International Journal of Scientific Research in Chemistry (IJSRCH)
© 2021 IJSRCH | Volume 6 | Issue 4 | ISSN : 2456-8457

The Effect of Replacing Milk Fat with Vegetable Oils on Labneh Content of Omega-3, Omega-6 and Omega-9

Mohamed Nour-Eldin Farid Hamad*[1], Dina Hamed Amin El-Bushuty[2], Amaal Moatamed Hassan Abdallah[3]

*[1]Dairy Department, Faculty of Agriculture, Damietta University, Damietta, Egypt

[2]Home Economics Department, Faculty of Specific Education, Damietta University, Egypt

[3]Dairy Department, Faculty of Agriculture, Damietta University, Damietta, Egypt

Article Info
Volume 6, Issue 4
Page Number : 38-48

Publication Issue :
July-August-2021

Article History
Accepted : 10 Aug 2021
Published : 25 Aug 2021

ABSTRACT

In this study, milk fat replacement in labneh by using some vegetable oils virgin olive, corn, sunflower oil, and sesame oils. These oils have many health, nutritional benefits, and high content of unsaturated fatty acids. oils were used at ratio 1-2%. Fatty acids composition for oils and labneh treatments were determined by using Gas Liquid Chromatography. Virgin olive oil contains oleic acid (omega-9), linoleic acid (omega-6) and linolenic acid (omega-3) reported 62.90%, 24.65% and 0.27%, respectively. While sunflower oil contains oleic acid (omega-9), linoleic acid (omega-6) and linolenic acid (omega-3) reported 27.48%, 57.36% and 0.53%, respectively. In addition, corn oil contains oleic acid (omega-9), linoleic acid(omega-6) and linolenic acid (omega-3) reported 27.50%, 57.00 and 0.54%, respectively. While sesame oil contains oleic acid (omega-9), linoleic acid (omega-6) and linolenic acid (omega-3) reported 42.00%, 41.33% and 0.40%, respectively. Replacement milk fat raise labneh content of unsaturated fatty acids when we compared results with control treatment. This study aimed to produce anew labneh product with many health and nutritional benefits.

Keywords: Labneh, Milk fat, Monounsaturated Fatty Acids, Polyunsaturated Fatty Acids

I. INTRODUCTION

Labneh is a conventional product of fermented milk. It is a popular food in different places of the world, particularly in the regions of the Middle East, where it plays an important role in the family diet. Over the last decade, it has grown in popularity. Nutritional benefits and storage are the economic significance of the features has increased (Shamsia; El-Ghannam, 2012). Milk fat has 60% saturated fat, 24% MUFA and 0.5% PUFA (Walther et al., 2008). Milk fat has a lot of short-chain fatty acids, and in addition, various rare branched, oxo and odd numbered fatty acids in small amounts. All around the world, Obesity is a growing

problem not only in Western countries. One of the major weight management problems has been known to be the fat decrease in total diet. It can be accomplished by selecting food products with a lower fat content and by lowering the fat content of specific foods. It is also beneficial to use milk products. Currently, to lose weight, dairy products can be helpful Astrup et al. (2010) concluded that possible mechanisms are the satiating power of dairy proteins, the increased faecalis excretion and the calcium appetite concept. Consumption of milk products, especially low-fat products, is often related to good metabolic health status, regular blood pressure maintenance (Ralston et al., 2012), and decreased risk of type 2 diabetes (Salas-Salvadó et al., 2011). Fatty acids can be categorized in classes as saturated, monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids. From the other hand, the unsaturated ones are classified into series known as omega, being ω-9 considered nonessential for humans, and the ω-3 and ω–6 as essential fatty acids, because mammals cannot synthesis the latter ones, they are therefore obtained from diet (Ristic and Ristic, 2003; Assiesa, et al., 2004). Eating the correct ratio of n-6 to n-3 FAs from the correct edible oil sources would help to increase thermogenesis, develop muscles and hormones such as eicosanoids, decrease CVD risk factors, high blood pressure levels, triglycerides, lipoprotein-a, fibrinogen, clot formation and inflammation, muscle breakdown, boost brain functions, mood, intelligence, behavior, and vision (Fan and Chapkin, 1998; Rodriguez–Leyva et al., 2010). Vegetable oils are one of the main components of human diets. In food products, vegetable oils play important functional and sensory roles, and they act as carriers of fat-soluble vitamins (A, D, E, and K). They also include an essential linoleic and linolenic acid, responsible for growth (Fasina et al., 2006; Dzisiak, 2004). In edible oils and fats, the proportion of unsaturated to saturated fatty acids is very important for human nutrition. While high levels of saturated fatty acids are desirable to increase oil stability, they are, on the other hand, nutritionally undesirable since high levels of saturated fatty acids are also considered to have an effect on raising the concentration of low density lipoproteins (LDL), affecting the ratio of LDL to HDL (high density lipoproteins), promoting clothing and vascular smooth muscle proliferation Diet with increasing intake of linoleic and linolenic acids increase HDL-cholesterol and decreases LDL-cholesterol, Although higher oleic acid intake reduces LDL-cholesterol, it does not affect levels of HDL cholesterol (Lawton et al., 2000). Milk fat replacement with palm, soya or sunflower oil may benefit arterial health (Ejeahalaka and On, 2019). In this study, we used virgin olive, corn, sunflower and sesame oils in preparing healthy labneh. These oils have many health and nutritional benefits in addition to their high content of unsaturated fatty acids.

