Chemistry Research Journal, **2018, 3(4):80-84**

Available online www.chemrj.org

ISSN: 2455-8990
CODEN(USA): CRJHA5

Research Article

Technology Development to Obtain Ostrich Oil

Fermín Aguirre-García*, Lourdes Yañez-López

Depto de Biotecnología, Universidad Autónoma metropolitana- Iztapalapa, Avenida San Rafael Atlixco 186, Colonia Vicentina, Delegación Iztapalapa, C.P. 09340, Ciudad de México

Abstract Ostrich fat contains a mixture of saturated and unsaturated oils, it is yellow and with a characteristic strong odor. Polyunsaturated oils in it are 18-carbon compounds as linoleic acid (LA) and alpha-linoleic acid (ALA), among others, and are commercially known as “Omegas”, they are not produced by the human body and should be taken from other meals. Scientific reports reveal that Omegas are antioxidants useful to prevent diseases caused by free radicals. In Mexico, ostrich oil is not industrially manufactured; the cost/kilogram of this importation purified oil is $2,300.00 Mexican pesos. Innovation of this process is related with technology development to obtain ostrich oil from its fat, using a vacuum heating system to maintain a low fusion temperature of the fat and avoiding breakage of unsaturated fatty acids and loss of its antioxidant effects. Such innovation includes obtaining an oil of a good quality that could be employed in other value-added items. Main objectives were: to determine a method to analyze ostrich fat and oil, extract and purify it to know its composition, to define equipment and necessary conditions for extraction and purification of ostrich oil from its fat, to standardize optimum conditions of: temperature, pressure or any necessary equipment to obtain ostrich oil.

An extraction and purification method of ostrich oil was developed without changing its composition; temperature, pressure, time and necessary equipment were defined for the process; technology proposed is not dangerous for the environment; it is possible to suggest it as healthy cooking oil.

Keywords Ostrich, Oil extraction, Omegas, antioxidants

Introduction

Ostrich fat contains a mixture of saturated and unsaturated oils, it is yellow and with a characteristic strong odor, its polyunsaturated oils are 18-carbon compounds as linoleic acid (LA) and alpha-linoleic acid (ALA) commercially known as Omega-3, Omega-6 and Omega-9; they are not produced by the human body and should be taken from other meals as fish, herring, salmon, sardine, red meat, bird meat, eggs or vegetable oils.

Scientific reports reveal that Omegas are antioxidants useful to prevent coronary diseases and brain-vascular accidents, reduce bad cholesterol in blood, (LDL), treat arthritis and rheumatism, prevent skin problems as eczemas and psoriasis; they also play a role in immunosuppression and cell regeneration [1]. In Mexico, there are no pharmaceutical, alimentary or cosmetic products made with this oil, even when in other countries a great variety of them are available and many scientific reports confirm its antioxidant properties.

In Mexico, about 150,000 ostriches are registered and distributed in 200 farms which supply meat to the national market, 5% of them are slaughtered per week, each animal provides 20 kilograms of fat, thus, about 150,000 kilograms of fat are produced per week, its price is $30.00 to $40.00 Mexican pesos per kilogram. Nevertheless, no technology has been developed to take advantage of its antioxidant properties in alimentary, cosmetic or pharmaceutical fields or to treat the mentioned affections [2]. Little market for fat is informally available for food and it is handled as handcraft.

In Mexico, ostrich oil is not industrially manufactured, the kilogram of this importation purified oil, is $2,300.00 Mexican pesos.

Innovation degree is related with technology development to obtain ostrich oil from its fat, using a vacuum heating system to maintain a low fusion temperature of the fat and avoid breakage of unsaturated fatty acids and loss of its antioxidant effects, several purification processes were also used as decoloration, deodorization, desiccation and filtration with a 0.45 micron cellulose membrane to obtain a less impure oil with a better quality. The required equipment is easily adapted with the one already on the market, reagents are commercially available, trained technicians exist as well as low investment costs and incomes within a security range.

The innovation of this method is related to the considerable quantity of ostrich farms in Mexico where oil is not industrialized yet; and with this proposal qualified oil could be obtained and employed in other value-added items.

