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In vitro determination of the sun protection factor of crude shea butter obtained from different processes in Burkina Faso

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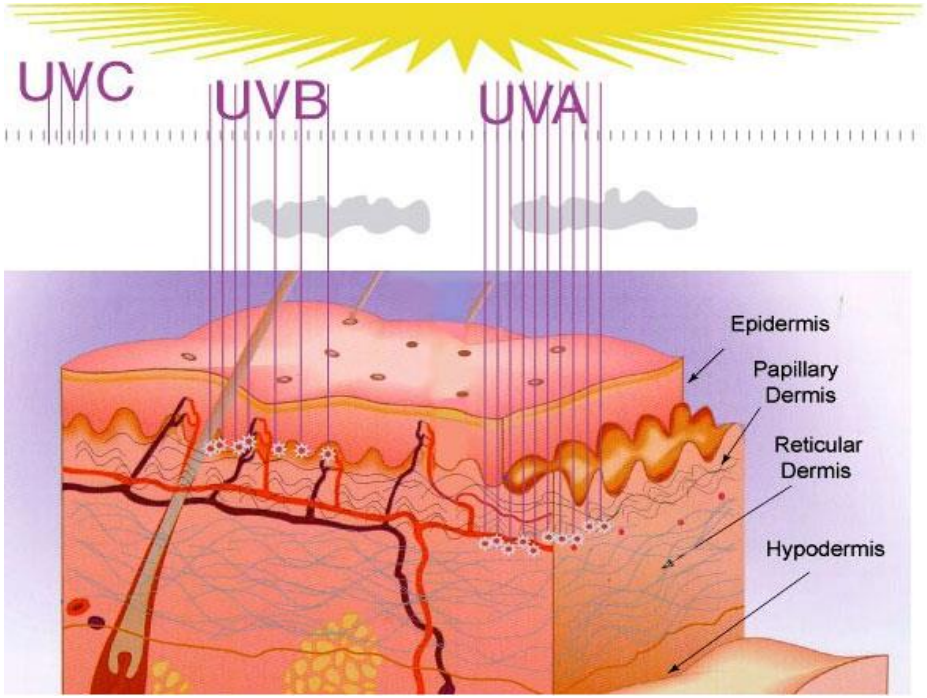
Nuts and crude shea butter

Shea fruits

Crude shea butter (SB):

- Fat extracted from shea fruits (*Vitellaria paradoxa* C.F. Gaertn),
- Of African origin, used for centuries in food, traditional medicine, cosmetics, and source of light energy,
- Economic interest for the food and cosmetic/pharmaceutical industries: Equivalent to coconut butter, anti-inflammatory, antioxidant, emollient, moisturizing properties, and probable absorption of UV-A and UV-B rays...



Ultraviolet radiation and our skin (1)
(1): https://opticamasia.files.wordpress.com

SPF

- Quantitative measurement of the effectiveness of a sunscreen formulation
- UV energy required to produce a minimal erythema dose (MED) on protected skin, divided by the UV energy required to produce a MED on unprotected skin
- MED: lowest time interval or dosage of UV light irradiation sufficient to produce a minimal, perceptible erythema on unprotected skin

$$SPF = \frac{MED\ in\ sunscreen\ of\ protected\ skin}{MED\ in\ nonsunscreen\ of\ unprotected\ skin}$$

Study aim:

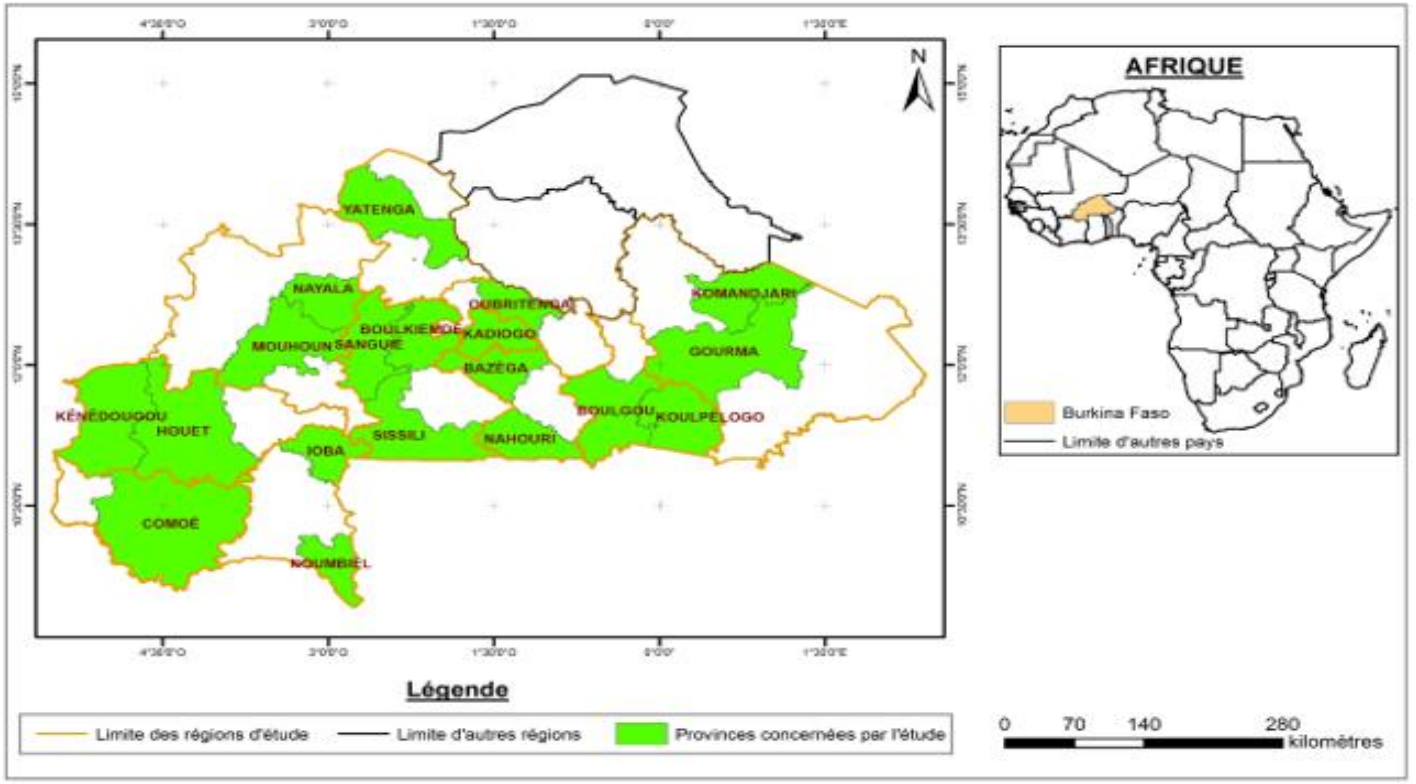
To establish a relationship between *in vitro* Sun Protection Factor (SPF) and crude SB.

Objective:

- Investigate the SPF of crude SB as a parameter of cosmetic and pharmaceutical interest, related to kariten.

Data collection:

- 37 fresh SB collected in Burkina Faso;
- By 32 extraction processes.
- 1 refined SB depleted in kariten (as industrial standard).



