±0.03[d]
	5	0.80±0.01[e]	1.02±0.01[a]	0.90±0.05[b]	0.86±0.04[c]	0.84±0.05[d]
	10	0.85±0.04[e]	1.28±0.03[a]	1.02±0.04[b]	0.94±0.05[c]	0.90±0.06[d]
	15	0.90±0.03[e]	1.44±0.04[a]	1.18±0.06[b]	1.08±0.02[c]	1.00±0.03[d]
pH	Fresh	4.70±0.02[a]	4.52±0.04[e]	4.58±0.06[d]	4.64±0.03[c]	4.68±0.02[b]
	5	4.58±0.04[a]	4.34±0.02[e]	4.36±0.03[d]	4.40±0.05[c]	4.46±0.06[b]
	10	4.56±0.03[a]	4.04±0.03[e]	4. 12±0.02[d]	4.20±0.04[c]	4.54±0.04[b]
	15	4.38±0.02[a]	3.84±0.02[e]	3.86±0.01[d]	3.88±0.02[c]	3.94±0.03[b]

* Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$).

Table 4. The effect of mushroom powder on total phenolic content and radical scavenging activity of low-fat yoghurt during storage at 5-7 °C for 15 day

Parameter	Storage period (day)	Treatment				
		C	C_1	T_1	T_2	T_3
Total phenolic content (mg /100 g)	Fresh	54.20±3.12[d]	50.40±3.25[e]	82.30±4.02[c]	112.60±5.14[b]	160.12±5.02[a]
	5	42.74±3.20[d]	38.28±3.32[e]	75.50±4.18[c]	100.84±4.02[b]	134.20±4.42[a]
	10	33.62±3.42[d]	30.22±3.40[e]	66.34±3.52[c]	94.44±3.40[b]	100.60±4.18[a]
	15	28.14±3.14[d]	26.60±3.18[e]	58.80±3.30[c]	82.30±3.12[b]	96.50±4.02[a]
Radical scavenging activity RSA %	Fresh	22.40±1.32[d]	20.30±1.24[e]	30.18±1.56[c]	48.24±1.72[b]	55.30±1.44[a]
	5	16.70±1.12[d]	13.50±1.33[e]	26.70±1.52[c]	42.20±1.28[b]	44.80±1.62[a]
	10	10.42±1.02[d]	9.20±1.36[e]	20.80±1.33[c]	34.80±1.18[b]	40.92±1.40[a]
	15	8.90±1.14	7.80±1.08[e]	14.82±1.122[c]	26.20±1.02	36.40±1.32

* Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$).

Rheological Properties of Low-Fat Yoghurt Supplemented With Mushroom Powder

Whey syneresis was increased while viscosity decreased by decreasing the fat content in yoghurt treatments. Fortification of low- fat yoghurt with MP significantly reduced whey syneresis and increased viscosity compared with control of low- fat yoghurt and these parameters in parallel with increasing the level of supplementation (Table 5). The whey syneresis and viscosity of all yoghurt treatments increased as storage period progressed.

These results might be due to increasing the water holding capacity brought by MP and the dietary fibers may which affect the viscosity, solubility, oil-binding capacity and hydration property in dairy products (**Behnia *et al*., 2013; Jambi, 2018**). Similar results were reported by **Hassan *et al*. (2015)**, who found that the addition of cress seed mucilage or guar gum to yoghurt reduced its whey syneresis and increased viscosity than control yoghurt. Also, **Pappa *et al*. (2018)**, found that addition of β-glucans, isolated from mushroom to yoghurt reduced the whey syneresis and increased the viscosity.

