Current Trends in Biomedical Engineering & Biosciences
ISSN: 2572-1151

Juniper Publishers
key to the Researchers

Research Article
Volume 8 Issue 5 - August 2017
DOI: 10.19080/CTBEB.2017.08.555746

Curr Trends Biomedical Eng & Biosci

Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit

Amany MM Basuny[1], Shaker M Arafat[2]* and Hanaa M Soliman[3]

[1]*Biochemistry Department, Beni-Suef University, Egypt*

[2]*Olis & Fats Dept., Food Technology Research Institute, Egypt*

[3]*Oils & Fats Department, National Research Centre, Egypt*

Submission: May 03, 2017; **Published:** August 31, 2017

***Corresponding author:** Shaker M Arafat, Olis & Fats Department, Food Technology Research Institute, Agricultural Research Centre, Egypt, Email: dr_shakerarafat@yahoo.com

Abstract

Ostrich (Struthiocanelus) was used as a new source of animal fats. Some physical and chemical properties for the ostrich oil, fatty acid composition and unsaponifiable matter were determined. Ostrich oil was fractionated to liquid and solid fractions and some characteristics of two fractions were determined. Ostrich oil and two fractions (olein and stearin) were feeding to rats for 8 weeks. The liver and kidney (aspartate amino transferase, alanine amino transferase and alkaline phosphatase activities) function testes and serum contents (total lipids, total cholesterol and low and high density lipoproteins) were measured. The data of the aforementioned measurements indicated that the feeding of ostrich oil did not cause any changes in liver and kidney function and serum contents. Ostrich stearin was used to replace fat in biscuit manufacture at ratios (0.00, 25.00, 50.00 and 75.00%). A sensory evaluation of biscuit was determined. Data revealed that replacements of fat with ostrich stearin improved sensory characteristics of baked biscuit.

Keywords: Ratite family; Ostrich oil; Fractionation; Biological evaluation

Introduction

The Ratite family includes flightless birds with a flat, keel less breastbone (the keel is where the flight muscles connect). Most of their muscle is in their legs and thighs. In the wild, ratites eat seeds, herbaceous plants, insect, and small rodents Olaf & Agnieszka [1].

Currently there are three major species of birds from the ratite family being raised in thus, namely ostrich, emu and rhea. There birds are produced primarily for their red meat, oil and the hide makes fine leather products Gegener [2] and Hernandez [3]. Currently the main market for ratite oils is in cosmetics. Examples of some commercial products from ratite oils including moisturizing, creams, body lotion, soap and lipbalm Grompone et al. [4] and Sethi [5]. The ostrich, (Struthiocamelus) the world's largest bird and one of the oldest (having existed as a species over 40 million years), is adapted to living in open, arid country Chris & Slates [6].

Ostrich oil is almost 100% triglyceride lipids. Triglycerides are abundant in human skin lipids, meaning that the composition of fatty acids in human skin is very similar to that of ostrich oil. This makes the absorption of ostrich oil into human skin faster and more effective. It is high in oleic acid, which increases its not ability to carry compounds through the skin Shahryar & Lotfi [7]. It does not contain phospholipids, which make absorption more difficult. This absence of phospholipids makes ostrich oil highly penetrating and allows it to absorb through the skin more easily Margaret (2003).

Characteristics of ostrich oil

Antibacterial, a low irritant, anti-inflammatory, enhances growth of skin, stimulates hair follicles to proliferate; grow and can be taken orally, ingested and injected Brown et al. [7]; Krawczyk [8]; Craig-Schmidt, [9] and Sales & Franken [10].

Ostrich oil is a completely safe, 100% natural moisturizer and pain reliever. It is used in skin care and beauty products for the body, skin, nails and hair; in pet products to reduce itchy skin from fleabites and to make a dull coat shine. Most importantly, ostrich oil can be used alone or combined with other ingredients to relieve pain. Ostrich oil contains no steroids or hormones, and is known for its normalizing abilities it can slow down an over performing body function or speed up one that is not performing well enough Grompone et al. [4], Knowlton & Pearee [11].

The ostrich oil contains 28% saturated fatty acids, mostly as palmitic acid (20%) and stearic acid (8%). The polyunsaturated

fatty acid is roughly 20% linoleic acid and 2% linolenic acid and the oil is high in oleic acid Krawczyk [8].