II. MATERIALS AND METHODS

Materials

Skim milk powder: Low heat food grad imported from USA produced by Dairy America/California USA obtained from El Sherbiny's company Reconstitute 1/10.

Fat	Protein	Moisture	Lactose
1.25%	34%	4%	51%

Starter: Yoghurt starter culture consist of *Streptococcus salvarius* Sub sp. *thermophilus* and *Lactobacillus delbreuckii* sub sp *bulgaricus* obtained from Hansen, s Lab, Denmark. Emulsifier: Di sodium hydrogen orthophosphate anhydrous (DSP) was obtained from producer ADWIC-Egypt. Salt: Commercial clean good grade of cooking salt (sodium chloride) obtained from the local market. Virgin Olive oil obtained from El-Dorra market in New Damietta that obtained from Suez Sinai added to labneh at a ratio 1-2%. Sunflower oil: Obtained from El Sherbiny's company in Damietta and it was produced

by Arma Company, Egypt. Corn oil: Obtained from El Sherbiny's company in Damietta and it was produced by Arma Company. Sesame oil: Obtained from Almasria Company for natural oils, Cairo, Egypt. Cloth bags of labneh: Obtained from local market in Damietta government.

Methods

Traditional Labneh manufacturing according to Abou Ayana and Gamal EL Deen, 2011)

Manufacturing control treatments

In this treatment, 5 kilograms of recombined skim milk were aged for 8 hours in the refrigerator at a temperature of 4°C, then added 0.10% DSP, stirring well in the mixer, then adding the fat milk at ratio 1% as equal 12.19 5g\L and stirring again then pasteurization at 90°C for 10 minutes, then cooling at 42°C, and adding the starter at the rate of 2%, then incubating at 42°C for 4 hours, after complete coagulation, the curd was salted at a rate of 0.5% NaCl, then cutting 1 X 1 X 1 cm, the samples were filtered in cloth bags for 14-18 hours without any pressing, then packing and preserving in the refrigerator at 5°C for 21 days and in a treatment of 2%, the same steps, but with an addition of 2% fat, equivalent to 24.39 g fat / L. Treatment control1 with 1% milk fat and treatment control2 with 2% milk fat.

Manufacturing treatments using vegetable oils:

The treatments were divided into:

Treatment O1 with 1% olive oil; Treatment C1 with 1% corn oil; Treatment S1 with 1% sunflower oil; Treatment M1 with 1% sesame oil; Treatment O2 with 2% olive oil; Treatment C2 with 2% olive oil; Treatment S2 with 2% Sunflower oil and Treatment M2 with 2% Sesame oil. Where, in each treatment, 5 kilograms of milk are aged and sorted. Each treatment is recovered separately for 8 hours in the refrigerator at a temperature of 4°C, then pasteurization at 90°C for 10 minutes, then cooling at 42°C, then adding 0.15% DSP, then adding oil at a rate of 1-2% and stirring in the mixer for 10 minutes, then adding the starter at a rate of 2%, then incubating at a temperature of 42°C for 4 hours, after complete coagulation, the curd was salted at a rate of 0.5% NaCl, then the curd is cut into small parts and filtered in cloth bags for 16-18 hours, then packing and preserving in the refrigerator at 5°C for 21 days.

Fatty acid composition

Fatty acids of olive, corn, sunflower, sesame oils and samples of fresh labneh treatments were determined using gas liquid chromatography ("Pay-Unicam 304" with flame ionization detector and column ECTM-WAX, 30m, ID 0.25mm, Film: 0,25μm) in Institute of Food and Feed Technology in Egypt according to AOAC (2016).

III. RESULTS AND DISCUSSION

A. Fatty acids composition of virgin olive oil, corn oil, sunflower oil and sesame oil using in manufacture of labneh treatments:

The Figure (1) showed the fatty acid content of virgin olive oil, and from the results obtained, we found that virgin olive oil contains Palmitic Acid, Stearic acid, Vaccenic acid, Oleic acid, Linoleic acid n6, Linolenic acid n3, Arachidic acid and Behenic acid that reported 6.5%, 3.56%, 0.72%, 62.9 %, 24.65%, 0.27%, 0.20% and 0.48%, respectively.

The Figure (2) showed the fatty acid content of sunflower oil, and from the results obtained, we found that virgin olive oil contains Palimitic Acid, Stearic acid, Vaccinic acid, Oleic acid, Linoleic acid n6 and Linolenic acid n3 that reported 11.39%, 1.84%, 0.56%, 27.48%, 57.36% and 0.53%, respectively.

