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Preparation of Cheese Yoghurt Using Extracted High Virgin Olive Oil

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ABSTRACT

Olive oil was laboratorial extracted by pressure system from olive fruit variety Koroneiki by using different concentration of sodium chloride (NaCl) during malaxation step. Using 2% NaCl was the best concentration where it enhanced oil extraction, improved the quality of the resultant oil as well as increased oil stability. The resultant olive oil was used in preparing of cheese yoghurt. Fermented buffalo milk (after adding the starter) was divided into three portions, the first portion serve as control while, the second and third part was fortified with 1 and 2% (w/w) of the extracted olive oil, respectively. The three portions were manufactured cheese yoghurt by the traditional method. Results revealed that samples manufactured by 1% olive oil gained the highest sensory scores, they possessed good flavor, acceptable body and texture and favorite appearance. These properties were gradually decreased with the progress of storage (after 2 weeks) to reach the minimum scores at the end of storage. Generally, the values of pH decreased during cold storage until 3 weeks; whereas, TS, TP increased in all treatments and TVFAs took the same trend. Acetaldehyde and diacetyl contents were also increased until 2 weeks then they began to decrease until the end of storage (3 weeks) in all treatments. Total viable count and lactic acid bacteria were gradually increased during storage at 5±1°C till the first week then it decreased through the remaining period of storage (2 weeks). Control and treatments behaved the same trend. Yeast and molds were not detected throughout storage. All samples were free of coliforms. So, It could be concluded that using of olive oil in preparing cheese yoghurt did not clearly affected the chemical and microbiological properties of the resultant product; however a noticeable improvement in the sensory properties was observed when used 1% olive oil.

Key words: Olive fruit variety Koroneiki, malaxation step, cheese yogurt, microbiology examinations, sensory properties

INTRODUCTION

Olive (*Olea europea* L.) is an evergreen tree that has been traditionally cultivated for olive oil and table consumption. Olive oil is classified as virgin olive oil if it has been extracted exclusively by mechanical or physical procedures such as milling, beating, centrifugation and decantation (Gandul-Rojas *et al*., 2000). The importance of virgin olive oil is related to its high levels of mono-unsaturated fatty acids (mainly oleic acid) and to the presence of minor components including aliphatic and tri-terpenic alcohols, sterols, hydrocarbons, volatile compounds and

several antioxidants (Ocakoglu *et al*., 2009). Several methods have been proposed improving oil extraction procedures including enzymatic pretreatment (Aliakbarian *et al*., 2008; De Faveri *et al*., 2008), sodium chloride (Cruz *et al*., 2007; Hassan *et al*., 2015) and calcium carbonate (Moya *et al*., 2010). However, limited studies have been carried out on the utilization of olive oil in dairy products. Concentrated yoghurt or cheese yoghurt is popularly known as labneh in the Middle East, as strained yoghurt in Greece, the rest of Europe and as suzme yoghurt in Turkey (Guler, 2007; Senel *et al*., 2011). In the last decades, consumer demands in the field of food production have considerably changed; consumers believe that foods contribute directly to their health (Mollet and Rowland, 2002) such as olive oil is needed. On the other hand, several researches were done to improvement the quality and shelf- life of labneh by different attitudes such as using olive oil (El-Sayed *et al*., 1993; Salem *et al*., 2007) and by using essential oils (Al-Otaibi and El-Demerdash, 2008; Mohamed *et al*., 2013; Zaky *et al*., 2013; Thabet *et al*., 2014).

Therefore, the objective of this study was to investigate the feasibility of using olive oil which extracted in the laboratory by pressure system from Koroneiki olive fruit variety by using 2% NaCl during malaxation step (as best treatment) in preparing of cheese yoghurt. Then study its effect on the sensory properties, chemical composition and the microbiological examination of the resultant product during cold storage at 5±1°C for 3 weeks.

MATERIALS AND METHODS

Materials: Fresh buffaloes milk (contain 6% fat and 17% TS) was obtained from the herd of the Faculty of Agriculture, Cairo University, Giza Egypt.

Pure cultures (*S. salivaricus* subsp. *thermophilus* and *L. delbruechii* subsp. *bulgaricus*) were obtained from Chr. Hansen's Laboratories, Corenhangen, Denmark. Cultures were propagated in sterile skim milk at 37°C. Olive oil was extracted by pressure system from Koroneiki olive fruit variety by using 2% NaCl during malaxation step as mentioned by Hassan *et al*. (2015). Its properties were as follow in Table 1.