The main of this work was to study physico- chemical properties, fatty acid composition and unsaponifiable matter of ostrich oil. Separate into two distinct phases, a liquid phase and a solid phase and study characteristics of these two phases. Safety evaluation of ostrich oil as a new source of animal fats. Finally, using of ostrich stearin for production biscuit.

Materials and Methods

Materials

Ostrich fat (Sturuthiocanelus) was obtained from Faculty of Agriculture Al-Azhar University, and sunflower oil was obtained from Savola Sim Misr 10th Ramadan, Egypt. All solvents used throughout the whole work were analytical grade and distilled before use: Alkaline phosphatase (AP), alanine aminotransferase (ALT), aspartate aminotransferase (AST), total cholesterol, HDL-cholesterol, LDL-cholesterol and total lipids in serum were estimated by kits obtained from Boehringer Mannheim Gmbh, Germany.

Methods

2-1- Lipids extract: Ostrich was extracted from fat tissues by dry rendering method reported by [12]. The rendering process was conducted at 90 °C for 3hrs. After cooling at 50 °C, the fats were filtered through Whatman No.1 filter paper and kept in brown bottles at 5oC until analysis.

2-2- Fractionation of ostrich oils: Ostrich oil was fractionated into two fraction namely olein as liquid fraction and stearin as a solid fraction according to the method described by Baileys [12].

2-4- Analytical procedures: Refractive index, melting point, acid value, peroxide value, iodine value, saponification number and unsaponifiable matter content were determined according to AOAC [13], fatty acid methyl esters were prepared and chromatographically analyzed by gas liquid chromatography according to Farag et al. [14] unsaponifiable matter composition of the samples was determined by using gas liquid chromatography according to Mordert [15] and oxidative stability was measured as a induction periods by using Rancimat method at 100 °C ±2 °C according to the method of Evangelisti et al. [16].

Biscuit preparation: Biscuits were prepared according to the formula of Khalil (1998) using the following recipe: 28gm wheat flour, 24gm margarine, 24gm sugar, 13.55gm whole egg, 0.45gm baking powder and 10ml defatted milk. To prepare the control cake, the sugar and margarine were creamed for 3min at speed in an Oster kitchen mixture (Model 972-26H, Sunbeam Corporation, Milwaukee Wisconsin, USA). The whole eggs were added and mixed in at the same speed for 2min. The flour, baking powder and defatted milk were added and batter was mixed for 4 min at speed. After scraping down the bowl the batter was mixed for an additional 1 min at speed. To prepare the replacer cakes, the margarine (fat weight basis in the formula was replaced with ostrich stearin (0.00, 25.00, 50.00 and 75.00%). The same order of mixing as described for the control was followed. Cake batter (100g) was weight into a greased and floyred aluminum foil cake pan. Cake batters were baked at 180 °C for 45min. After 5min the cakes were removed from the pans and cooled for 60min then wrapped in transparent film to avoid surface drying and stored at room temperature (25 °C) for 24 hour.

Sensory evaluation: Twenty panelists who were graduate students and staff members in the Department of Oils & Fats, National Research Center, Dokki, Giza, Egypt performed sensory evaluation. Panelists were selected on the basis of their interest and availability. Two training sessions were conducted in which the panelists were trained to evaluate sensory attributes of cakes. Sensory quality attributes were evaluated using a point hedonic rating scale with 1 for dislike extremely to 9 for like extremely for each attribute. Cakes were evaluated for appearance, crust and crumb colors, flavor, texture and overall acceptability. Cakes were evaluated 24 hour after baking. After cooling, cakes were cut into 1.50cm radial sections, placed in plastic bags, sealed and stored at room temperature (25 °C) until subjected to sensory analysis. Randomly coded samples were presented to the panelists in a white plates and served one at a time. Samples were served to panelists in a room with partitions between each seat with overhead fluorescent light panelists were instructed to rinse their mouth with tap water before starting and between sample evaluation.