Table 5. Whey syneresis and viscosity of low- fat yoghurt supplemented with mushroom powder during storage at 5-7°C for 15 day

Parameter	Storage period (day)	Treatment				
		C	C_1	T_1	T_2	T_3
Whey syneresis (ml/100gm)	Fresh	24.00±0.42[e]	32.00±0.54[a]	30.00±0.52[b]	28.00±0.44[c]	26.00±0.60[d]
	5	28.00±0.55[e]	35.00±0.57[a]	32.00±0.46[b]	30.00±0.48[c]	29.00±0.42[d]
	10	31.00±0.46[e]	40.00±0.52[a]	36.00±0.42[b]	33.00±0.50[c]	31.00±0.52[d]
	15	34.00±0.60	44.00±0.62[a]	40.00±0.58[b]	38.00±0.52[c]	36.00±0.44[d]
Viscosity (C. P.S.)	Fresh	5100±110[a]	4120±114[e]	4210±130[d]	4530±144[c]	5000±150[b]
	5	5240±98[a]	4230±105[e]	4280±140[d]	4580±160[c]	5080±140[b]
	10	5320±114[a]	4320±144[e]	4340±152[d]	4610±142[c]	5130±118[b]
	15	5380±104[a]	4380±118[e]	4390±122[d]	4640±152[c]	5160±130[b]

* Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$).

Microbiological Evaluation of Low-Fat Yoghurt Supplemented with Mushroom Powder

Table 6 showed that there were significant differences in viable bacterial count between control full fat yoghurt and other low- fat yoghurt samples. The results indicated that control full fat yoghurt had the lowest total bacterial but contain the highest count of yeast and mould compared with low fat yoghurt treatments. Low- fat yoghurt supplemented with MP had the highest counts of total bacterial counts in parallel with increasing the level of supplementation compared with control of low-fat yoghurt. Total bacterial counts of all treatments decreased gradually as storage period progressed.

Coliform counts were not detected in all treatments up to the end of storage period. The general trend of these results to agree with those reported by **Elsanhoty *et al.* (2009) and Habib *et al.* (2018)**. In addition, similar results were obtained by **Elsanhoty and Ramadan (2017) and Pappa *et al.* (2018)**, who found that fortification of low- fat yoghurt with barley β-glucan or β-glucans, isolated from mushroom enhanced the microbial quality of yoghurt during storage.

Organoleptic Properties of Low-Fat Yoghurt Supplemented with Mushroom Powder

From Table 7 it can be seen that fortification of low- fat yoghurt milk with MP improved the organoleptic properties of low fat treatments and this improvement in parallel with increasing the level of supplementation. Low-fat yoghurt supplemented with 2 % PM was similar to the full fat yoghurt (control). The Organoleptic properties of all yoghurt treatments decreased as the storage period progressed. A similar observation was found by **Al-Hamdani *et al.* (2015)**, who found that supplementation of yoghurt with lupine flour enhanced the sensory evaluation of resultant yoghurt. Also **Atwaa *et al.* (2020)**, found that fortification of low fat yoghurt with Mango pulp fiber waste powder enhanced the sensory evaluation of resultant yoghurt.

Conclusion

Mushroom powder contain high amount of dietary fiber. Therefore, mushroom powder could be used at a rate of 2 % as a source of dietary fiber in manufacture of low- fat yoghurt to improve its physicochemical, rheological and sensory properties.

Table 6. Microbiological evaluation of low- fat yoghurt supplemented with mushroom powder during storage at 5-7 °C for 15 day

Properties	Treatments	Storage period (days)			
		Fresh	5	10	15
T.B.C CFU /g	C	36×10^7	34×10^7	30×10^7	26×10^7
	C1	47×10^7	43×10^7	42×10^7	38×10^7
	T1	49×10^8	46×10^8	45×10^8	41×10^8
	T2	52×10^8	49×10^8	49×10^8	45×10^8
	T3	50×10^8	46×10^8	46×10^7	39×10^8
Coliform CFU /g	C	ND	ND	ND	ND
	C1	ND	ND	ND	ND
	T1	ND	ND	ND	ND
	T2	ND	ND	ND	ND
	T3	ND	ND	ND	ND
Yeasts & Moulds CFU/10^2/ g	C	ND	ND	ND	18×10^2
	C1	ND	ND	ND	12×10^2
	T1	ND	ND	ND	8×10^2
	T2	ND	ND	ND	6×10^2
	T3	ND	ND	ND	8×10^2

ND= not detected.