Objectives

- To determine a method to analyze ostrich fat and oil, extract and purify it to know its composition. To analyze comparatively ostrich and a standard commercial oil to confirm if it could be used as a comestible item for food, supplements, cosmetics and pharmaceutical products.
- To define equipment and necessary conditions for extraction and purification of ostrich oil from its fat.
- To design an analysis method by gas chromatography to identify ostrich oil composition and purity.
- To standardize optimum conditions of: temperature, pressure or any necessary equipment, to obtain ostrich oil.

Materials and Methods

Ostrich fat and reagents for the analysis were donated by Architect Sergio Guzmán, owner of San Andrés ostrich farm. Flask, magnetic plate, vacuum pump and fridge were provided by the Pharmaceutical Technology Lab at Universidad Autónoma Metropolitana Iztapalapa, Ciudad de México, México. Gas chromatograph was borrowed in agreement with Facultad de Química, Universidad Nacional Autónoma de México, Ciudad de México, México.

Ostrich fat was chemically analyzed and; humidity, ash, peroxide and acid index were performed according to Official Mexican Standards [3-8], obtaining the following results:

To analyze ostrich fat composition, a gas chromatography was carried out to know about unsaturated oils and quantity of each one [9].

Chromatographic analysis of ostrich oil

A fat sample was melt and extracted with solvent reflux; fractions were injected to a Shimadzu gas chromatograph, model GC2010PLUS-FID with integrator, column: SP-2560 de 75 m x 0.18 mm x 14 um, temperature of the injector was 250^{o}C, FID detector temperature was 250^{o}C; oven to 140°C (5 min), at 4^{o}/min, up to 240 ^{o}C (2 min.); control method: 37STD, fatty acids, analysis method: SP2560, calculus mode % Area.

Numerical values obtained

Numerical values of each fraction obtained with the previous analysis using the chromatographic integrator are reported in Table 1:

Table 1: Ostrich fats chromatographic analysis

Fatty Acids Content	Saturated Fatty Acids Content
55.99%	44.01%

Fatty Acid	%
Myristic Acid 14:0	1.75
Palmitic Acid 16:0	34.18
Palmitoleic Acid 16:1 (n-7)	4.80
Stearic Acid 18:0	8.08
Oleic Acid 18:1 (n-9) cis	33.67
Linoleic Acid 18:2 (n-6) trans	1.62
Linolenic Acid 18:2 (n-6) cis	12.62
Ɣ-Linolenic Acid 18:3 (n-3)	3.28
Arachidonic Acid	<0.001

As shown in Table 1, ostrich fat contains 55.99% of polyunsaturated acids like Omega-3, Omega-6, Omega-7 and Omega-9, which can be identified as linoleic and α-linoleic acids.

This ostrich fat analysis was a preliminary result of raw material used before obtaining a purified ostrich oil.

Oil Extraction Process

A kilogram of fat was chopped into small pieces and homogenized in a grinder with stainless steel blades, the product obtained was placed in a round-bottom flask of 10 liters, with a vacuum modification, and heated in an electric basket with a plate and a magnetic mixer, then, vacuum and heat (60 ^{o}C) was applied for 30 minutes, afterwards, this hot product was vacuum filtered using a 0.45micron membrane [10].

Refining Process

Refining of filtered oil was performed by alkaline saponification, adding 130 ml of 10% sodium hydroxide, heating to 60°C, agitating for three hours and resting for one hour, after this, the solid fraction was decanted.

Bleaching Process

For this process, 2% of activated clay was added to the liquid phase and vacuum heated to 60°C for an hour, then, it was vacuum filtered using Wathman 42 paper and cooled to -5 ^{o}C for 5 hours (Processing of ratites oils).

Deodorization Process

High pressure steam was injected to the previously obtained oil, bubbling within oil for 30 minutes; it was finally drained adding anhydrous sodium sulfate agitating for 15 minutes and filtering with filter-paper. A pale yellowish homogeneous oil was obtained with a slight off-odor. Ten probes were done under the same conditions, obtaining the following results.