Yoghurt cheese preparation: Samples were prepared by a procedure normally used in the Middle East (El-Sayed *et al.,* 1993). Milk was heated at 85°C for 15 min, then cooled to 40°C, inoculated with 2% starter culture (*S. thermophilus*+*L. bulgaricus*, 1:1). Milk was divided into three portions; the first was served as control while the two other portions were fortified by 1 and 2% extracted olive oil (w/v), respectively. The fermented milks were incubated for 12 h at 40°C for complete coagulation. Resultant coagula were held in refrigerator (4-5°C) for 3 h, then hanging in the refrigerator overnight in cloth bags to drain the whey. The resulting curds were mixed with 1.0% salt and stored for 21 days in refrigerator. Samples were analyzed fresh and during cold storage (7, 14 and 21 days) for chemical, microbiological and organoleptic properties.

Table 1: Physical and chemical properties of extracted olive oil

Samples	Olive oil
FFA (oleic acid)	0.6600±0.02
PV (meq O_2/kg oil)	9.4800±0.09
Iodine value (g I_2/100 g oil)	80.7700±1.21
RI (25°C)	1.4670±0.01
Oxidative stability (h)	31.1500±1.12
Melting point (°C)	0.9000±0.22

Analytical methods

Sensory evaluation: Sensory evaluation was carried out for all treatments, using a score scheme (10, 40 and 50 points) for appearance, body and texture and flavor, respectively by a panel of 20 trained Jude's of stuff members at Dairy Laboratory NRC, according to score card suggested by Keating and White (1990).

Chemical analysis: Total solids, total protein and soluble nitrogen were determined according to AOAC (2007). The pH values were measured using a digital laboratory PH meter (HI 94 1400, Hanna instruments). Total Volatile Fatty Acids (TVFAs) values were determined according to Kosikowski (1986) and expressed as milliliter of 0.1 N NaOH/100 g. Acetaldehyde content (mmol/100 g) was estimated according to Lee and Jago (1969) and diacetyl content (mmol/100 g) was determined as reported by Pack *et al.* (1964).

Microbiological examination: Total viable count was determined by using plate count agar medium as described by Klose (1968), coliform detected by Violet Red Bile Agar medium (VRBA) using the method described by the APHA (1978). Moulds and yeasts were also detected by acidified potato dextrose agar according to Harrigan and McCance (1966). Lactic acid bacteria count was carried out on MRS medium for *Lactobacillus bulgaricus* and M 17 for *Streptococcus thermophilus* as described by Gruev (1982) and Krusch *et al.* (1987).

Statistical analysis: Statistical analysis was performed using the GLM procedure with SAS (2004) software. Analysis of variance (ANOVA) and Duncan's multiple comparison procedure were used to compare the means. A probability of $p<0.05$ was used to establish statistical significance.

RESULTS AND DISCUSSION

Sensory properties: From Table 2, it could be noticed that cheese yoghurt samples contained olive oil (T_1 and T_2) were more acceptable than control and they gained a highest total score. It is also clear that (labneh contained 1% olive oil, T_1) had gained the highest total scores followed by T_2 and control. Gradually decreases in scores were observed with the progress of storage to reach the minimum scores at the end of storage. Slight differences were, also observed in the appearance

Table 2: Organoleptic properties of yoghurt cheese samples when fresh and during storage at 5±1°C for 21 days

Time and treatments	Appearance (10)	Body and texture (40)	Flavor (50)	Total score (100)
Zero time				
Control	8.80±1.20^a	36.00±1.52^b	44.37±1.51^c	89.11
A	8.60±1.15^a	37.00±1.40^a	47.40±1.60^a	93.00
B	8.60±1.45^a	37.00±1.70^a	46.60±2.38^b	92.20
After one week				
Control	7.00±1.14^b	33.12±1.45^b	44.20±2.30^c	84.32
A	8.37±2.62^a	34.37±2.15^a	46.37±1.95^a	89.11
B	8.25±2.21^a	34.87±1.88^a	45.12±2.45^b	88.24
After two weeks				
Control	7.00±2.04^b	32.42±2.25^b	42.00±1.57^c	81.42
A	8.25±1.86^a	33.65±2.18^a	45.25±1.68^a	87.15
B	8.15±1.68^a	33.92±1.97^a	44.35±2.84^b	86.42
After three weeks				
Control	6.85±1.54^b	31.64±2.02^b	40.50±1.25^c	78.99
A	7.98±1.87^a	32.95±1.89^a	43.16±2.89^a	84.09
B	7.28±1.62^a	32.14±1.92^a	42.28±2.35^b	81.70

C: Control, T_1: Sample with 1% olive oil, T_2: Sample with 2% olive oil, Means follower by different letters are significantly different

of control and treatments. T_1 had gained the highest score for flavor and their values were gradually decreased until the three weeks. These results are in agreement to El-Sayed *et al*. (1993), Salem *et al.* (2007), Zaky *et al*. (2013) and Thabet *et al*. (2014). On the other side, T_2 sample which prepared with (2% olive oil) had a highest score for body and texture than control and other treatments. Control and other treatments behaved the same trend.