Table 7. Organoleptic properties of low-fat yoghurt as affected by adding mushroom powder during storage at 5-7°C for 15 day

Parameters	Storage period (day)	Treatments				
		C	C_1	T_1	T_2	T_3
Body& texture (30)	**Fresh**	30.00 ± 0.42^a	$22 .00\pm0.40^a$	26.00 ± 0.36^a	28.00 ± 0.40^b	28.00 ± 0.32^b
	5	30.00 ± 0.33^a	22.00 ± 0.28^e	25.00 ± 0.42^d	28.00 ± 0.38^b	27.00 ± 0.35^c
	10	28.00 ± 0.28^a	20.00 ± 0.36^e	22.00 ± 0.33^d	25.00 ± 0.30^b	24.00 ± 0.40^c
	15	26.00 ± 0.30^a	20.00 ± 0.32^d	22.00 ± 0.35^c	23.00 ± 0.36^b	23.00 ± 0.38^b
Flavour (60)	**Fresh**	56.00 ± 0.62^a	53.00 ± 0.70^d	$55 .00\pm0.50^d$	56.00 ± 0.54^b	55.00 ± 0.44^b
	5	58.00 ± 0.52^a	55.00 ± 0.63^d	56.00 ± 0.64^c	57.00 ± 0.62^b	57.00 ± 0.50^b
	10	56.00 ± 0.60^a	50.00 ± 0.55^d	53.00 ± 0.72^d	55.00 ± 0.58^b	54.00 ± 0.62^b
	15	56.00 ± 0.58^a	50.00 ± 0.72^d	50.00 ± 0.66^d	54.00 ± 0.55^b	53.00 ± 0.70^b
Appearance (10)	**Fresh**	9.00 ± 0.16^a	8.00 ± 0.18^b	8.00 ± 0.11^b	8.10 ± 0.09^{bc}	7.90 ± 0.11^c
	5	8.50 ± 0.20^a	7.50 ± 0.16^b	7.50 ± 0.18^b	7.60 ± 0.12^{bc}	7.30 ± 0.14^c
	10	8.30 ± 0.12^a	7.30 ± 0.12^b	7.30 ± 0.14^b	7.40 ± 0.18^{bc}	7.20 ± 0.20^c
	15	8.00 ± 0.18^a	7.10 ± 0.20^b	7.10 ± 0.20^b	7.30 ± 0.16^{bc}	7.00 ± 0.22^c
Total (100)	**Fresh**	95.00 ± 1.02^a	83.00 ± 1.12^e	89.00 ± 1.00^d	92.10 ± 1.14^b	90.90 ± 1.16^c
	5	96.50 ± 0.96^a	84.50 ± 1.04^e	88.50 ± 1.02^d	92.60 ± 1.06^b	91.30 ± 1.04^c
	10	92.30 ± 1.14^a	77.30 ± 0.96^e	82.30 ± 0.98^d	87.40 ± 102^b	85.20 ± 1.00^c
	15	89.00 ± 0.92^a	77.10 ± 0.94^e	79.10 ± 1.02^d	84.30 ± 1.12^b	83.00 ± 0.98^c

* Values (means ±SD) with different superscript letters are statistically significantly different ($P \leq 0.05$).

REFERENCES

Al-Hamdani, M.S., E.H. Al-Anbary and M. Ahmed (2015). Effect of Lupin (*Lupinus albifrons*) flour on microbial and sensory properties of local Yoghurt. Advances in Life Sci. and Technol., 34.1-6.

AOAC (2007). Association of official analytical chemists-official method of analysis (18th Ed.), Benjamin Franklin Station Washington, DC, USA.

Arora, S.K., A.A. Patel and O.P. Chauhan (2015). Trends in Milk and Milk Products Fortification with Dietary Fibers. Ame. J. Advanced Food Sci. and Technol., 3 (1): 14-27.

Aryana, K.J. (2003). Folic acid fortified fat free plain set yoghurts. Int. J. Dairy Technol., 56 (4): 219-222.

Atwaa, E.H., Eman T. Abou Sayed-Ahmed and M.A.A. Hassan (2020). Physicochemical, microbiological and sensory properties of low fat probiotic yoghurt fortified with mango pulp fiber waste as source of dietary fiber. J. Food and Dairy Sci., 11 (9):271-276.

Behnia, A., H. Karazhiyan, R. Niazmand and A.R.M. Nafchi (2013). Rheological properties of low fat yoghurt containing cress seed gum. Agric. Sci., 4: 29–32.