The Figure (3) showed the fatty acid content of corn oil, and from the results obtained, we found that virgin olive oil contains Palimitic Acid, Palmitoleic acid, Stearic acid, Vaccinic acid, Oleic acid, Linoleic acid n6, Linolenic acid n3 and Arachidic acid that reported 11.56%, 0.10%, 1.73%, 0.61%, 27.5%, 57.0%, 0.54% and 0.20%, respectively.

The Figure (4) showed the fatty acid content of sesame oil, and from the results obtained, we found

that virgin olive oil contains Palimitic Acid,, Stearic acid, Vaccinic acid, Oleic acid, Linoleic acid n6, Linolenic acid n3, Arachidic acid and Gadolic acid that reported 9.14%, 5.10%, 0.96%, 42.0%, 41.33%, 0.4%, 0.54% and 0.20%, respectively.

Also, from the results we found that most of the fatty acids in virgin olive oil was USFA (Unsaturated Fatty Acids) because the highest content of Linoleic acid 24.65% and Oleic acid 62.9%. Orsavova, et al. (2015) reported that sunflower oil C18:1cis (n-9) 28.0%, C18:2cis (n-6) 62.2%; sesame oil C18:1cis (n-9) 41.5% C18:1cis (n-9) 40.9%; virgin olive oil C18:1cis (n-9) 66.4% C18:2cis (n-6) 16.4%. In fact, some studies have reported various impacts of SFAs on the human health. It has been concluded that lauric acid (C12:0) as well as myristic acid (C14:0) raise plasma total cholesterol concentrations, the first due to an increase in LDL cholesterol, the latter due to a rise of both LDL and HDL cholesterol concentrations (Denke and Grundy 1992; Zock, et al. 1994). However, according to (Mensink, 2003; Lawrence, 2013), fatty acids composition of vegetable oils is formed by a mixture of saturated (SFAs) and unsaturated (UNFAs) fatty acids classified according to the number of unsaturated bonds as monounsaturated (MUFAs) or polyunsaturated fatty acids (PUFAs). Nevertheless, each of analyzed vegetable oils has specific fatty acid distribution depending on their plant sources.

B. Monounsaturated Fatty Acids (MUFAs)

We found the virgin olive oil, sunflower oil, corn oil and sesame oil are a good source of Monounsaturated Fatty Acids (MUFAs) because the highest of Monounsaturated Fatty Acids (MUFAs) that reported in virgin olive oil 63.62%, sunflower oil 28.04, corn oil 28.21and sesame oil 43.3%.

C. Polyunsaturated Fatty Acids (PUFAs)

The difference between the locations of the first double bond in the fatty acid carbon chain (n-3 and n-6 PUFAs) is the reason of significant differences in their biological functions that might be derived. From the course of their interactions Mišurcová, et al. (2011) the n-6/n-3 ratio is the key factor for balanced synthesis of eicosanoids and its nutritional importance has been frequently discussed as well as dependence of n-6/n-3 ratio value on a dietary pattern.

In the analyzed oils, From the Figure (1), n-3 PUFAs represented by α-linolenic acid (ALA, C18:3, n-3) were found in virgin olive oil at ratio 0.27%, while the group of n-6 PUFAs was represented by linoleic (LA, C18:2, n-6) 24.65%. In addition, From the Figure (2) n-3 PUFAs represented by α-linolenic acid (ALA, C18:3, n-3) were found in sunflower oil at ratio 0.53%, while the group of n-6 PUFAs was represented by linoleic (LA, C18:2, n-6) at ratio 57.36%.

From the Figure (3) n-3 PUFAs represented by α-linolenic acid (ALA, C18:3, n-3) were found in corn oil at ratio 0.54%, while the group of n-6 PUFAs was represented by linoleic (LA, C18:2, n-6) at ratio 57%. Also, data showed in the Figure (4) n-3 PUFAs represented by α-linolenic acid (ALA, C18:3, n-3) were found in sesame oil at ratio 0.4%, while the group of n-6 PUFAs was represented by linoleic (LA, C18:2, n-6) at ratio 41.33%. These results agreement with (Sirtori et al., 1992; Gharby et al., 2017; Chowdhury 2007).

D. Fatty acids composition of fresh labneh treatments with 1-2% vegetable oils:

Table (1) showed the fatty acids composition of fresh labneh fortified with 1% vegetable oils. Con1 treatment contained saturated fatty acids: Caprylic acid, Capric acid, Lauric acid, Myristic acid, Pentadecanoic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 1.10%, 3.04%, 3.51%, 11.51%, 1.53%, 35.29%, 1.39%, 10.51% and 0.13%, respectively. In addition, unsaturated fatty acids: Tetradecanoic acid, Palmitoleic acid, Hexagonic acid, Oleic acid, Vaccenic acid, Octadecosaenoic acid, Linoleic acid, Linolenic acid and Stearidonic acid reported 1.18%, 1.89%, 0.23%, 21.36%, 2.07%, 1.47%, 2.60%, 0.41% and 0.39%, respectively. O1 treatment contained saturated fatty acids: Capric acid, Lauric