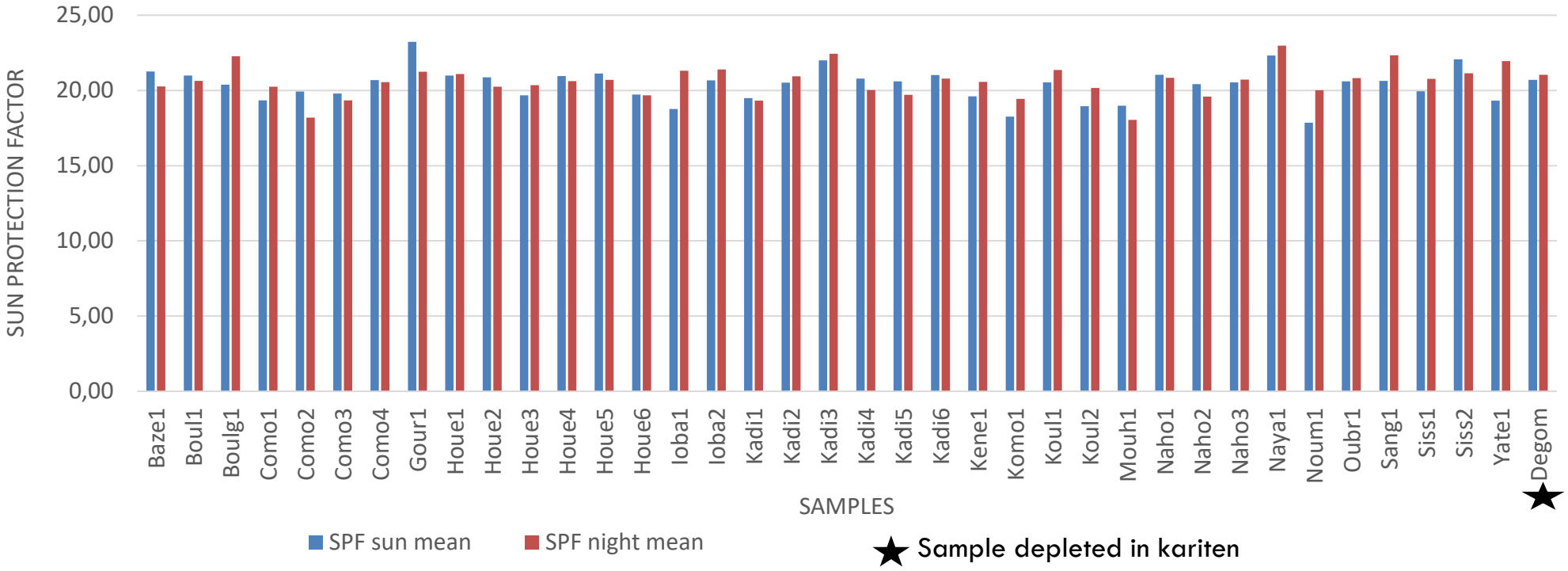
Data collection area (Burkina Faso)

Spectrophotometric measurement and SPF determination

- Experimental conditions: 2 samples aliquots in under direct solar radiation (“”*sun*”), and darkness (“*night*”) conditions at 37°C, for 21 days;
- The absorbance (290 – 320 nm) of each preparation at a final concentration of (1% w/w) in ethanol was determined using a UV-Vis spectrophotometer *(Fonseca & Rafaela, 2016; Santos et al., 1999).*
- SPF in vitro calculation *(Mansur, et al., 1986):*