Results

Oil production obtained in the ten probes performed under the same conditions is reported in figure 1.

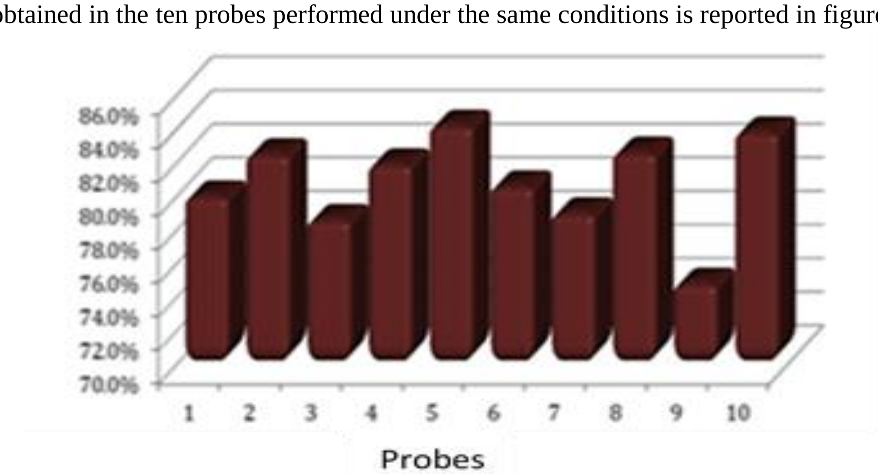

Figure 1: Ostrich oil production obtained (Mean 80.8%)

To test quality and composition of omega fractions from obtained oil by this method, a sample of: ostrich fat, oil obtained and a commercial one, were selected for a comparative analysis using gas chromatography and taking commercial ostrich oil as standard, which was purchased from Corporación de Productores de Avestruces Santa Anita S.P.R de R.L.

Table 2 shows ostrich oil chromatography results from an oil probe obtained in this trial, compared with a standard commercial sample of ostrich oil purchased in Guadalajara, México.

Table 2: Comparative results of the obtained ostrich oil

Composition %	Fat %	Sample Standard %	Oil % LOT 3
OMEGA-7	4.80	12.48	11.04
OMEGA--9	33.67	30.67	39.52
OMEGA-6 Trans	1.62	2.29	2.55
OMEGA-6 cis	12.62	10.95	11.65
OMEGA-3	3.28	2.55	2.74
TOTALS	55.99	58.94	67.50

Graphic results of Omega fractions, according to the previous table are the following:

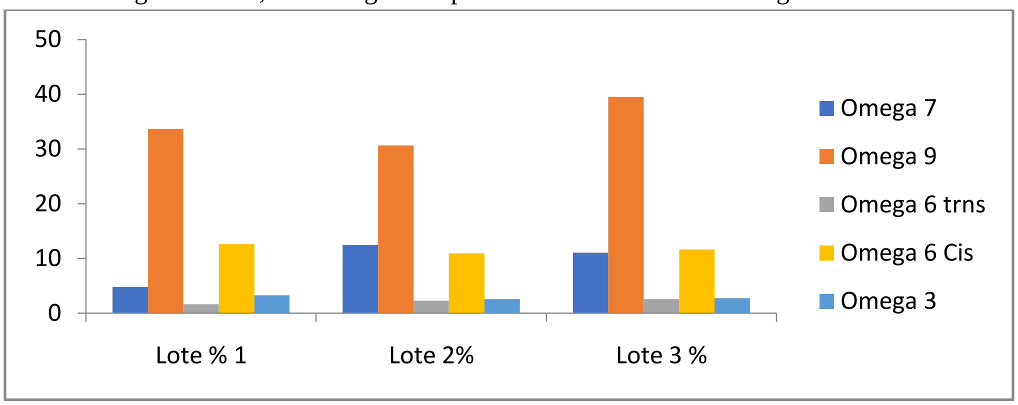

Figure 2: Comparative results of ostrich oil

Discussion

Ostrich fat was analyzed, revealing its high percentage of unsaturated oils (Omegas). Ostrich oil obtained in this trial contains the same components as the standard, with a high percentage of Omega-9 (39.52%), Omega-6 (14.20%), Omega-7 (11.04%) and Omega-3 (2.74%), a total of 67.50% of Omegas which provides it with antioxidant qualities. It is noteworthy to say that an extraction and purification method of ostrich oil was developed without breaking down its unsaturated oils, preserving its original qualities. Temperature, pressure, time and necessary equipment were defined for the process in a trustable and reproducible way. Comparatively, a commercial standard was used to know its quality.