Cheung, P.C.K. (2013). Mini-review on edible mushrooms as source of dietary fiber: Preparation and health benefits. Food Sci. and Human Wellness, 22:1-5.

Dabija, A., G.G. Codinăa, A.M. Gâtlana and L. Rusu (2018). Quality assessment of yoghurt enriched with different types of fibers. Cyta – J. Food, 16 (1): 859–867.

Deshpande, A. and D. Tamhne (1981). Studies on dehydration of mushrooms. J. Food Sci. Tech., 18: 96-101.

Paeaekkoenen, K. and R. Kurbela (1987). Effect of drying method on the water sorption of blanched Northern milk cap mushrooms (*Lactarius trivialis*) at different temperatures. Lebens. Wiss. Technol., 20: 158-161.

Duboc, P. and B. Mollet (2003). Applications of exopolysaccharides in the dairy industry. Int. Dairy. J., 11: 759-768.

Elsanhoty, R., A. Zaghlol and A. Hassanein (2009). The manufacture of low fat labneh containing barely beta-Glucan 1-Chememical composition, microbiological evaluation and sensory properties. Current Res. Dairy Sci., 1: 1-12.

Elsanhoty, R.M. and M.F. Ramadan (2018). Changes in the physicochemical and microbiological properties of probiotic-fermented low-fat yoghurt enriched with barley β-glucan during cold storage. Mljekarstvo, 68 (4): 295-309.

Folkenberg, D.M. and M. Martens (2003). Sensory properties of low fat yoghurts. Part A: Effect of fat content, fermentation culture and addition of non-fat dry milk on the sensory properties of plain yoghurts. Milchwissenschaft, 58: 48-51.

Gulcin, I., O.I. Kufrevioglu, M. Oktay and M.E. Buyukokuroglu (2004). Antioxidant, antimicrobial, antiulcer and analgesic activities of nettle (*Urticadioica* L.). J. Ethnopharmacol., 90: 205–215.

Habib, E.E., S.S.A. Awad and H.M. Ziena (2018). Physicochemical and sensory properties of labneh fortified with *salvia Officinalis*. Alex. Sci. Exch. J., 38 (4): 761-769.

Han, N., W.A.N.W. Ahmad and W.R.W. Ishak (2016). Quality Characteristics of Pleurotus Sajor-caju Powder: Study on Nutritional Compositions, Functional Properties and Storage Stability. Sains Malays., 45: 1617–1623.

Hanato, T., H. Kagawa, T. Yasuhara and T. Okuda (1988). Two new flavonoids and other constituents in licorice root: their relative astringency and radical scavenging effects. Chem. Pharm. Bull., 36: 2090–2097.

Hasani, S., A.A. Sari, A. Heshmati and M. Karamim (2017). Physicochemical and sensory attributes assessment of functional low-fat yoghurt produced by incorporation of barley bran and *Lactobacillus acidophilus*. Food Sci. Nutr., 5:875–880.

Hassan, L.K., H. Haggag, M. ElKalyoubi, M. Abd El-Aziz, M. El-Sayed and A. Sayed (2015). Physico-chemical properties of yoghurt containing cress seed mucilage or guar gum, Ann. Agric. Sci., 60 (1): 21–28.

Houghtby, G.A., L.J. Matuin, and E.K. Koenig (1992). Microbiological count methods. In: Standard methods for the examination of dairy products Marshall, T.R. (Editor) Ame. Public Health Assoc., Washington, DC., USA.

Ibrahium, M.I. and A.I. Hegazy (2014). Effect of replacement of wheat flour with mushroom powder and sweet potato flour on nutritional composition and sensory characteristics of biscuits. Current Sci. Int., 3 (1): 26-33.

Jambi, H.A. (2018). Evaluation of physio-chemical and sensory properties of yoghurt prepared with date pits powder. Current Sci. Int., 7 (1):1-9.

Kebary, K.M.K. and S.A. Hussein (1999). Manufacture of low fat Zabady using different fat replacers. Acta Alimetaria, 28 (1): 1 – 14.

Ma, G., W. Yang, L. Zhao, F. Pei, D. Fang and Q. Hu (2018). A critical review on the health promoting effects of mushrooms nutraceuticals. Food Sci. and Human Wellness Human Wellness, 7 (2):125-133.

