

Research Paper

Contribution to the constitution of shea butter sensorial standard based on Ivoirian consumers criteria

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Abstract

Shea butter is becoming one of the most natural ingredients in beauty and personal formulation because it brings functional benefits to users. Despite its wide sensorial variability on Ivoirian markets, consumers always complain on its sensorial quality. Hence, sensorial preferential criteria were determined in order to constitute an Ivoirian exploitable data basis about shea butter. A survey was carried out in order to collect consumers' criteria; markets shea butter distribution was also evaluated. The chi² test performed on collected data revealed that white colored (51.90%), odorless (58.40%) and fondant (35.70%) shea butter were mostly preferred by Ivoirian consumers while on markets, yellow colored, rancid and compact (hard) were predominant on markets. Shea butter texture, the first criteria (85.30%) of choice, was significantly affected by consumers' genre (1-p=99.02%), profession (1-p=99.07%) and utilization (1-p=99.93%), when the genre (1-p=99.99%) and the age (1-p=99.99%) influenced its utilization. Above all, aches treatment (83.80%) represented the main purpose, when beauty care and feeding occurred respectively for 68.20% and 20.80%.

Keywords: shea butter, consumers' preference, survey, market, sensorial criteria.

Introduction

Shea tree (*Vitellaria paradoxa*, syn. *Butyrospermum parkii*, *B. paradoxa*), an indigenous African tree, represents crescendo, an important socio-economical resource ^[1,2,3,4] for its producing countries. Indeed, shea butter has become one of the most popular ingredients used in food, pharmaceutical, cosmetics and often by chocolate manufacturers and for margarine and baking purpose ^[4,5,6,7]. According to PNUD ^[4] and FAOSTAT ^[8], the highest shea producers countries are situated in West Africa (701510 tones) and Côte d'Ivoire just represents the fifth producer with 30000 tones. In the whole producing countries, the shea industry is mainly driven by the work of women who use their own approach of process ^[9], and for whom shea butter provides more than half of their income ^[4]. Moreover, according to Elias and Carney ^[2], and AAK Global ^[7], traditional processing shea butter (Bio-shea butter) interest consumers, more than chemical one. Nevertheless, these processing involve several steps which include wide variability from a producer to another ^[6,10,11]. This situation leads to various types of shea butter ^[6,12]. Despite this variability, consumers in general and particularly citizens of Côte d'Ivoire, always complain about the quality of shea butter sold on their markets. The present study aimed to propose shea butter sensorial standards according to Ivorian consumers. Hence, a survey was carried out through the country in order to notice consumers' sensorial (color, odor and texture) criteria. Moreover, shea butter current situation on Ivorian markets was obtained by collect realized on markets to evaluate sensorial distribution.

Materials and Methods

Biological material

Ordinary shea butters were collected (purchased) from the main markets of several towns located in *V. paradoxa* region in the North of Côte d'Ivoire (Bondoukou, Dabakala, Katiola and Korogho) and from Abidjan district (Abobo, Adjamé, Anyama, Bingerville, Dabou and Yopougon).

Constitution of the survey population

The survey was carried out in some shea producing areas of Côte d'Ivoire (Dabakala, Ferké, Katiola, Bouaké, Abidjan district. People (women and men) of three category of age (Junior, major and senior), with divers profession and from various origin were interviewed, mainly in areas of great meeting such as car and bus stations, markets, around (and in) schools and universities. About the category of age, junior are people under 25 years, adult, those who have between 25 and 40 years when senior consisted in people with more than 40 years.

Samples collect on markets and sensorial characterization

Samples (164 samples of shea butters) were purchased with sellers in transit and those staying at permanent locations of the main markets of Abidjan district. In producing areas, collect were realized only, on market days.

Each sample was conserved in a sterile plastic wrapper and transported in an icebox containing ice cubes, following the international norms (ISO/CEI 17025) described in 2000 by the European Union. At the laboratory, the different samples were codified according to their origins (market, town and area). Then the color, odor and texture were determined using Konan *et al.*^[13] method

Collection of information

Structured questionnaires were established following a survey method on *Sphinx plus²* Software. The questionnaire took into account either the socio-demographic status of the respondents or their knowledge and preference about shea butter sensorial characteristics. Respondent filed a questionnaire after his (her) agreement. Each of them had first, to provide information on their genre, age, ethnic group and education level. Secondly, they had to precise their main criteria (color, odor and texture) they in the choice shea butter, and inally, the sensorial characteristics expect. For the previous purpose, they made choices among several sensorial characteristics proposed to them, or added others characteristics the questionnaire did not notice.