Chemical parameters: Figure 1-2 showed the chemical composition of fresh samples and that stored at 5±1°C for 3 weeks. It could be notice that control had the highest pH values followed by T_1, T_2. Generally, the pH values (Fig. 1a) of control as well as T_1 and T_2 samples were decreased during cold storage. These results were in accordance with Ersoz *et al.* (2011) and Zaky *et al*. (2013). For total solids contents (TS%), it is clear that control had the highest TS followed by T_1, T_2, (Fig. 1b). The TS contents increased in all treatments as the cold storage increased until 3 weeks. These results were in agreement also to Mahdi *et al*. (1990) and El-Sayed *et al*. (1993). On the other side, control had the highest content of TP% followed by T_1, T_2 and gradually increased (either control or treatments) during storage until 3 weeks and T_2 had lowest TP%. These results were in agreement with Al-Otaibi and El-Demerdash (2008) and Thabet *et al*. (2014).

Soluble nitrogen content (%) was the highest at (T_2) followed by (T_1) and control (Fig. 1d). They contents were gradually increased during cold storage at 5±1°C until 3 weeks. These results were in agreement to Ismail *et al.* (2006).

From Fig. 2a, the Total Volatile Fatty Acids (TVFAs) contents were affected by addition of olive oil. T2 had the highest content of TVFAs where control had the lowest content of TVFAs. Increasing

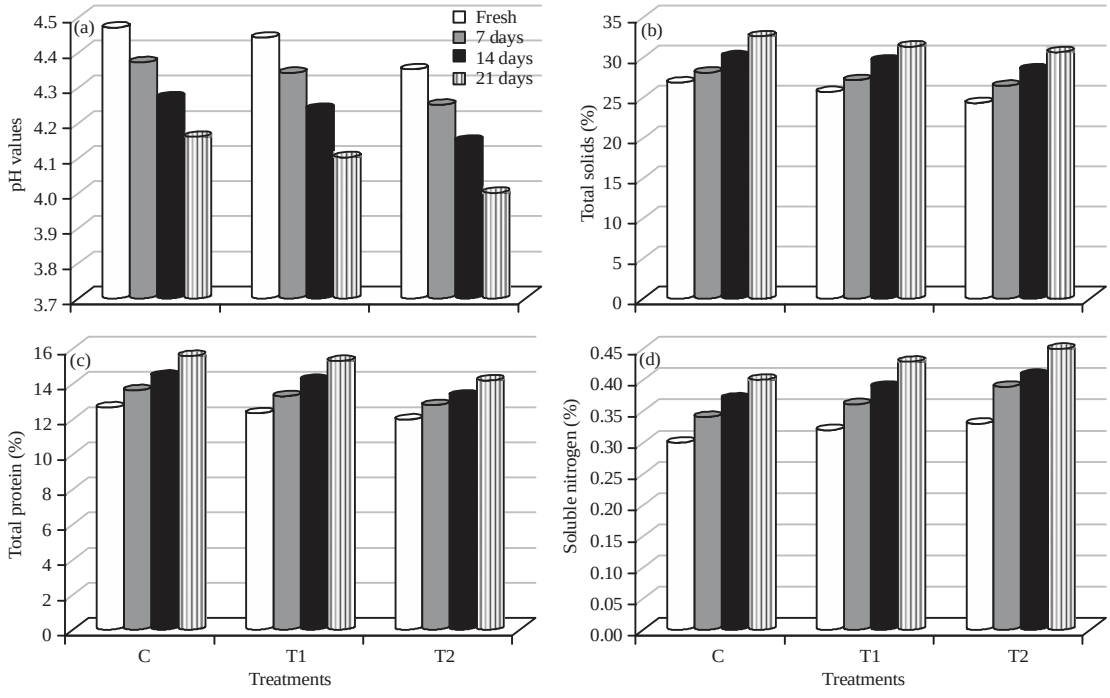

Fig. 1(a-d): (a) pH values, (b) Total solids, (c) Total protein and (d) Soluble nitrogen of cheese yoghurt samples as affected by adding olive oil during 21 days of storage at 5±1°C, C: Control, T_1: Sample with 1% olive oil, T_2: Sample with 2% olive oil