2-5- Experimental animal: Male Wister (32 rats of 60 days old with an average weight of 70g) were obtained from the Faculty of Veterinary Medicine. Cairo University, Giza, Egypt. The animals were fed an a basal diet for 7 days as an adaptation period. The basal diet was formulated according to A.O.A.C, (2016) method and consisted of casein (15%), corn oil (10%), cellulose (5%), salt mixture (4%), vitamin mixture (1%) and starch (65%). Water was available ad liptium.

2-5-1- Feeding experiment: The animals were divided into 4 groups, each group contain 8 rats to evaluate the effect of feeding on basal diet containing 10% of fresh ostrich oil, olein fraction and stearin fraction orally compared with control which contained corn oil . Blood samples were drawn from rats eyes every week for 8 weeks, then centrifuged to separate serum which was kept in deep- freezer until analysis.

2-5-2- Serum analysis: ALT, AST and AP activities were measured according to the methods described by Kachmar & Moss [17], Bergmeyer & Harder (1986) and Varley et al. [18], respectively. The level of serum cholesterol, low and high density lipoproteins, total lipids and triglycerides were determined according to the methods outlined by Roechlau et al. [19], Assmann [20], Frings & Dunn [21] and Wahelefed [22], respectively.

Statistical analysis: Data analysis: At least three replications for each oil sample were performed with each test. The averages and standard deviation were calculated by statistical analysis using SPSS program 10.0 (IBM Corporation,

How to cite this article: Amany MM B, Shaker M A, Hanaa M S. Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit. Curr Trends Biomedical Eng & Biosci. 2017; 8(5): 555746. DOI: 10.19080/CTBEB.2017.08.555746

Armonk, Ny). The differences were considered level significant when P<0.05 at a confident level of 95%. Arrangement of data for statistical analysis was performed by using Microsoft Office Excel (2007).

Results and Discussion

Physico-chemical properties of ostrich oil and two fractions

Table 1: Physico-chemical properties of ostrich oil, ostrich olein and ostrich stearin.

Parameter	Ostrich	Ostrich Olein	Ostrich Stearin
Moisture content %	0.01±0.001	0.01±0.001	0.01±0.001
Refractive index at 40 °C	1.4562±0.001	1.4586±0.001	1.4472±0.001
Melting point (°C)	25.50±1.20	20.00±1.02	54.00±3.45
Color Yellow			
Red	35.00±2.39	35.00±2.39	35.00±2.39
	2.00±0.11	2.10±0.15	2.00±0.13
Acid value (as oleic acid)	0.10±0.001	0.09±0.001	0.08±0.001
Peroxide value (meq./kgoil)	0.90±0.19	0.85±0.18	0.87±0.18
Iodine value (Hanus)	79.00±5.67	58.00±3.96	49.00±3.34
Saponification number	205.00±10.11	200.00±9.91	201.00±9.81
Unsaponifiable matter (%)	1.50±0.10	1.20±0.09	1.00±0.71

Data are expressed as mean±SD values given represent means of three determinations.

Table 1 shows the physico- chemical properties of ostrich oil and two fractions. The results revealed that the contents of moisture and volatile matter in the ostrich oil and two fractions 0.01%. Whereas, the values of refractive index at 40 °C of ostrich oil and two fractions were 1.4562, 1.4652 and 1.4567; respectively. Data showed that the color of ostrich oil and two fractions was under the limitation that reported by the Egyptian Standard Specification (1993) which mentioned that the red were 2.00 2.20 and 2.50 at yellow 35 for edible oils. Melting point of ostrich oil was lower than that other fats. These data are comparable while the fact that the ostrich oil are semi-solid at room temperature.

The results indicated that the acid value (as % oleic acid) of ostrich oil was lower (0.10%) than two fractions (0.27 and 0.30); respectively. The peroxide value of ostrich oil was 0.90 compared with two fractions which amounted in, 1.70 and 1.85meq./ kg oil: respectively. The iodine value of ostrich oil (79.00 gI2) is higher than that of two fractions (53.00, and 56.00), respectively. Saponification number and unsaponifiable matter of ostrich oil higher (205.00 and 1.5%; respectively) than those of two fractions shown in Table 1. These results are agreement with that reported by International Ostrich Oil Standards (1998).

Fatty acid composition of ostrich oil compared with animal fats

Table 2: Fatty acids composition of ostrich oil, ostrich olein and ostrich stearin.