acid, Myristic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.12%, 0.15%, 0.43%, 14.23%, 0.42%, 3.78% and 0.38%, respectively. In addition, unsaturated fatty acids: Tetradecanoic acid, Palmitoleic acid, Hexagonic acid, Oleic acid, Vaccenic acid, Linoleic acid, Linolenic acid and Stearidonic acid reported 0.16%, 0.67%, 0.17%, 47.08%, 1.47%, 26.52% and respectively. S1 treatment contained saturated fatty acids: Caprylic acid, Capric acid, Undecanoic acid, Lauric acid, Myristic acid, Pentadecanoic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.14%, 0.28%, 0.24%, 0.46%, 0.95%, 0.90%, 12.27%, 0.26%, 5.76%, 0.13% and 0.13%, respectively. In addition, unsaturated fatty acids: Tetradecanoic acid, 10-Pentadecanoic acid, Palmitoleic acid, Hexagonic acid, Oleic acid, Vaccenic acid and Linoleic acid reported 0.17%, 0.15%, 0.20%, 0.14%, 28.58%, 0.89% and 47.72%, respectively. C1 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Pentadecanoic acid, Palmitic acid, Heptadecanoic acid, Stearic acid, Arachidic acid and Behenic acid reported 0.13%, 0.17%, 0.71%, 0.11%, 13.08%, 0.23%, 2.85%, 0.32% and 0.24%, respectively. In addition, unsaturated fatty acids: Palmitoleic acid, Oleic acid, Vaccenic acid and Linoleic acid, Linolenic acid, Gadoleic acid, Eicosaenoic acid reported, 0.23%, 26.81%, 0.72%, 52.22%, 0.55%, 0.25%, 0.38%, respectively. M1 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.15%, 0.31%, 0.45%, 11.82%, 0.11%, 5.44%, 0.54%, respectively. In addition, unsaturated fatty acids: Palmitoleic acid, Oleic acid, Vaccenic acid and Linoleic acid, Linolenic acid, Eicosaenoic acid reported 0.24%, 40.24%, 0.98%, 38.96%, 0.38%, 0.14%, respectively.

From data presented in Table (1) when we compared treatment Con1 with labneh fortified by 1% olive oil, sunflower oil, corn oil, and sesame oil, there were increase in labneh contain of unsaturated fatty acids which were Oleic acid of O1, S1, C1 and M1 treatments recorded 47.08%, 28.58%, 26.81% and 40.24%, respectively. Labneh fortified with virgin olive oil recorded the highest value of oleic acid followed by labneh fortified with sesame oil. This is due to the high content of oleic acid in virgin olive oil and sesame, while treatment Con1 was lower than labneh fortified by vegetable oils recorded 21.36%. In addition to linoleic acid, it increased significantly in Labneh fortified with vegetable oils than the control treatment, where it was 2.60% while labneh treatments O1, S1, C1 and M1 recorded 26.52%, 47.72%, 52.22% and 38.96%, respectively. In contrast to the saturated fatty acids, it was less in the labneh fortified with vegetable oils.

Table (2) showed the fatty acids composition of fresh labneh fortified with 2% vegetable oils. Con2 treatment contained saturated fatty acids: Caprylic acid, Capric acid, Lauric acid, Myristic acid, Pentadecanoic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.95%, 2.75%, 3.22%, 10.64%, 1.40%, 33.9% and 0.14%, respectively. In addition, unsaturated fatty acids: Tetradecanoic acid, Palmitioleic acid, Hexagonic acid, Oleic acid, Vaccenic acid, Octadecosaenoic acid, Linoleic acid, Linolenic acid and Stearidonic acid reported 1.06%, 1.80%, 0.24%, 22.21%, 1.96%, 1.37%, 0.51%, 0.39% and 0.39%. O2 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.12%,0.15%, 0.63%, 14.48%, 0.15%, 4.05% and 0.38%, respectively. In addition, unsaturated fatty acids: Palmitioleic acid, Hexagonic acid, Oleic acid, Vaccenic acid, Linoleic acid, Linolenic acid and Gadoleic acid reported 0.61%, 0.10%, 46.85%, 1.79%, 27.45%, 2.30% and 0.18%, respectively. S2 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Palmitic acid, Stearic acid, Arachidic acid and Behenic acid reported 0.10%, 0.13%, 0.43%, 8.07%, 3.84% and 0.20%, respectively. In addition, unsaturated fatty