Statistical analysis

Information obtained on the each survey questionnaire was treated on *Sphinx Plus²* Software using frequencies comparison by Chi2 test. As for collected shea butters, chi2 test was performed on percentages on SPSS logician version 10.0.

Results and Discussion

Consumers' criteria about shea butter

1- Survey population characteristics

Chi2 test performed on survey data revealed that respondents from various origins (south, north and center of Côte d'Ivoire), as indicated in Figure 1A, were mainly constituted by women (61.7%); men just represented 37.7% (Figure 1B). Both genres belonged to three age categories, but majors were the most dominant (Figure 1C). Indeed, there were 17.5% under twenty-five years or juniors (<25), 63% between twenty-five and forty years or majors (25-40) and 18.20%, with more than forty years or seniors (40+). About their activities, four categories of professions were identified (Figure 1D), namely self-employ (39.87%), students (24.18%), civil servants (20.26%) and unemployed (15.69%).

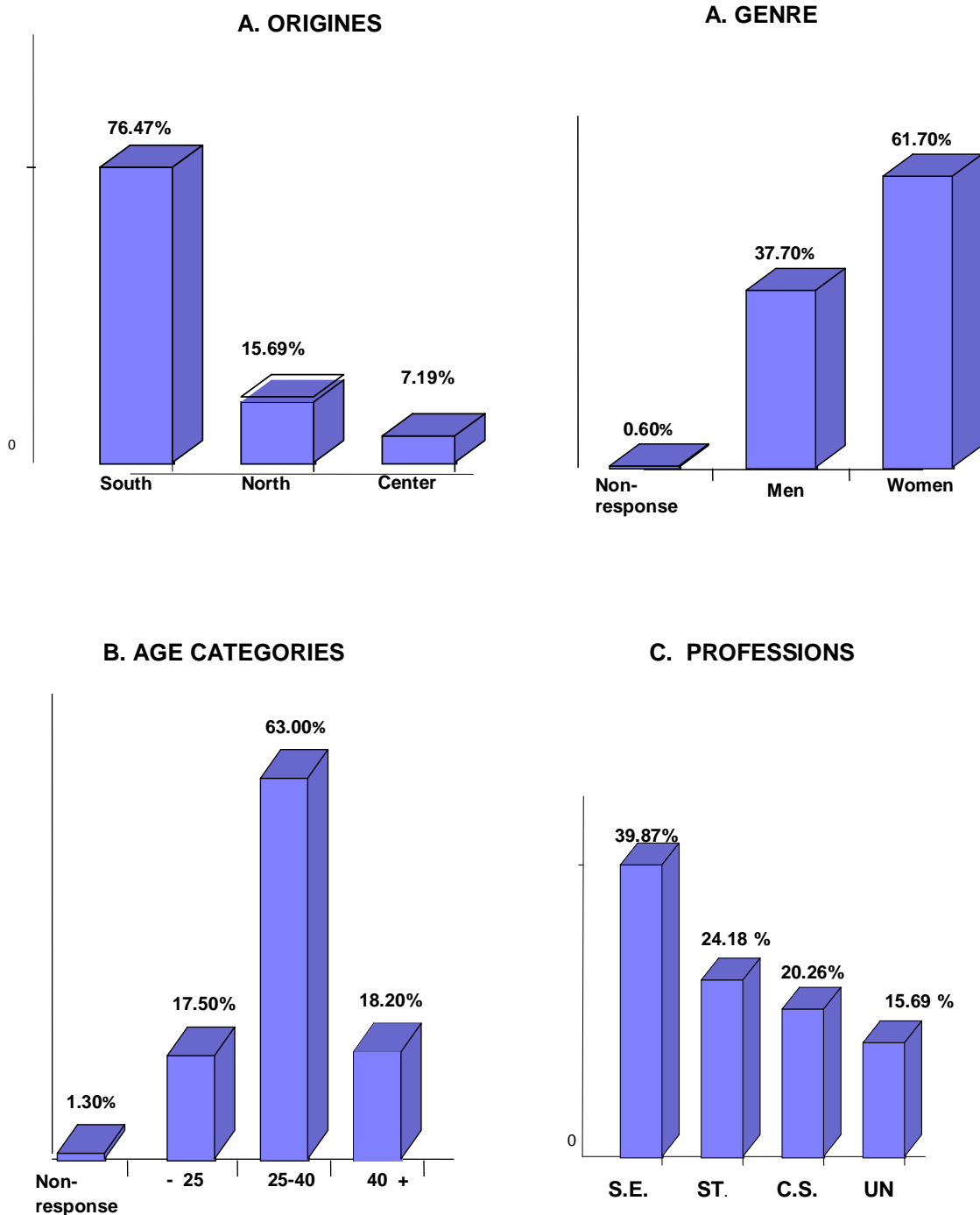


Figure 1: Survey population characteristics
Legend: S.E. - Self-employed, ST. - Student, C.S. - Civil servants, UN- Unemployed

2- Respondents' choices about shea butter criteria and utilization