Fatty Acid (%)	Ostrich	Ostrich Olein	Ostrich Stearin
$C_{12:0}$	0.81±0.17	0.30±0.01	0.43±0.01
$C_{14:0}$	1.00±0.001	0.13±0.001	0.17±0.001
$C_{16:0}$	28.50±1.24	17.50±0.82	55.83±3.96
$C_{18:0}$	6.20±0.54	2.30±0.18	17.50±0.62
$C_{18:1}$	46.75±3.17	57.37±4.22	19.50±0.93
$C_{18:2}$	13.29±0.72	15.40±0.69	6.10±0.51
$C_{18:3}$	4.95±0.33	6.30±0.53	0.60±0.01
Saturated fatty acid (%)	36.51±2.56	20.23±1.00	73.93±5.87
Monounsaturated (%)	46.75±3.58	57.37±4.98	19.50±0.89
Polyunsaturated (%)	18.24±0.77	21.70±1.34	6.70±0.53

Data are expressed as mean±SD values given represent means of three determinations.

Fatty acid composition of ostrich oil, ostrich olein and ostrich stearin were identified by gas liquid chromatography and the obtained results are tabulated in Table 2. It could be noticed that oleic acid is found to be the dominant unsaturated fatty acid in ostrich oil and ostrich olein, which represented about (46.75%). Palmitic acid was found also to be the dominant saturated fatty acid in ostrich oil and ostrich stearin (28.50%). The results are in agreement with that reported by Bailey's Industrial Oil and Fat Products, [12] and Mandal et al. [23].

Unsaponifiable matter components of ostrich oil compared with animal fats

Table 3: Unsaponifiable matter (%) composition of ostrich oil ostrich olein and ostrich stearin.

Compounds	Ostrich	Ostrich Olein	Ostrich Stearin
Hydrocarbons: $C_{12:0}$	2.05±0.11	2.00±0.10	2.01±0.01
$C_{14:0}$	2.14±0.09	1.90±0.11	2.05±0.01
$C_{16:0}$	2.13±0.18	2.50±0.16	1.88±0.11
$C_{18:0}$	4.20±0.23	3.66±0.21	3.81±0.22
$C_{20:0}$	6.50±0.43	7.50±0.51	6.00±0.45
$C_{22:0}$	1.93±0.10	1.92±0.12	1.86±0.13
$C_{24:0}$	7.30±0.65	7.28±0.63	7.45±0.51
$C_{26:0}$	10.20±0.89	10.00±0.88	9.81±0.81
$C_{28:0}$	16.65±0.92	15.80±0.97	15.00±0.71
Squalene	2.20±0.12	3.50±0.24	1.50±0.12
$C_{30:0}$	3.60±0.18	2.60±0.19	2.71±0.11
Sterols: Choleterol	3.50±0.16	3.41±0.17	3.33±0.23
β-sitosterol	28.50±1.55	27.50±1.62	20.11±0.95
Stigmasterol	4.50±0.21	3.20±0.31	2.30±0.11
Campasterol	4.60±0.31	3.23±0.29	3.12±0.19

How to cite this article: Amany MM B, Shaker M A, Hanaa M S. Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit. Curr Trends Biomedical Eng & Biosci. 2017; 8(5): 555746. DOI: 10.19080/CTBEB.2017.08.555746

Data are expressed as mean±SD values given represent means of three determinations.

The hydrocarbons and sterols in the unsaponifiable matter of ostrich oil, ostrich olein and ostrich stearin are analyzed by using gas liquid chromatography. The obtained data are illustrated in Table 3. Data shows that C28 is the major hydrocarbon in ostrich oil while two fractions showed that C30 is the major hydrocarbon. Concerning the sterols, B-sitosterol is the major component in ostrich oil and two fractions rich. Cholesterol content in ostrich oil 3.50%, respectively.

Sensory evaluation of biscuit

Table 4: sensory evaluation of biscuit produced from ostrich stearin.