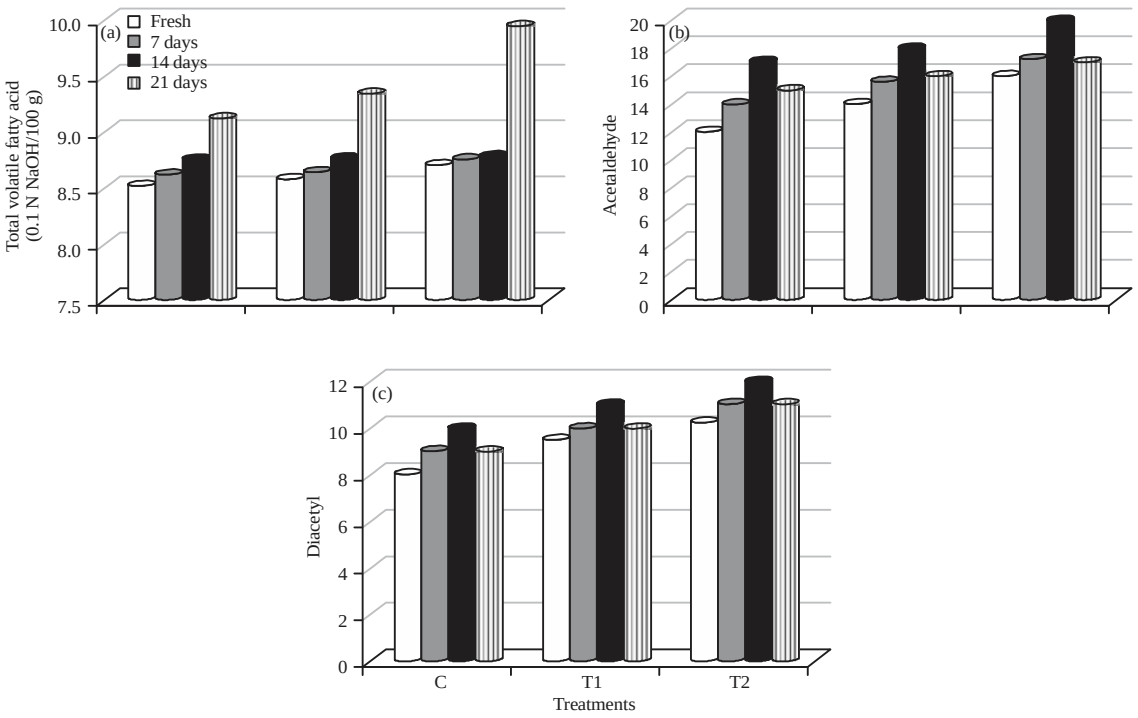

Fig. 2(a-c): (a) Total volatile fatty acids, (b) Acetaldehyde content and (c) Diacetyl content of cheese yoghurt samples as affected by adding olive oil during 21 days of storage at 5±1°C, C: Control, T_1: Sample with 1% olive oil, T_2: Sample with 2% olive oil

the concentration of oil led to increase of TVFAs. The TVFAs had gradually increased during cold storage until (3 weeks). These results were in agreement to Zaky *et al*. (2013) and Al-Otaibi and El-Demerdash (2008). The increases in TVFAs could be explain on the basis that the increase in the cheese proteolysis as amino acid can serve as precursors for the development of certain volatile fatty acid (Salem *et al*., 2007) and the TVFAs of olive oil itself. Similar results were also reported for Edam cheese by Kebary *et al*. (2002) and Abd El-Salam *et al*. (2011) for probiotic labneh.

Acetaldehyde and diacetyl contents: Figure 2b-c indicated the acetaldehyde and diacetyl contents (mmol/100 g) of labneh fresh and during cold storage. It could be notice that level of acetyldehyde was higher than diacetyl either fresh or during cold storage. T_2 samples had a higher content of both acetaldehyde and diacetyl than control and T_1 samples. It was obvious that both acetaldehyde and diacetyl contents were increased to reach maximum values till 14 days of cold storage then deceased until the end of experiment (21 days) in all treatments. These results are in agreement to Salem *et al*. (2007) and Zaky *et al*. (2013).