Purified ostrich oil is not commercially produced in Mexico and is highly requested in national market, its price is $2,300 Mexican pesos/kg, and so, it represents a high value-added item. Ostrich fat, instead, does not have a commercial use in Mexico yet, and its price in the market is $30.00 to $40.00 Mexican pesos/kg thus, utility margin is profitable. Net present value (NPV) revealed a result above cero, which means that the product generates higher incomes than investment. The internal rate of return (IRR) was 38.25% and the maximum contribution rate risk (CRR) was 15%. Return on investment (ROI) was 365% considering 4% of inflation, revealing good incomes. The market analysis for the product was considered up to the year 2020 indicating its profitability. (Brennan, G.)

Conclusions

A process to obtain ostrich oil from its fat, without breaking it down, was set up.

Ostrich fat and obtained oil contain a high percentage of Omegas which are natural antioxidants very useful in food, cosmetics and drugs.

It is possible to suggest it as a cooking oil to substitute other less unsaturated oils that lead to low-density cholesterol (LDL) accumulation in arteries and the risk of cardiovascular diseases.

The technology proposed is not dangerous for the environment.

Acknowledgments

Architect Sergio Guzmán, owner of San Andrés ostrich farm

Corporación de Productores de Avestruces Santa Anita S.P.R de R.L

Facultad de Química, Universidad Nacional Autónoma de México, Ciudad de México, México

Pharmaceutical Technology Lab at Universidad Autónoma Metropolitana Iztapalapa, Ciudad de México.

References

1. Anonymous. (1977). *Grasas y Aceites en la Nutrición Humana.* Consulta: FAO/OMS de expertos. Roma. OMS. Volumen (57), 143-180.
2. Anonymous. Mundo Avestruz. Productos de avestruz. (2015, Mayo). Available in: http://www.mundoavestruz.com/index.php.
3. NMX-F-211-SCFI-2011. *Alimentos-Aceites y Grasas vegetales o animales-Determinación de Humedad y material volátil* por el método de placa caliente Declaratoria de vigencia. Publicada en el diario oficial de la federación, el 14 de febrero del 2011.
4. NMX-F-089-S (1997). *Guía para la redacción, presentación de las Normas Mexicanas.* Publicadas en el Diario Oficial de la Federación el 31 de octubre de 1977.
5. NMX-F-154 (2010). *Alimentos-aceites y grasas vegetales o animales. Determinación del Valor del Peróxido.* Publicada en el diario oficial de la federación en abril del 2010.
6. NMX-F-154-SCFI-2010. *Alimentos-Aceites y grasas vegetales o animales*. *Determinación del Valor de Peróxido*. Publicada en el diario oficial de la federación el 14 de abril del 2010.
7. NMX-F-101-SCFI-2012. *Alimentos, Aceites y grasas vegetales o animales*. *Determinación del valor Ácidos Grasos*. Publicada en el diario oficial de la federación el 12 de marzo del 2012.
8. NMX-F066-S-1978. *Determinación de Cenizas en Alimentos-Aceites y Grasas*. Normas Mexicanas. Dirección General de Normas.
9. Anonymous. Official Methods of Analysis (1980) of the Association of Analytical Chemistry. Thirteenth edition. William Horwitz. Editor. Chapter 14, pg. 213.
10. Márquez, R. Repiso, L. Sala, A. Salle, L. Silvera, C. (2007). *Estudio de una Tecnología y Fraccionamiento del Aceite de Ñandú.* Facultad de Ingeniería. Universidad Católica de Uruguay. (2),4-6.