Three colors (white, yellow and grey), three odors (odorless, strong and slight smells), two textures (hard or compact and fondant) and three purposes of usage, were précised by respondents, about shea butter . Above all, results revealed that the first criteria consumers considered for shea butter choice, was the texture which recorded 85.30% of importance ($\chi^2=95.77$, $1-p=99.99\%$); Color ($\chi^2=87.56$, $1-p=99.99$) and odor ($\chi^2=116,29$, $1-p=99.99$) followed with 80% and 75% of interest, respectively (Table 1).

Table 1: Shea butter criteria importance for consumers (%)

	Color	Odor	Texture
Important	80.00	77.90	85.30
Not important	16.80	17.90	11.60
Non-response	3.20	4.20	3.20

Concerning shea butter color ($\chi^2=81.53$, $1-p=99.99\%$), the white one (51.90%) recorded the most important percentage (figure 2), in opposition to the grey one (1.30%). Yellow shea butter, as for it, registered 29.30%. About the odors ($\chi^2=99.97$, $1-p=99.99\%$), consumers preferentially chose odorless (58.40%) shea butter, compared to slight (17.50%) and strong (4.50%) smelling ones. As for shea butter texture ($\chi^2=18.36$, $1-p=99.96\%$), consumers opted mostly for fondant (35.70%) shea butter; doughy and hard ones were respectively selected by 22.70 and 29.20% of the respondents. As for shea butter utilization ($\chi^2=159.12$, $1-p=99.99$), the main place was recorded by aches treatment (81.80%), followed by beauty care (68.20%) and feeding (20.81%), as showed on Figure 2. It's worth précising that, the utilization for one purpose did not exclude systematically the others.