acids: Palmitoleic acid, Oleic acid, Vaccenic acid, Linoleic acid and Linolenic acid reported 0.15%, 24.58%, 0.69%, 60.38% and 0.30%, respectively. C2 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Palmitic acid, Stearic acid, Arachidic acid and reported 0.14%, 0.21%, 0.62%, 12.62%, 2.16%, 0.27%, respectively. In addition, unsaturated fatty acids: Palmitoleic acid, Oleic acid, Vaccenic acid, Linoleic acid, Linolenic acid, Gadoleic acid and Eicosaenoic acid reported 0.19%, 27.58%, 0.68%, 53.58%, 0.54%, 0.25% and 0.14%, respectively. M2 treatment contained saturated fatty acids: Capric acid, Lauric acid, Myristic acid, Palmitic acid, Heptadecanoic acid, Stearic acid and Arachidic acid reported 0.10%, 0.10%, 0.25%, 9.74%, 0.07%, 5.30% and 0.54%, respectively. In addition, unsaturated fatty acids: Palmitoleic acid, Oleic acid, Vaccenic acid and Linoleic acid, Linolenic acid, Eicosaenoic acid reported 0.17%, 41.00%, 0.96%, 41.16%, 0.45% and 0.16%, respectively.

From data presented in Table (2) when we compared treatment Con2 with labneh fortified by 2% olive oil, sunflower oil, corn oil, and sesame oil, there were increase in labneh contain of unsaturated fatty acids which were Oleic acid of O2, S2, C2 and M2 treatments recorded 46.85%, 24.58%, 27.58% and 41.00%, respectively. Labneh fortified with virgin olive oil recorded the highest value of oleic acid followed by labneh fortified with sesame oil. This is due to the high content of oleic acid in virgin olive oil and sesame. While treatment Con1 was lower than labneh fortified by vegetable oils recorded 22.21%. In addition to linoleic acid, it increased significantly in Labneh fortified with vegetable oils than the control treatment, where it was 4.98% while labneh treatments O2, S2, C2 and M1 recorded 27.45%, 60.38%, 53.58% and 41.16%, respectively. Labneh fortified with sunflower oil recorded the highest value of linoleic acid followed by labneh fortified with corn oil. This is due to the high content of linoleic acid in sunflower oil and corn oil. In addition, there were Linolenic acid in labneh treatments O2, S2, C2 and m1 recorded 2.30%, 0.30%, 0.54% and 0.45%, respectively. In contrast to the saturated fatty acids, it was less in the labneh fortified with vegetable oils. On the other hand, Data in Tables (1 - 2) showed reducing of SFA and increasing of USFA by fortifying labneh with olive oil, sunflower oil, corn oil and sesame oil increase the healthy benefit of this product because it is well known that unsaturated fatty acids are more important in human nutrition. As it is well known, omega fatty acids are a group of essential fatty acids very important for human health. Labneh fortified with vegetable oils characterized by very high levels of linoleic acid (omega-6) and α-linolenic acid (omega-3) as compared with Labneh manufactured from labneh control. The follow-up studies for many authors reported the healthy importance of linoleic and α-linolenic acids. Simopoulos (1996) explained that the beneficial health effects of omega-3 fatty acids, eicosa pentaenoic acid (EPA) and docosa hexaenoic acid (DHA) were first detected in the Eskimos of Greenland who consumed a high diet of seafood and had low rates of coronary heart disease, asthma, type 1 diabetes mellitus and multiple sclerosis. The beneficial health effects of omega-3 fatty acidification after that discovery, the health benefits of omega-3 fatty acids have been expanded to include cancer, inflammatory bowel disease, rheumatoid arthritis, and psoriasis-related benefits.

IV. CONCLUSION

Sesame oil, sunflower oil, corn oil and virgin olive oil are sources of unsaturated fatty acids, it contains high percentage of monosaturated fatty acids MUFAs and polysaturated fatty acids and PUFA groups. Replacement milk fat in labneh by using unsaturated vegetable oils aimed to reduce saturated fatty acids and raise labneh content of unsaturated fatty acids.

The highest treatment in content of unsaturated fatty acids was S2 treatment (with 2% sunflower oil) reported 86.73%. In addition, all labneh treatments with unsaturated vegetable oils had high percentage of omega-3, omega-6 and omega-9 compared to the control labneh treatment except for labneh treatments with 1-2% sunflower oil, corn oil and sesame oil was lower in omega-3 content than control labneh. In general, this result aimed to produce anew labneh product with many health and nutritional benefits.

