Uruguayan Nandu (*Rhea americana*) Oil: A Comparison with Emu and Ostrich Oils

Sir:

The South American ostrich, the Nandu or Greater Rhea (*Rhea americana*), is a ratite bird native to the grassy plains of the south of Brazil, Argentina, and Uruguay. Found throughout the Uruguayan territory, it has been bred commercially since 1985. Rhea oil is available on the market for use in cosmetic manufacture. The ostrich (*Struthio camelus*), however, being a larger bird with reduced fat content, is preferred for meat production. The emu (*Dromaeus novaehollandiae*), native to the barren lands of Australia, is the smallest of all three ratites. The emu has a higher proportion of fatty tissue, its oil being widely valued. Major emu oil properties, either cosmetic or pharmacological, are related to skin penetration and moisturizing effects, as well as anti-arthritic and anti-inflammatory properties. Scientific work published on the composition of oil extracted from this ratite is scarce (1–3).

Uruguayan rhea oil, in addition to being exported as such, is also currently used in cosmetic formulations. The availability of scientific research data regarding rhea oil composition and properties is of major interest. The main objective of this research work is to evaluate differences between oils obtained from these ratite species and to determine whether they could be interchangeable for use in the cosmetic industry.

For industrial extraction of emu oil, only internal tissue (tissue within the carcass) is used, whereas external tissue (subcutaneous), which is considered unsuitable, is usually disposed of. In the case of rhea, the internal fat tissue differs widely in appearance from the external tissue, a fact that justifies a separate study of the composition of oils extracted from either type of tissue. The first study is aimed at determining whether differences in the properties of the resulting oils justify the separate extraction of both oil types.

TABLE 1
Major FA Composition of Oil Extracted from Internal and External Fat Tissues of Different Rhea Specimens

Samples	16:0	16:1	18:0	18:1	18:2n-6	18:3n-3
Internal fat tissue						
A	18.7	1.9	9.0	43.5	20.4	2.0
B	26.7	2.9	6.5	45.0	16.4	1.5
C	19.4	2.3	8.0	45.4	21.7	3.2
D	27.0	3.2	6.7	36.9	21.7	1.9
E	25.1	2.3	7.4	32.4	27.7	3.1
F	27.0	3.2	7.2	33.5	23.6	2.6
H	20.8	2.6	9.3	45.7	19.6	2.0
J	19.1	1.4	10.7	38.3	27.1	1.9
K	20.9	2.9	6.7	43.5	22.0	2.1
Average	22.7	2.5	7.9	40.5	22.2	2.3
SD	3.6	0.6	1.4	5.3	3.5	0.6
Minimum value	18.7	1.4	6.5	32.4	16.4	1.5
Maximum value	27.0	3.2	10.7	45.7	27.7	3.2
External fat tissue						
A	18.3	2.4	10.2	42.6	21.3	2.6
B	22.1	2.4	10.1	44.5	17.0	3.9
C	20.3	2.7	8.2	43.1	21.7	4.0
D	27.8	3.4	7.4	34.9	22.5	2.2
E	27.2	3.7	6.8	35.2	20.9	2.7
G	27.8	3.4	7.4	34.9	22.5	2.2
I	27.2	5.3	6.4	43.1	15.4	1.3
J	21.8	2.0	9.0	36.9	26.7	2.3
K	20.7	2.4	8.5	41.5	23.8	2.0
Average	23.7	3.1	8.2	39.6	21.3	2.6
SD	3.8	1.0	1.4	4.1	3.4	0.9
Minimum value	18.3	2.0	6.4	34.9	15.4	1.3
Maximum value	27.8	5.3	10.2	44.5	26.7	4.0

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TABLE 2
Major FA Composition of Rhea, Emu, and Ostrich Oils

	Rhea (minimum)	Rhea (maximum)	Rhea[a]	Emu (USA)	Emu (Canada)	Emu[a]	Ostrich[a]
16:0	18.3	27.8	34.4	22.7	22.5	21.4	34.9
16:1	1.4	5.3	4.5	3.5	4.1	3.6	7.4
18:0	6.4	10.7	5.4	9.5	8.8	8.1	5.7
18:1	32.4	45.7	30.6	47.5	51.3	43.6	30.5
18:2n-6	15.4	27.7	21.0	15.0	11.4	20.6	16.0
18:3n-3	1.3	4.0	1.9	0.6	0.6	1.5	2.1
Saturated	27.4	35.2	41.1	32.2	31.3	29.5	40.6
MUFA	34.7	48.4	35.1	51.0	55.4	47.2	37.9
PUFA	16.7	30.8	22.9	25.6	12.0	22.1	18.1

[a]Craig-Schmidt (3).

In the first study, oil was obtained by means of steam extraction for 2 h in an autoclave from both internal and external fat tissue obtained from different rhea specimens supplied by Uruguayan breeders. Each specimen was identified by one letter in order to compare the composition of both types of tissue.