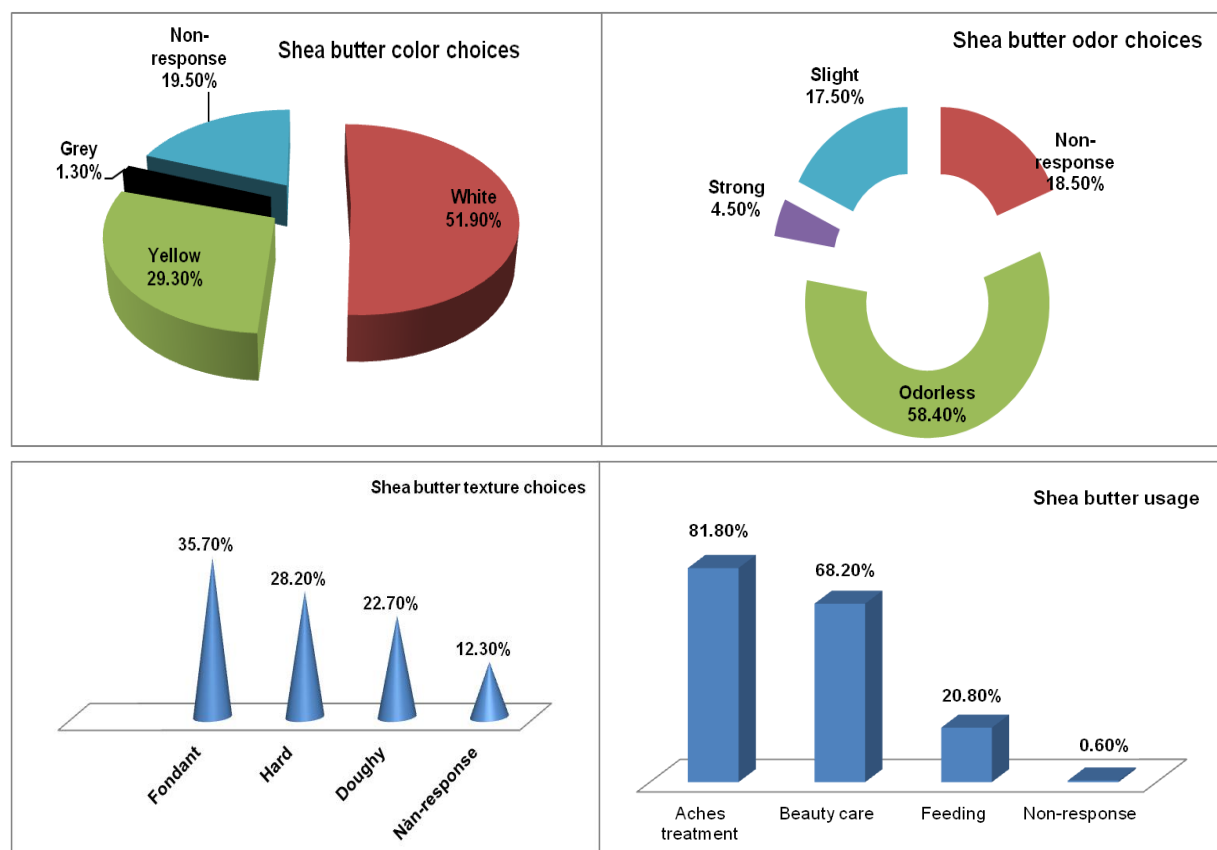


Figure 2: Respondents' choices about shea butter

I- Markets shea butter sensorial distribution

The whole collected shea butter was composed of various colors (beige, yellow and grey), odors (rancid, odorless, slight and strong smell) and textures (fondant and hard or compact). Color, odor and texture distribution were not affected by the origin of the butter ($\chi^2=9.84$, $1-p=86.80\%$; $\chi^2=15.45$, $1-p=92.10\%$ and $\chi^2=3.58$, $1-p=69.00\%$, respectively). In fact, as far as color was concerned (Figure 3), the most dominant on the whole markets was yellow (67.90%), followed by the

beige (29.63%) and the grey (2.47%). For the odor, rancid shea butter registered the most important percentage with 33.95% of the whole collected shea butter, when slight and strong fragrances counted respectively 33.33 and 11.73%; odorless represented 20.99%. About the textures, hard or compact shea butters (93.83%) were the most common shea butter met on markets, in opposition to fondants (6.17%).

A wide range of variation exists in the traditional methods of shea nuts transformation, even within the same ethnic group, and leads to a wide and intentional diversity in shea butters sensorial characteristics [6,14]. Indeed, each texture, color and odor results from specific proceeding and accords to specific purposes. Hence, the texture might be as waterless as possible for better conservation [14,15], so shea butter might present hard texture which would have more oil content. Moreover, according to traders, selling ball of hard textured shea butter would not melt trading time long. Soft shea butter, as for it, should be easy melting and consequently interesting for body robbing. Despite this interest, soft shea butter would be more perishable than the hard one, according to Ghanaian consumers [15].

In conformity with the previous consumers, the present study underlined not only the implication of shea butter in body care mainly as far as unemployed, student and self-employed are concerned, but also precise the necessity of getting it fondant (firm but easily fondant when pressed between fingers). That propriety should mainly depend on the fact of re-melting and stirring frequently the hot shea butter to avoid crystallization until the butter solidifies [16]. Fondant texture choice of Ivoirians is also conform to cosmetics needs of body fat [7]. Hence, producer/traders would rather propose fondant shea butter, and in order to preserve it from fusion, they must avoid sun exposure. Color would be linked not only to kernels roasting duration [6,12] but also to the adding of some *Cochlospermum spp.* root dye [6,15,16,17]. The first effect might lead to color ranging from dirty white to grey, when the second one (dye adding) would give yellowish shea butter. The second proceeding might prevent shea butter from rancidity because of the presence of high amount of tannins in roots dye [17,18]. This preservation could explain the wide presence of yellow colored shea butter on Ivorian local markets and would also justify Ivorian consumers' complain, since the latest generally prefer whitish shea butter.