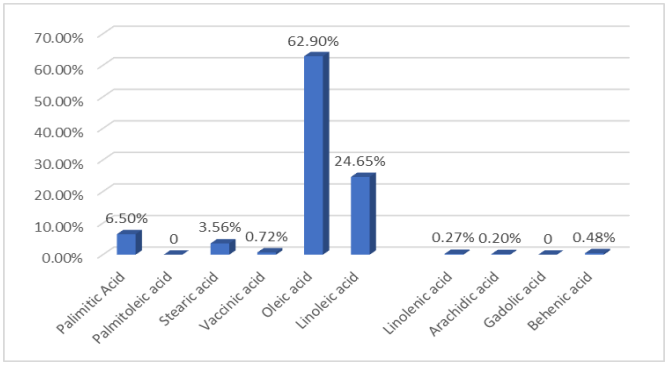

Fig. (1). Fatty acids composition of virgin olive oil

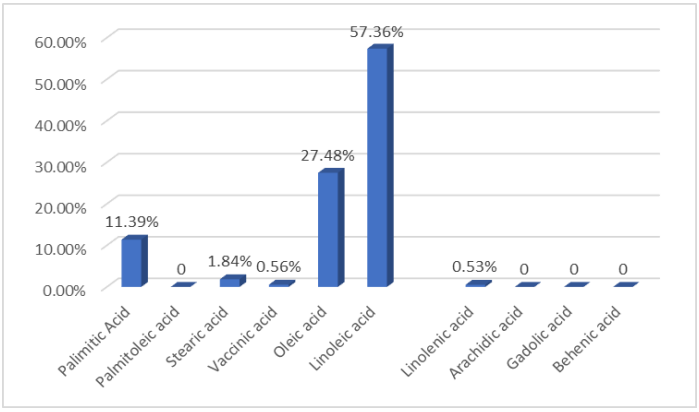

Fig (2). Fatty acids composition of sunflower oil

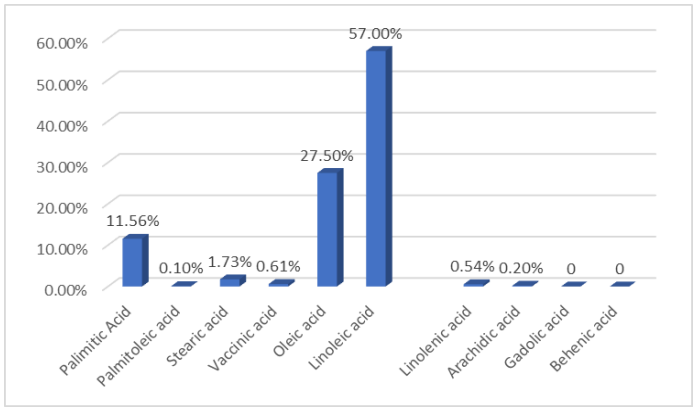

Fig (3). Fatty acids composition of corn oil

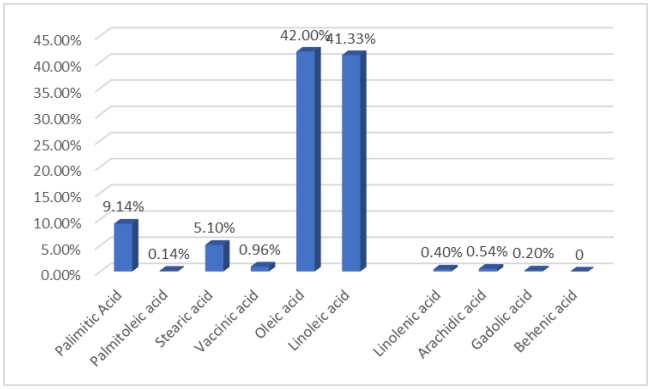

Fig (4). Fatty acids composition of sesame oil

V. REFERENCES

[1] Abou Ayana IAA, Gamal El Deen AA (2011) Improvement of the properties of Goat's milk Labneh using some aromatic and vegetable oil. International Journal of Dairy Sci. 6(2): 112-123.

[2] AOAC (2012) Association of Official Analytical Chemists Official Methods of Analysis of AOAC International 19th (Ed) Pub Washington DC USA https://doi.org/10.1002/0471740039.vec0284

[3] Assiesa J, Loka A, Bocktinga CL, Weverlingb GJ, Lieversec R, Visserd I, Abelinge NGGM, Durane M, Schenea AH (2004) Fatty acids and homocysteine levels in patients with recurrent depression: an explorative pilot study. Prostaglandins, Leukotrienes and Essential Fatty Acids. (70): 349-356.

[4] Astrup A, Chaput JP, Gilbert JA, Lorenzen JK (2010) Dairy beverages and energy balance. Physiology & Behavior, 100: 67-75.

[5] Chowdhury K, Banu LA, Khan S, Latif A (2007) Studies on the fatty acid composition of edible oil. Bangladesh Journal of Scientific and Industrial Research 42(3): 311-316.

[6] Denke MA, Grundy SM (1992) Comparison of effects of lauric acid and palmitic acid on plasma lipids and lipoproteins. Am J Clin Nutr 56: 895–898.

[7] Dzisiak D (2004) New oils reduced saturated and Trans fats in processed foods. Cereal Foods World 49(6): 331-333.

[8] Ejeahalaka KK, On SL (2019) Chemometric studies of the effects of milk fat replacement with different proportions of vegetable oils in the formulation of fat-filled milk powders: Implications for quality assurance. Food chemistry 295: 198-205.

[9] Fan YY, Chapkin RS (1998) Importance of dietary alpha linolenic acid in human health and nutrition. J Nutr 128:1411–1414.

[10] Fasina OO, Hallman CHM, Clementsa C (2006) Predicting Temperature-Dependence Viscosity of Vegetable Oils from Fatty Acid Composition. JAOCS 83(10): 899-903.