In the second study, based on data obtained in the first study, a comparison was made among the combined rhea data, literature data, and the analysis of two commercial emu oil samples from different suppliers: (A) pharmaceutical quality, refined oil of 100% purity (High Cascade Premier Enterprises, Ltd., Eagle Point, Oregon) and (B) 100% pure oil of Dundee brand (Léo Désilets, Scotstown, Québec, Canada).

In all cases, the determination of FA composition (as methyl esters) was carried out on a Shimadzu model 14 B gas chromatograph equipped with a BPX-70 capillary column (SGE Australia Pty. Ltd., Ringwood, Victoria, Australia).

Table 1 shows the FA composition of oil extracted from nine samples of internal fat tissue and nine samples of external fat, respectively. For each slaughtered bird, differences between both types of tissue were found to be small. In addition, average values for either type of tissue did not differ widely enough to justify separate processing of the extracted oil types.

Table 2 shows the composition of major FA of rhea oil (minimum and maximum values of Table 1) of both commercial emu oil samples analyzed, as well as values found in the literature (3) for emu oil (average value among 10 specimens), ostrich oil (average of 20 specimens), and rhea oil (average of 23 specimens). Uruguayan rhea oil has a lower percentage of 16:0 (and saturated FA in general) and a higher percentage of 18:1 than the value reported in the literature (3). The composition of both emu oils analyzed also differed slightly from the values reported in the literature (3).

Palmitic acid values for emu oil were within the range determined for Uruguayan rhea oil, with a higher percentage of 16:0 in ostrich oil. The 18:1 content of emu oil tends to be higher than that of Uruguayan rhea oil. Linoleic acid values do not differ greatly. No significant amounts of eicosapentaenoic acid (20:5n-3) or docosahexaenoic acid (22:6n-3), known to inhibit synthesis of pro-inflammatory eicosanoids, were found in any of the oils.

Thermal analysis of different samples was carried out on a Shimadzu model DSC 50 differential scanning calorimeter. After melting the samples, they were placed in aluminum capsules with lids and weighed on analytical scales. They were later tempered in a freezer at −20°C for 48 h. Liquid nitrogen was used as the refrigerant for all runs on the calorimeter. The initial temperature was −60°C, and heating up to 70°C was achieved at a rate of 5°C/min. Figure 1 shows thermograms and solid fat indices for both commercial emu oils and for a Uruguayan rhea oil. From the thermograms, the temperature

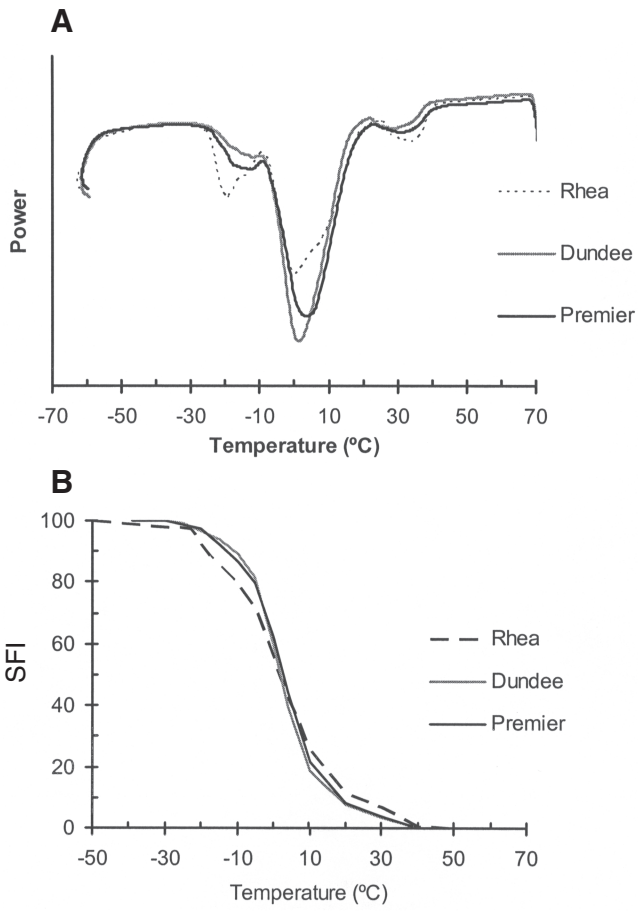

FIG. 1. Two commercial emu oil samples (Dundee and Premier) and one Uruguayan rhea oil sample. (A) Thermograms; (B) solid fat index (SFI).

at which complete melting was achieved was also determined (T_{endset}). The value for rhea oil was 39.6°C, for Canadian emu 38.0°C, and for American emu 40.1°C.

The thermogram for emu oils had three peaks: one at −12°C, a second peak at 3°C, and a third peak at 31°C. Three peaks were also obtained for rhea oil, located at −19, 1, and 34°C, and were of a different size from those for emu oil. Such differences were also reflected in the variation of solid fat content with temperature. Thus, the thermal behavior was slightly different for emu and rhea oils, but both were semisolids at a room temperature of approximately 20°C.

It may be concluded that emu and rhea oils are not identical, yet they are alike enough to be used equally in cosmetic formulations without important changes in physicochemical behavior. This may open good commercial prospects for Uruguayan rhea oil.

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