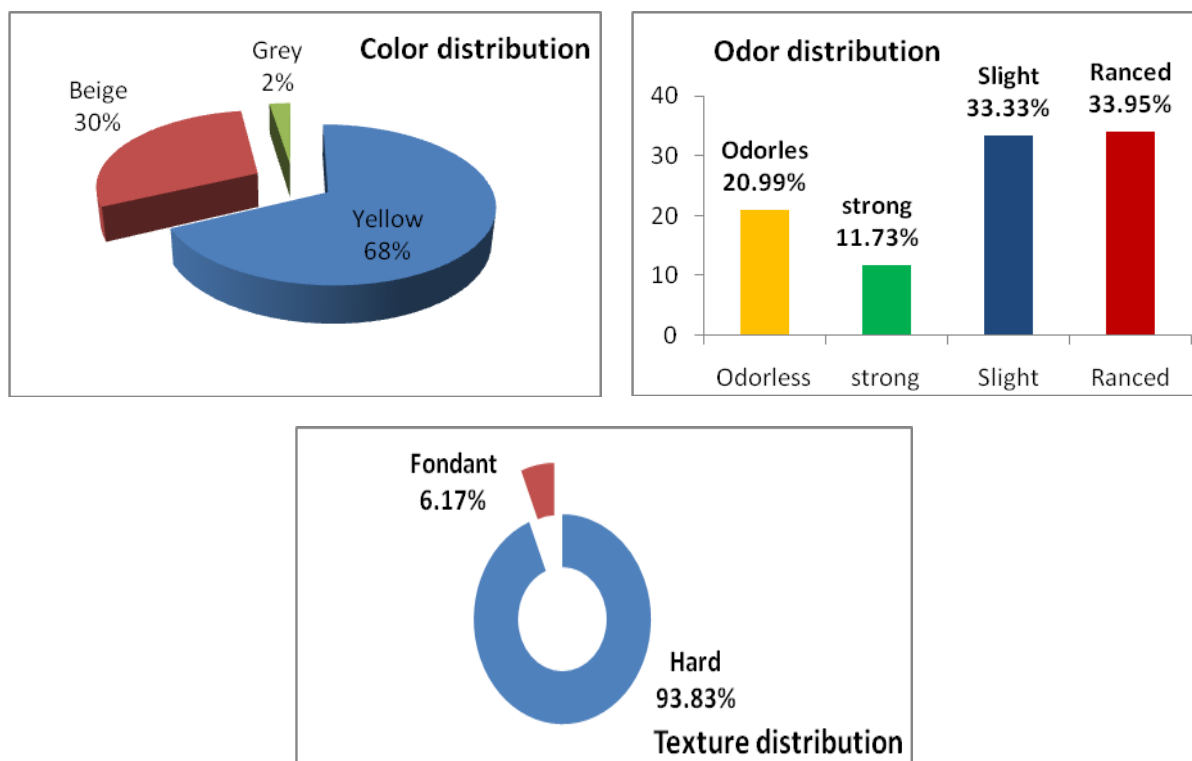


Figure 3: Shea butter sensorial characteristics distribution on Ivorian markets

Table 2: Socio-demographical influence on shea butter texture and utilization (%)