[11] Gharby S, Harhar H, Bouzoubaa Z, Asdadi A, El Yadini A, Charrouf Z (2017) Chemical characterization and oxidative stability of seeds and oil of sesame grown in Morocco. Journal of the Saudi Society of Agricultural Sciences 16(2): 105-111.

[12] Lawrence GD (2013) Dietary fats and health: Dietary recommendations in the context of scientific evidence. Adv Nutr 4: 294–302.

[13] Lawton CL, Delargry HJ, Brockman J, Simith RC, Blundell JE (2000) The degree of saturation of fatty acids of fatty acids influences in post ingestive satiety. British Journal of Nutrition 83(5): 473-482.

[14] Mensink RP, Zock PL, Kester, ADM, Katan MB (2003) Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: A meta-analysis of 60 controlled trials1–3. Am J Clin Nutr 77: 1146–1155.

[15] Mišurcová L, Vávra Ambrožová J, Samek D (2011) Seaweed lipids as nutraceuticals. Adv Food Nutr Res 64: 339–355.

[16] Orsavova J, Misurcova L, Ambrozova JV, Vicha R, Mlcek J (2015) Fatty acids composition of vegetable oils and its contribution to dietary energy intake and dependence of cardiovascular mortality on dietary intake of fatty acids. International journal of molecular sciences 16(6): 12871-12890.

[17] Ralston RA, Lee JH, Truby H, Palermo CE, Walker KZ (2012) Review – A systematic review and meta-analysis of elevated blood Pressure and consumption of dairy foods. Journal of Human Hypertension 26: 3-13.

[18] Ristic V, Ristic G (2003) Role and importance of dietary Polyunsaturated fatty acids in the prevention and therapy of atherosclerosis. Med Pregled 56(1-2): 50-53.

[19] Rodriguez-Leyva MD, Chantal MC, Bassett MC, McCullough R, Pierce NG (2010) The Cardiovascular effects of flaxseed and its omega–3 fatty acid, alpha-linolenic acid. Canadian J Cardiol 26:489–496.

[20] Salas-Salvadó J, Martinez-González MÁ, Bulló M, Ros E (2011) The role of diet in the prevention of type 2 diabetes. Nutrition, Metabolism & Cardiovascular Diseases 21: B32-B48

[21] Shamsia, SM, El-Ghannam MS (2012) Manufacture of Labneh from Cow's Milk Using Ultrafiltration Retentate With or Without Addition of Permeate Concentrate. Journal of Animal Production Advances 2(3): 166-173

[22] Simopoulos AP (1996) Omega–3 fatty acids. Part I: – Metabolic effects of omega–3 fatty acids and essentiality. In: GA Spiller (Ed). pp. 51–73. Handbook of Lipids in Human Nutrition. CRC Press Inc. Boca Raton, Florida.

[23] Sirtori CR, Gatti E, Tremoli E, Galli C, Gianfranceschi G, Franceschini G, Perego P (1992) Olive oil, corn oil, and n–3 fatty acids differently affect lipids, lipoproteins, platelets, and superoxide formation in type II hypercholesterolemia. The American journal of clinical nutrition 56(1): 113-122.

[24] Walther B, Schmid A, Sieber R, Wehrmüller K (2008) Review - Cheese in nutrition and health. Dairy Science and Technology 88: 389-405.

[25] Zock PL, de Vries JHM, Katan MB (1994) Impact of myristic acid versus palmitic acid on serum lipid and lipoprotein levels in healthy women and men. Arterioscler Thromb Vasc 14: 567–575.

Cite this article as :

Mohamed Nour-Eldin Farid Hamad,, Dina Hamed Amin El-Bushuty, Amaal Moatamed Hassan Abdallah, "The Effect of Replacing Milk Fat with Vegetable Oils on Labneh Content of Omega-3, Omega-6 and Omega-9 ", International Journal of Scientific Research in Chemistry (IJSRCH), ISSN : 2456-8457, Volume 6 Issue 4, pp. 59-69, July-August 2021. URL : https://ijsrch.com/IJSRCH21648

Table (1) Fatty acids composition of fresh labneh treatments with 1% unsaturated vegetable oils