Parameters	Replacer Levels (%)			
	0.00	25.00	50.00	75.00
Appearance	8.30±0.54	8.80±0.59	7.70±0.49	6.50±0.41
Crust color	8.70±0.55	8.80±0.56	7.60±0.48	6.60±0.39
Crumb color	8.60±0.50	8.80±0.54	7.50±0.50	6.90±0.45
Flavor	8.50±0.53	8.70±0.51	7.60±0.49	6.70±0.44
Texture	8.80±0.55	8.90±0.62	7.90±0.48	6.50±0.45
Overall acceptability	8.70±0.50	8.90±0.55	7.80±0.48	7.60±0.49

Data are expressed as mean±SD values given represent means of three determinations.

The sensory evaluation of biscuit revealed that biscuit prepared from ostrich stearin (fat replacer) was more acceptable with the best taste, favor, color and texture compared with control Table 4. Biscuit prepared from ostrich stearin had significantly (P>0.05) improved flavor, texture and general acceptability. While, no significant differences were found in texture and color between cakes (fat replacer) and control

Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase of rats

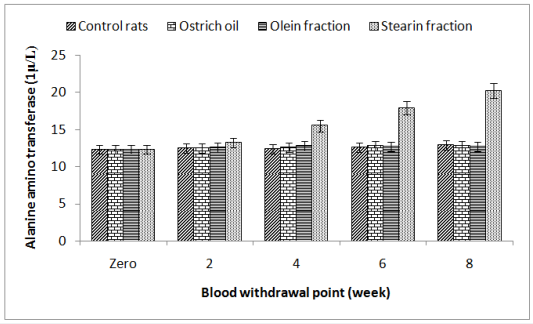

Figure 1: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum alanine amino transferase.
Data are expressed as mean±SD values given represent means of three determinations

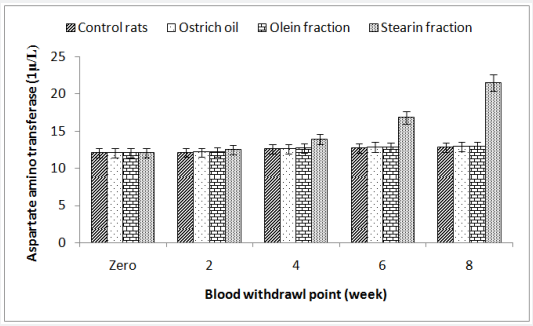

Figure 2: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum aspartate amino transferase.
Data are expressed as mean±SD values given represent means of three determinations.

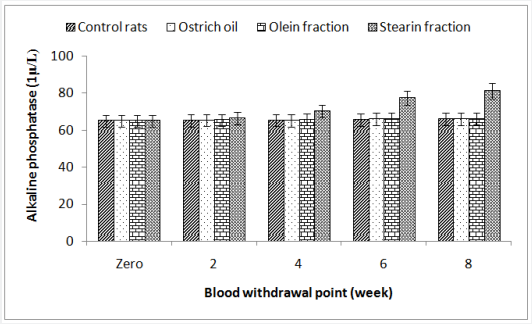

Figure 3: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum alanine phosphatase.
Data are expressed as mean±SD values given represent means of three determinations.

Figures 1-3 shows the activities of ALT, AST and AP for control rats and the values were slightly increased during the whole experiment (8 weeks). Feeding on stearin fraction induced significant increases in serum ALT, AST and AP activities after 2 weeks from the commencement and towards the end of the experiment. While, feeding on ostrich oil and olein fraction did not cause any significant changes in enzyme activities compared with the control experiment.

Influence of feeding of ostrich oil, olein and stearin fraction on serum lipid profile

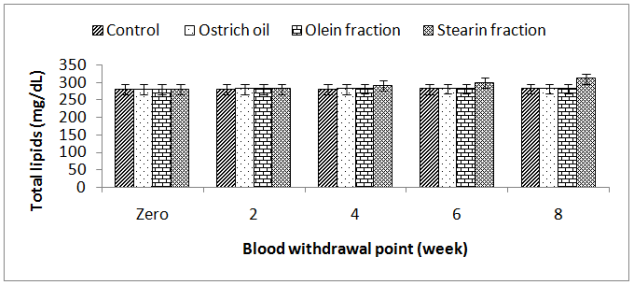

Figure 4: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum total lipids. Data are expressed as mean±SD values given represent means of three determinations.