		TEXTURE				UTILIZATION			
		Fondant	Doughy	Hard	No choice	Beauty	Feeding	Aches	No choice
Genre	Men	10.40	5.80	<u>15.60</u>	5.80	15.60	9.10	34.40	5.80
	Women	25.30	16.90	<u>13.60</u>	5.80	52.60	11.70	47.40	5.80
	No response	0.00	0.00	0.00	<u>0.60</u>	0.00	0.00	0.00	<u>0.60</u>
Age (year)	- 25	5.80	4.50	6.50	0.60	11.00	2.60	11.70	0.60
	25-40	26.00	12.30	14.90	9.70	44.80	8.40	51.90	9.70
	40+	3.20	5.80	7.80	1.30	11.70	9.70	17.50	1.30
	No response	0.60	0.00	0.00	0.60	0.60	0.00	0.60	<u>0.60</u>
Fonction	Self-employed	<u>8.50</u>	<u>13.70</u>	13.10	0.00	14.80	6.50	21.30	0.00
	Student	11.10	3.90	5.90	0.00	10.60	1.10	9.50	0.00
	Civil servant	<u>12.40</u>	2.60	3.30	0.00	7.20	1.10	8.70	0.00
	Unemployed	3.90	2.60	<u>7.20</u>	0.00	7.20	3.40	8.40	0.00
Utilization	Beauty care	26.60	20.80	<u>14.90</u>	5.80	-	-	-	-
	Feeding	3.90	4.50	<u>12.30</u>	0.00	-	-	-	-
	Acheas traitment	26.00	19.50	26.60	9.70				
	No response	0.00	0.00	0.00	<u>0.60</u>				

Legend: Values in bold underlined the significance of factors (real effectiveness were significantly different from those of the theory).

This Ivorian preference for white shea butter is in conformity with that of Ghanaian, according to Carrette *et al.* [15]. In fact, white shea butter would be natural (no adding) and then better for food preparation and skin care. At the all, it might be understood that traders propose a less perishable and more attractive product (yellow shea butter) where consumers simply expect a white product. So, producers/traders might find another proceed to lengthen shea butter shelf-live instead of tinting it, given that lighter colored shea butter rancies very quickly [19]. Nevertheless, it would be worth noting that, the whiteness of shea butter would be generally, the result of a refining [7,9,20] which often cause the removing of unsaponifiable fraction with medicinal properties [21,22,23]. In reality, dirty white or beige might be the clearer color shea butter could have because of the natural pigment [1,20,24] and kernel roasting resulting compound named melanoïdine [25,26]. This reality could suppose that, what consumers mean by white could be beige (or dirty white). In this case, producers might use either unroasted or short-time-roasted kernel as recommended by Hall *et al.* [6]. About yellow colored shea butter, Omujal [27] and Okullo *et al.* [28] reported that yellow to brown naturally colored shea butter which would be in Uganda (a subspecies *Vitellaria nilotica* country) consumers' habit; these natural colors might be due to butter contain in β -carotene [9]. Hence, shea butter consumers' sensorial criteria might depend on the subspecies producing area but also on consumers habit, since in northern Ghana for instance, consumers opt for yellow shea butter [15] as some Ivorian did.

Traditional shea butter exhale diverse fragrances [6,15,16,29] which would be linked to kernels quality [30], drying and roasting time [6,30], but also result from the butter storage conditions [31,32]. Consumers generally prefer odorless shea butter either for body care or cooking [15], because its natural odor would be unpleasant [29]. That natural unpleasant odor might be due to the presence of decomposed proteins resulting from nuts fermentation during storage and/or drying and from over-roasting [6]. Bad quality of shea nuts could also affect the butter odor, mainly by conferring a rancid odor resulting from nut fats oxidation [30]. Moreover, according to Mohagir *et al.* [33], rancidity could also due to the aqueous extraction of traditional process. Whatever the odor is, let's recall here, that industrial and some experimented consumers generally deodorize shea butter by heating it or adding various additives [15]. Nevertheless, no guaranteed is given that the resulting shea butter would conserve its original nutritional and/or medicinal propriety [9]. Hence, on the basis of the natural cause of shea butter fragrance (odor), it would be better avoiding nuts fermentation and kernels over-roasting in order to achieve the odorless characteristic most of consumers need [12]. That precaution supposes that fresh nuts might be transformed as rapidly as possible, and the resulting shea butter might be preserved from sun or/and over heat exposure.

Conclusion

Ivoirian shea butter consumers mostly prefer uncolored, odorless and fondant product which might mainly result from a rapid transformation of freshly picked nuts. More precisely, nuts fermentation caused by a long drying time might be avoided, so does kernel over-roasting and the oil tinting. In addition, resulting shea butter might be conserve out off sun and another heating source. Chemical shea butter which would not be conformed to their exceptive might not be proposed to them, since they mostly utilize shea butter as aches treatment and body care for its medicinal properties which would be lost through solvent extraction.

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