Marshall, R.T. (1992). Standard Methods for the Examination of Dairy Products. 16th Ed. Ame. Public Health Assoc. (APHA), Washington, DC, USA, 158.

Martin-Diana, A.B., C. Janer and T. Requena, (2003). Development of a fermented goat's milk containing probiotic bacteria. Int. Dairy J., 13 : 827-833.

McClave, J.T. and P.G. Benson (1991). Statistical for business and economics. Max Well Macmillan Int. Ed. Dellen Publishing Co. USA, 272-295.

Mohamed, A.G., A.F. Zayan and N.M. Shahein (2014). Physiochemical and sensory evaluation of yoghurt fortified with dietary fiber and phenolic compounds. Life Sci. J., 11 (9): 816-822.

Nelson, J.A. and G.H. Trout (1981). Judging of dairy products, 4th Ed. INC Westport, Acad. Press., 345-567.

Pappa, E.C., E. Kondyli and W.M. Naughtan (2018). Quality and sensory properties of reduced fat yoghurt made with addition of β-glucans. Food and Nutr. Sci. Food and Nutr. Sci., 9: 390-402.

Rashidi, A.N.M. and T.A. Yang (2016). Nutritional and antioxidant values of oyster mushroom (*p. sajor-caju*) cultivated on rubber sawdust. Int. J. Advanced Sci., Eng. and Information Technol., 6 (2):161-164.

Salama, W.M., R.O. Mohamed and A.S Elsisi (2009). Production of yoghurt fortified with mushroom. Egypt. J. Agric. Res., 87: 1479-1490.

Salehi, F. (2019). Characterization of different mushrooms powder and its application in bakery products: A review. Int. J. Food Properties, 22(1): 1375–1385.

Sandoval-Castilla, O., C. Lobato-Calleros, E. Aguirre-Mandujano and R.J. Vernon-Carter (2004). Microstructure and texture of yoghurt as influence by fat replacers. Int. Dairy J., 14: 51-159.

Sezer, Y.C., O. Süfer and G. Sezer (2017). Extraction of phenolic compounds from oven and microwave dried mushrooms (*Agaricus bisporus* and *Pleurotus ostreatus*) by using methanol, ethanol and aceton as solvents. Indian J. Pharm. Education and Res., 51 (3): 5393-5397.

Skerget, M., P. Kotnik, M. Hadolin, A. Rižner-Hraš, M. Simonič and Z. Knez (2005). Phenols, proanthocyanidins, flavones and flavonols in some plant materials and their antioxidant activities. Food Chem., 89: 191–198.

Tolera, K.D. and S. Abera (2020). Nutritional quality of oyster mushroom (*Pleurotus Ostreatus*) as affected by osmotic pretreatments and drying methods. Food Sci Nutr., 2017: 1–8.

الخصائص الفيزوكيميائية والريولوجية والحسية لليوجورت منخفض الدهن المدعم بمسحوق فطرعيش الغراب

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تمت دراسة تأثير إضافة مستويات مختلفة من مسحوق فطر عيش الغراب المجفف كمصدر لمضادات الأكسدة والألياف عند المستويات 1.0 و 2.0 و 3.0% على الخصائص الفيزيائية، الكيميائية، الريولوجية، البكتريولوجية، المحتوى الكلى للفينولات ، النشاط المضاد للأكسدة والحسية لليوجورت منخفض الدهن المصنع خلال التخزين لمدة 15 يومًا على درجة حرارة 5-7 درجة مئوية.أظهرت النتائج حدوث زيادة لقيم الأس الهيدروجيني، الألياف الغذائية، اللزوجة، محتوى الفينولات الكلية والنشاط المضاد للأكسدة بزيادة نسبة مسحوق الفطر المضاف الى اليوجورت منخفض الدهن. من ناحية أخرى، قلت قيم الحموضة وانفصال الشرش مع زيادة نسبة مسحوق الفطرالمضاف. .ولوحظ ان اليوجورت منخفض الدهن المدعم ب 2% من مسحوق الفطر المجفف له نفس المظهر والنكهة والقوام و القبول العام لعينة اليوجورت كامل الدسم.

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