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Physico-chemical properties and fatty acids composition of two fats used in ethno-medicinal treatment of arthritis in Southwestern Nigeria: *Vitellaria paradoxa* and *Python sebae*

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ABSTRACT

Formulations of shea butter (Vitellaria paradoxa) and python fat (Python sebae) are common among the elderlies, who suffer from bone inflammation and arthritis in Southwestern Nigeria, as topical applications on the skin to effect relief from such conditions. Physico-chemical properties and fatty acids of these two lipids were investigated using standard methods. Some of the physico-chemical values include refractive indices (1.46, 1.46), iodine values (49.09, 50.52 mgI_2/g), peroxide values, (11.10, 11.35 meqO_2/Kg) and saponification values (150 and 172 mgKOH/g) for P. sebae and V. paradoxa respectively. The principal fatty acids in V. paradoxa are oleic (C18:1, 55.2%) and stearic acids (C18:0, 25.6%), and in P.sebae are myristic (C14:0, 32.0%) and oleic (C18:1, 29.2%) acids. The total saturated and unsaturated fatty acids in P. sebae were 61.6% and 37.5% respectively. These were an opposite of the trend observed for V. paradoxa (34.7%, 64.8 %).

Keywords: Shea butter, *Vitellaria paradoxa, P.sebae,* Fatty acids, Physico-chemical Properties,

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INTRODUCTION

The shea butter is a vegetable fat obtained from the *Vitellaria paradoxa* tree. The tree is unique to Africa and grows widely in the savannah region of the continent [1]. *V.paradoxa* has been recognized for its emollient, anti-inflammatory, anti-tumor promoting and healing properties. It is readily used in the production of skin balms, soaps and shampoos. Its use in personal care products and food is, however, growing steadily in recent times. [2,], [3], [4].

The processing of shea butter from its nuts has been an exclusive business of women. The nuts are usually handpicked and processed into creamy butter. The creamy butter obtained is sold and helps provide income for the family [3].

Python fat is a lipid obtained from the intestinal walls of *Python sebae,* also known as African Rock python. The non-venomous snake is called, 'Ere' and its fat is referred to as 'Ora Ere' in the Yoruba language of Southwestern Nigeria. The Python fat is usually sold by local women who trade in ingredients of folklore medicine in rural markets in Southwestern Nigeria. *Python sebae* is a vulnerable specie which is usually hunted for subsistence, leather and many other traditional use in ethno-medicine [5], [6].

Formulations of shea butter and python fat are common among the elderlies who suffer from bone inflammation and arthritis, as topical application on the skin to effect relief from such conditions [Adebayo, S. personal

communication 20 June, 2012]. The cosmetic properties of the oil obtained from some birds from the Ratite family appear to increase when used in combination with phospholipids from vegetable oils [7]

The aim of this research work was to investigate the physico-chemical properties and fatty acids compositions of the two lipids used in topical applications for the relief of bone inflammation and arthritis in Southwestern Nigeria.

MATERIALS AND METHODS

Physico-chemical Properties

Refractive index was measured at 35 ^{o} C using Abbe refractometer as described by Kirk and Sawyer [8]. Specific gravity of the oils were measured using specific gravity bottle, other properties such as melting point, flash point, smoke point and fire point were determined using the standard methods of the American Society for Testing and Materials [9]. Saponification value, iodine value, acid value, free fatty acids value and peroxide value were determined using the standard methods of Pearson [10].

Fatty acid analysis

The oil from samples was converted to fatty acid methyl esters (FAME) through trans- methylation using sodium hydroxide and methanol and analysed using the method described by Akintayo, *et al*. [11].

Statistical analysis

The results of physico-chemical properties of the oils were expressed as mean ± standard deviation (SD) of three replicates. Data obtained were statistically analysed using student t test, a tool in Statistical Packages for Social Sciences [12]. The level of significance was set at $P < 0.05$.

RESULTS AND DISCUSSION

The results of the physico-chemical properties of the lipids are presented in Table 1. The melting points for *V. paradoxa* and *P. sebae* are 32.0 ^{0}C and 42.3 ^{0}C, however, the *P. sebae* has a higher melting point than that of shea butter. Both lipids melt by the heat of the palm of the hands when rubbed into the skin in such formulations used in skin care and in ethno-medicinal treatment of arthritis.

In all the physico-chemical properties determined on the two lipids, the melting points and the moisture contents were the only properties in which the shea butter had lower values than those obtained for *P. sebae*. Both lipids had similar refractive indices (1.46), iodine (49.09, 50.52 mgI_2/g) and peroxide (11.10, 11.35) values. Their refractive indices are within the range of values reported for some crude vegetable oils by FAO/WHO [13]. The iodine values for the fats in this study are similar to those reported for palm oil (50 - 55.0) by FAO/WHO [13].