Name	Fatty acids	Relative distribution				
		Con1	O1	S1	C1	M1
Saturated fatty acids						
Caprylic acid	C8:0	1.10%	--	0.14%	--	--
Capric acid	C10:0	3.04%	0.12%	0.28%	0.13%	0.15%
Undecanoic acid	C11:0	--	--	0.24%	--	--
Lauric acid	C12:0	3.51%	0.15%	0.46%	0.17%	0.31%
Myristic acid	C14:0	11.51%	0.43%	0.95%	0.71%	0.45%
Pentadecanoic acid	C15:0	1.53%	--	0.90%	0.11%	--
Palmitic acid	C16:0	35.29%	14.23%	12.27%	13.08%	11.82%
Heptadecanoic acid	C17:0	1.39%	0.42%	0.26%	0.23%	0.11%
Stearic acid	C18:0	10.51%	3.78%	5.76%	2.85%	5.44%
Arachidic acid	C20:0	0.13%	0.38%	0.13%	0.32%	0.54%
Behenic acid	C22:0	--	0.17%	--	0.24%	--
Total		68.01	19.68	21.39	17.84	18.82
Unsaturated fatty acids						
Tetradecanoic acid	C14:1 ω 5	1.18%	0.16%	0.17%	--	--
10-Pentadecanoic acid	C15:1 ω6	--	--	0.15%	--	--
Palmitoleic acid	C16:1 ω7	1.89%	0.67%	0.20%	0.23%	0.24%
Hexagonic acid	C16:1 ω4	0.23%	0.17%	0.14%	--	--
Oleic acid	C18:1 ω9	21.36%	47.08%	28.58%	26.81%	40.24%
Vaccinic acid	C18: 1 ω7	2.07%	1.47%	0.89%	0.72%	0.98%
Octadecosaenoic acid	C18:1 ω5	1.47%	--	--	--	--
--	C18:2 ω7	0.36%	0.86%	0.12%	--	--
Linoleic acid	C18:2 ω6	2.60%	26.52%	47.72%	52.22%	38.96%
--	C18:2 ω4	--	0.22%	0.61%	0.72%	--
--	C18:3 ω4	--	0.27%	--	0.20%	--

Linolenic acid	C18:3 ω3	0.41%	2.16%	--	0.55%	0.38%
Stearidonic acid	C18:4 ω3	0.39%	--	--	--	--
Gadoleic acid	C20:1 ω 9	--	0.25%	--	0.20%	--
Eicosaenoic acid	C20:1 ω11	--	--	--	0.38%	0.18%
Total		31.96	79.83	78.58	82.03	81.18
Non-Identified fatty acids	--	0.03%	0.49%	0.03%	0.13%	0.20%

Con1 = Treatment with 1% fat milk, **O1** = Treatment with 1% olive oil, **S1** = Treatment with 1% sunflower oil, **C1** = Treatment with 1% corn oil, **M1** = Treatment with 1% sesame oil.

Table (2) Fatty acids composition of fresh labneh treatments with 2% unsaturated vegetable oils

Name	Fatty acids	Relative distribution				
		Con2	O2	S2	C2	M2
Saturated fatty acids						
Caprylic acid	C8:0	0.95%	--	--	--	--
Capric acid	C10:0	2.75%	0.12%	0.10%	0.14%	0.10%
Undecanoic acid	C11:0	--	--	--	--	--
Lauric acid	C12:0	3.22%	0.15%	0.13%	0.21%	0.10%
Myristic acid	C14:0	10.64%	0.63%	0.43%	0.62%	0.25%
Pentadecanoic acid	C15:0	1.40%	--	--	--	--
Palmitic acid	C16:0	33.9%	14.48%	8.07%	12.62%	9.74%
Heptadecanoic acid	C17:0	1.30%	0.15%	--	--	0.07%
Stearic acid	C18:0	10.15%	4.05%	3.84%	2.16%	5.30%
Arachidic acid	C20:0	0.14%	0.38%	0.20%	0.27%	0.54%
Behenic acid	C22:0	--	--	0.48%	--	--
Total		64.45	19.96	13.25	16.02	16.1
Unsaturated fatty acids						
Tetradecanoic acid	C14:1 ω 5	1.06%	--	--	--	--
10-Pentadecanoic acid	C15:1 ω6	--	--	--	--	--
Palmitioleic acid	C16:1 ω 7	1.80%	0.61%	0.15%	0.19%	0.17%
Hexagonic acid	C16:1 ω4	0.24%	0.10%	--	--	--
Oleic acid	C18:1 ω9	22.21%	46.85%	24.58%	27.58%	41.00%
Vaccinic acid	C18:1 ω 7	1.96%	1.79%	0.69%	0.68%	0.96%
Octadecosaenoic acid	C18:1 ω 5	1.37%	--	--	--	--
--	C18:2 ω7	0.33%	--	--	--	--
Linoleic acid	C18: 2 ω6	4.98%	27.45%	60.38%	53.58%	41.16%
--	C18:2 ω4	--	0.18%	0.63%	0.72%	--
--	C18:3 ω4	--	0.27%	--	0.10%	--

Linolenic acid	**C18:3 ω3**	0.51%	2.30%	0.30%	0.54%	0.45%
Stearidonic acid	**C18:4 ω 3**	0.39%	--	--	--	--
Gadoleic acid	**C20:1 ω 9**	--	0.18%	--	0.25%	--
Eicosaenoic acid	**C20:1 ω 11**	--	--	--	0.14%	0.16%
Total		34.85	79.73	86.73	83.78	83.9
Non-Identified fatty acids	**--**	0.70%	0.31%	0.02%	0.20%	zero

Con2 = Treatment with 2% fat milk, **O2** = Treatment with 2% olive oil, **S2** = Treatment with 2% sunflower oil, **C2** = Treatment with 2% corn oil, **M2** = Treatment with 2% sesame oil.