Serum total lipids: The results in Figure 4 shows that there was non-significant differences in the total lipids for control

How to cite this article: Amany MM B, Shaker M A, Hanaa M S. Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit. Curr Trends Biomedical Eng & Biosci. 2017; 8(5): 555746. DOI: 10.19080/CTBEB.2017.08.555746

rats throughout the whole experiment. The feeding on stearin fraction caused significant and gradual increases in serum total lipids. Feeding on ostrich oil and olein fraction (obtained by fractionation) induced non-significant rise difference in rat serum total lipids.

Serum total cholesterol and low density lipoprotein cholesterol (LDL-C)

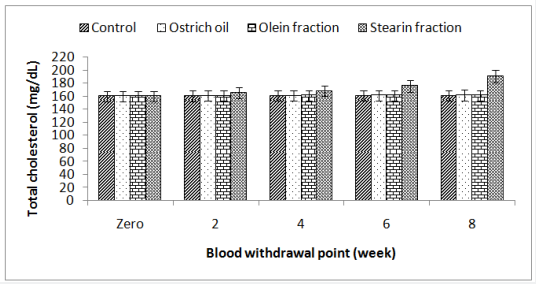

Figure 5: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum total cholesterol. Data are expressed as mean ±SD values given represent means of three determinations.

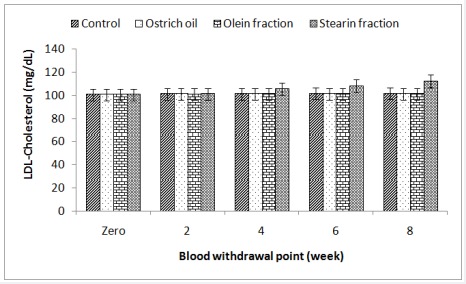

Figure 6: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum LDL-Cholesterol.

Data are expressed as mean±SD values given represent means of three determinations.

Figure 5 & 6 shows the levels of serum total cholesterol and low density lipoprotein cholesterol of control rats; rats feeding of ostrich oil, olein fraction and stearin fraction. The results for the control rats and rats feeding of ostrich oil, and olein fraction, indicated that there were no significant increases in total cholesterol levels and LDL-C during the entire experiment. While, stearin fraction caused significant increases in total cholesterol and LDL-C levels during the entire experiment [24-30].

Serum high density lipoprotein cholesterol (HDL-C)

The data Figure 7 for the control rats and rats feeding of ostrich oil and olein fraction showed non-significant changes in the levels of HDL-C during the entire experiment period (8 weeks). On the contrary, stearin fraction exhibited gradual increases on the levels of rat serum HDL-C.

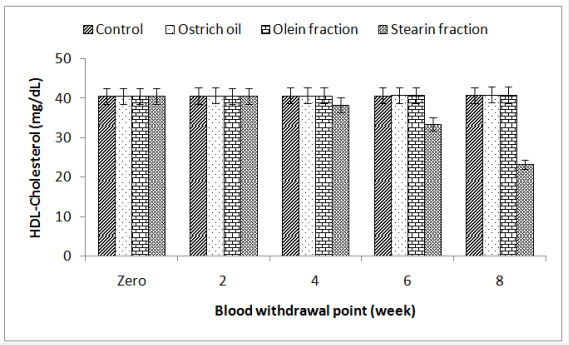

Figure 7: Influence of feeding of ostrich oil, olein and stearin fractions on the activity of serum HDL-Cholesterol.

Data are expressed as mean±SD values given represent means of three determinations.