Microbiological examination: Figure 3-5 reflected the microbiological changes of yoghurt cheese (labneh) through 3 weeks of storage. Total viable count were gradually increased during storage up to 7th day, then they decreased though the remaining period of storage in control and other treatments (Fig. 3). These results were in agreement to Al-Otaibi and El-Demerdash (2008), who found that total viable counts were gradually increased up to 7th day of storage then decreased thereafter.

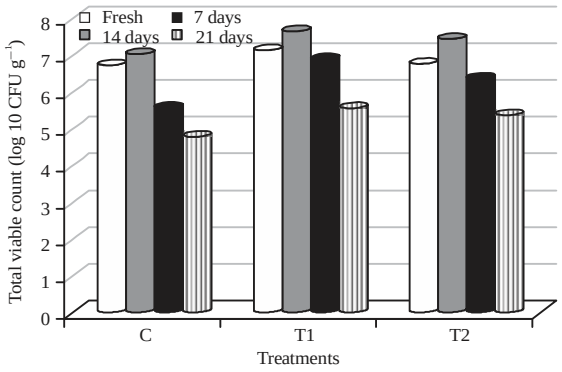

Fig. 3: Total viable count of cheese yoghurt sample as affected by addition of olive oil during 21 days of storage at 5±1°C, C: Control, T_1: Sample with 1% olive oil, T_2: Sample with 2% olive oil

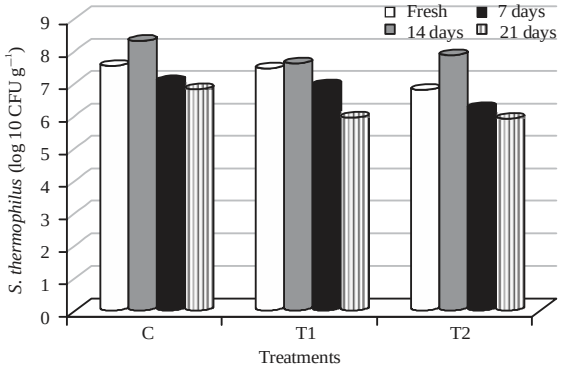

Fig. 4: Starter culture (*S. thermophilus*) count in cheese yoghurt sample as affected by of addition olive oil during cold storage, C: Control, T_1: Sample with 1% olive oil, T_2: Sample with 2% olive oil

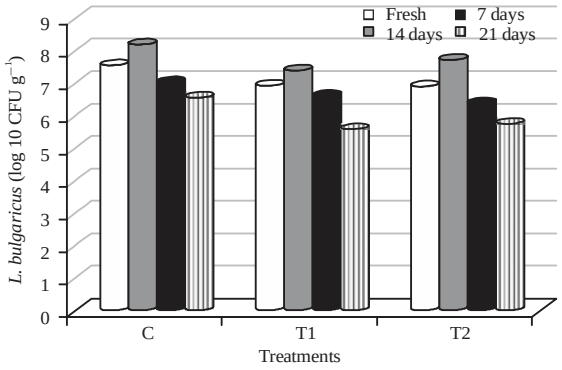

Fig. 5: Starter culture (*L. bulgaricus*) count in cheese yoghurt sample as affected by addition olive oil during cold storage, C: Control, T_1: Sample with 1% olive oil, T_2 sample with 2% olive oil

Figure 4 and 5 indicated that the counts for *S. thermophilus* and *Lactobacillus delbrueckii* spp. *bulgaricus* (in control and treatments) were increased gradually up to 7th days of storage and

then decreased thereafter. The control had the highest content of streptococcus and lactobacillus at 7th day of cold storage. From the same figures, it could be notice that increase in the oil concentration (T_2) lead to decrease in lactic acid bacterial count. Abou Ayana and Gamal El Deen (2011), Khaleel (2000) and Sharaf *et al*. (1996) reported that addition of some aromatic and essential oils to yoghurt and labneh had stimulatory effect on lactic acid bacteria by enhancing their growth and acid production. Coliform group was not detected in control or treatments. Yeast and moulds were also not detected in labneh containing olive oil throughout storage; whereas control had yeast and moulds at the end of storage period (21st day). These results were in accordance to El-Sayed *et al*. (1993) and Thabet *et al*. (2014).

CONCLUSION

Olive oil which extracted in the laboratory by pressure system from Koroneiki olive fruit variety by using 2% NaCl during malaxation step was successes in manufacture of cheese yoghurt by using 1.0 and 2.0% olive oil and improved body and texture and gave good appearance and flavor than control. On the other hand it improved the quality. So, it is concluded that 1.0% olive oil is the best treatment for preparation of yoghurt cheese.

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