Table 1: Physico-chemical properties of *V. paradoxa* and P. *sebae*

Property	*V. paradoxa* Shea butter	P. *sebae* African Rock Python fat
Physical		
Melting point (^{o}C)	$32.0^{a} \pm 1.00$	$42.3^{b} \pm 0.57$
Refractive index	$1.46^{a} \pm 0.01$	$1.46^{a} \pm 0.01$
Specific gravity	$0.93^{b} \pm 0.01$	$0.89^{a} \pm$
Flash point (^{o}C)	$217^{b} \pm 2.51$	$201^{a} \pm 2.08$
Smoke point (^{o}C)	$163^{b} \pm 1.52$	$143^{a} \pm 3.51$
Fire point (^{o}C)	$245^{b} \pm 3.00$	$227^{a} \pm 1.00$
Moisture content (%)	$5.97^{a} \pm 0.10$	$10.50^{b} \pm 0.07$
Chemical		
Free fatty acids (mg/g)	$9.53^{b} \pm 0.27$	$8.53^{a} \pm 0.20$
Acid value (mg KOH/g)	$19.05^{b} \pm 0.53$	$17.06^{a} \pm 0.40$
Saponification value (mgKOH/g)	$172^{b} \pm 3.85$	$150^{a} \pm 1.65$
Iodine value (mgI_2/g)	$50.52^{a} \pm 0.65$	$49.09^{a} \pm 1.39$
Peroxide value (Meq/Kg)	$11.35^{a} \pm 0.25$	$11.10^{a} \pm 0.17$

Values are presented as mean ± standard deviation for triplicates replication.
Means with different superscript on the same row are significantlly different (P< 0.05)

V. paradoxa had higher values than *P. sebae* in the other physico-chemical properties determined such as flash point (217, 200 ^{0}C), smoke point (163, 143 ^{0}C), fire point (245,227 ^{0}C), free fatty acids (9.53, 8.53 mg/g), acid values

(19.05, 17.06 mg KOH/g), saponification value (172, 150 mg KOH/Kg) and specific gravity values (0.93, 0.89) for *V. paradoxa* and *P. sebae* respectively. However, all these values are within the range of values reported by Obibuzor *et al.* [14] for a two-year seasonal survey of the quality of shea butter produced in Niger State of Nigeria.

The fatty acid composition of the samples is presented in Table 2. The principal fatty acids observed in shea butter were oleic (C18:1, 55.2%) and stearic acids (C18:0, 25.6%), this quite agrees with the results of other workers and is in the agreement with some reported values for shea sample from sub-Saharan Africa [15]. Oleic acid, a monounsaturated (omega-9) fatty acid readily finds application in cosmetic and pharmaceutical formulations as an excipient. It serves as penetration enhancer in transdermal formulations for the bioavailability of poorly hydrophilic active ingredients [16]. The principal fatty acids observed for the *P. sebae* are myristic (C14:0, 32.0%) and oleic (C18:1, 29.2%) acids. The stearic and oleic acids in *V. paradoxa* are about twice those found in *P. sebae.* The combined oleic acid contents of both lipids (C18:1, 84.4%) is very high and may be a very important contributory factor to the healing effects noticed when used in ethno-medicinal applications. From the fatty acids profiles of these two lipids, it can be deduced that there is a balance between total saturated fatty acids (TSFA, 34.7%, 61.6%) and total unsaturated fatty acids (TUFA, 64.8%, 37.5%) of the two lipids for *V. paradoxa* and *P. sebae* respectively. It seemed as though what is lacking in one lipid is provided for in the other lipid. TSFA level in *V. paradoxa* is 34.7%, but TUFA in the same sample is 64.8%. In the *P. sebae*, a completely opposite trend is noticed, whereby TSFA is 61.6% and TUFA is 37.5%.

Table 2: Fatty acids composition of *V.paradoxa* and P. *sebae* (%)

Fatty acid	Systematic name	Formula	*V.paradoxa*	P. *sebae*
Myristic	Tetradecanoic acid	C14.0	0.0001	32.0
Palmitic	Hexadecanoic acid	C16:0	8.5	8.1
Stearic	Octadecanoic acid	C18.0	25.6	15.6
Oleic	(Z)-9-octadecenoic acid	C18:1	55.2	29.2
Linoleic	(Z,Z)-9,12-octadecadienoic acid	C18:2	6.5	5.8
Linolenic	(Z,Z,Z)-9,12,15-octadecatrienoic acid	C18:3	3.1	2.5
Arachidic	Eicosanoic acid	C20:0	0.6	5.9
Total Saturated Fatty acids		TSFA	34.7	61.6
Total Unsaturated Fatty acids		TUFA	64.8	37.5

CONCLUSION

The two lipids had some similarities in their physical properties which may be of advantage in their applications as ingredients of topical formulations in cosmetics and pharmaceuticals. The principal fatty acids in *V. paradoxa* are oleic (C18:1, 55.2%) and stearic acids (C18:0, 25.6%), and those found in *P.sebae* are myristic (C14:0, 32.0%) and oleic (C18:1, 29.2%) acids. The total saturated and unsaturated fatty acids in *P. sebae* were 61.6% and 37.5% respectively, but were an opposite of the trend observed for *V. paradoxa* (34.7%, 64.8 %).

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