$$SPF = CF\ x \sum_{290}^{320} EE\ (\lambda)\ x\ I(\lambda)\ x\ Abs\ (\lambda)$$

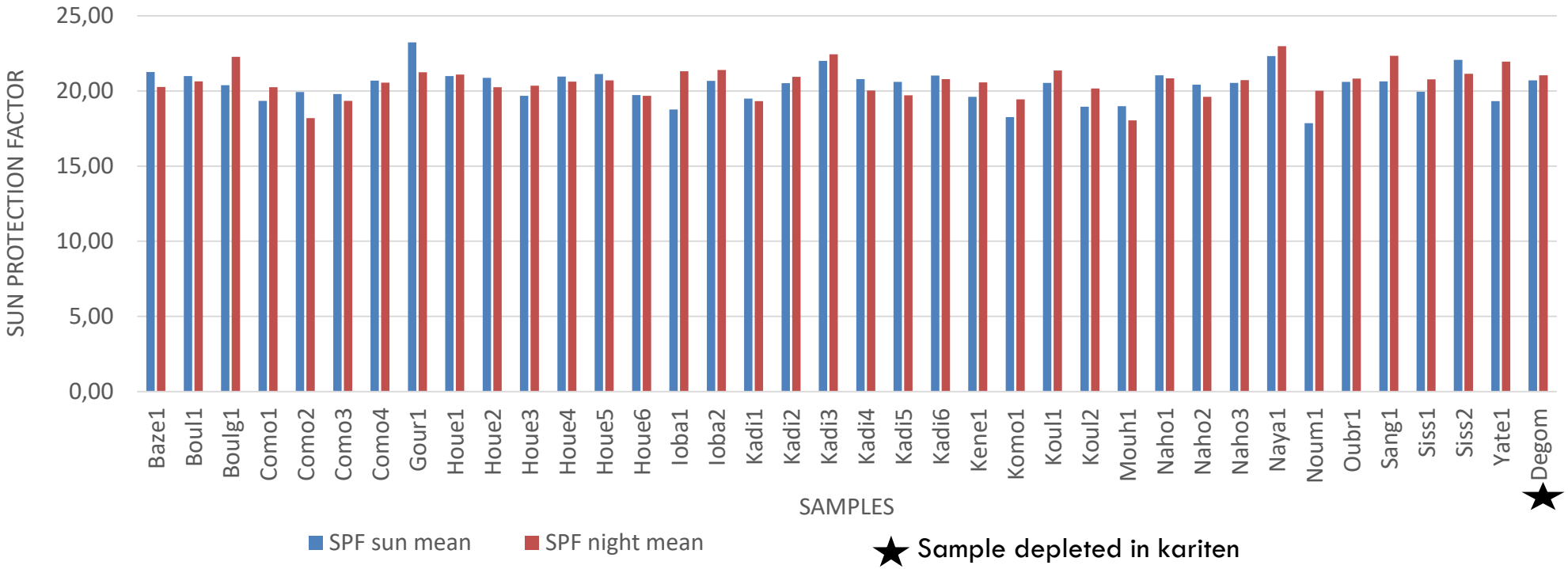
Crude shea butter sun protection factor



In vitro determination of SPF average value of crude shea butter

- Variance of SPF average value by Paired t-test: was not statistically significant, *p*-value = 0.228 between "sun" and "night" conditions.
- Variance of SPF average value by One-sample t-test: was not significantly different at $P \leq 0.05$ between ref. sample and crude shea butter from Burkina Faso.

Crude shea butter sun protection factor



In vitro determination of SPF average value of crude shea butter

- SPF average value: Ref. sample = 20.88; Crude samples = 20.49;
- SPF min and max value for crude samples: 18.51 and 22.65;
- Non standardization of extractions processes.

European commission recommandation			COLIPA standard		Shea butter SPF	
Labelled category	Labelled SPF	Measured SPF (measured in accordance with the principles recommended in point 10)	Label SPF	Protection class	SPFMean min value	SPFMean max value
Low protection	6 10	6 - 9.9 10 -14.9	6 10	Low		
Medium protection	15 20 25	15 - 19.9 20 - 24.9 25 - 29.9	15 20 30	**Moderate** High	**18.51** -	- **22.65**
High protection	30 50	30 - 49.9 50 - 59.9	50 50 +	 Very high		
Very high protection	50 +	60 ≤	-		-	

Labelled category of crude shea butter SPF

- SPF average value: Ref. sample = 20.88; Crude samples = 20.49;
- SPF min and max value for crude samples: 18.51 and 22.65;
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Crude shea butter sun protection factor

- Crude SB has "***medium protection***" against UV radiation on our skin;
- Kariten would absorb very strongly in UV and confers to SB its complementary properties to U.V filters → *(Krist et al., 2006; Lipp & Anklam, 1998; Peers, 1977; Karleskind, 1992);*
- However, others compounds as triterpene compounds, polyphenols, tocopherols, carotenoids, chlorophyll and phytosterols had skin protection properties against UV-A and UV-B radiation → *(Morin & Pagès-Xatart-Parès, 2012; Nahm et al., 2013; Rabasco Alvarez & González Rodríguez, 2000; Israel, 2014; Nahm et al., 2013)*

- Crude shea butter has medium sun protection factor and is part of the reason for its growing interest in the cosmetics industry .

Perspectives:

- Alternatives methods should be explored to investigate the relationship between SPF and kariten in order to ensure the results obtained.

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