References

1. Olaf KH, Agnieszka W (2016) Technological and nutritional properties of ostrich, emu, and rhea meat quality. J Vet Res 60: 279-286.
2. Gegener L (2001) Ratite production: Ostrich, emu and rhea, Livestock production Guide, ATTRA-National Sustainable Agriculture Information Services.
3. Hernandez E (2003) Pocessing of ratite oils. J Am Oil Chem Soc Newsletter 9: 100-102.
4. Grompone AM, Irigaray B, Gil M (2005) Uruguayan nandu (Rhea americana oil: A comparison with emu and ostrich oils. J Am Oil Chem Soc 82(9): 687-689.
5. Sethi APS (2015) Rearing emu birds at GADVASU. Personal Communication.
6. Chris P, Slates C (1999) Uses and benefits of emu oil. Nutrition & Food Science, pp. 38-42.
7. Brown MA, Craig Schmidt PC (1995) Fatty acid composition of emu (Dromaiusnavaehollandiae) oil, Inform, 6: 470.
8. Krawezyk T (1997) Emu: premier oil bird. Inform 8: 246-252.
9. Craig-Schmidt MC (1999) Ratite oils: composition and claimed beneficial effects, Lipid Technol. Newsletter 8: 80-83.
10. Sales J, Franken L (1996) Ostrich fat, Australian Ostrich Association Journal 37: 39-45.
11. Knowlton J, Pearce S (1993) Handbook of cosmetic science and technology, Elsevier Editorial, Oxford, UK.
12. Baileys (1996) Industrial oil and products. Wiley Internet. Science Publication John Wiley and Sons, Inc., USA, P. 20.
13. AOAC (2016) Official Methods of Analysis Association of official Analytical Chemists, (20th edn), Association International, Arlington, Virginia, USA.
14. Farag RS, Abdel-Rahim EA, Elsharabasy AM, Hewedy FM, Ragab AA (1984) Biochemical studies on lipids of hens egg during incubation. Seifen de-fette, Wachse 100: 63.
15. Mordert F (1968) Comparison and study of methods of obtaining Unsaponifiable matter. J Crops Grasses 6: 389-397.

How to cite this article: Amany MM B, Shaker M A, Hanaa M S. Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit. Curr Trends Biomedical Eng & Biosci. 2017; 8(5): 555746. DOI: 10.19080/CTBEB.2017.08.555746

16. Evangelisti F, Zunin P, Tisconia E, Petacchi R, Drava G, et al. (1997) Stability to oxidation of virgin olive oils as related to olive condition: study of polar compounds by chemometric methods. J Am Oil Chem Soc 74(8): 117.

17. Kachmar JF, Moss DW (1976) Fundamentals of clinical chemistry. N Tiez (Ed.), Philadelphia, USA, p. 680.

18. Varley H, Gewenlock A, Bell M (1980) Practical Clinical Biochemistry. William Heinemen Medical Books Ltd., London, pp. 741-897.

19. Roechlau P, Betnt E, Gruber WL (1974) Kinetics of the cholesterol. sulfuric acid reaction. A fast kinetic method for serum cholesterol. Clin Chem Biochem 12: 403-408.

20. Assmann G (1979) Cholesterol determination in high density lipoprotein separated by three different methods. Clin Chem 23(5): 882-824.

21. Frings CS, Dunn RT (1979) Colorimetric method for determination of total serum lipids based on the sulpho-phospho-vanillin reaction. Am J Clin Pathol 53(1): 89-91.

22. Reitman S, Frankel S (1986) A colorimetric method determination of serum glutamic oxalacetic and glutamic pyruvic transaminase. Am J Clin Pathol 28(1): 56-63.

23. Mandal AB, Wadhwa M, Bakshi MPS (2016) Animal Feeding-Concepts and Practices, Published by Satish Serial Publishing House, Azadpur, Delhi-110033, India.

24. Wahelefed AW (1974) In methods of enzymatic analysis. Academic. Press, New York, USA.

25. Drury RAB, Wallington EA (1967) Carleton's Histological Technique, Oxford University press, USA.

26. Egyptian Standard Specification (1993) Egyptian standard (49/1993) for Oils Egyptian Organization for Standardization and quality Control, Ministry of Industry, Cairo, Egypt.

27. Shahryar HA, Lotfi A (2012) Fatty acid composition of fat depot in 11 month old slaughtered ostriches (*Struthio camelus* L.). Current Biotica 6: 246-250.

28. International Ostrich Oil Standards (1998) American Emu Association oil standards, AEA, News, 5: 7.

29. Margret C (2003) Uses and benefits of emu oil Nutrition & Food Science, pp. 38-42.

30. Snedecor CW, Cochron G (1981) Statistical methods, Iowa State University, Iowa, USA, pp. 23- 29.

DOI: 10.19080/CTBEB.2017.08.555746

How to cite this article: Amany MM B, Shaker M A, Hanaa M S. Biological Evaluation of Ostrich Oil and Using It for Production of Healthy Biscuit. Curr Trends Biomedical Eng & Biosci. 2017; 8(5): 555746. DOI: 10.19080/CTBEB.2017.08.555746