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Composition and quality of artisanal crude palm oils in Cameroon in link with production factors

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Introduction: Cameroon, amongst African countries of the Guinean gulf, is a traditional producer and eater of both artisanal and industrial crude palm oil (CPO) [1]. Nowadays oils and fats consumption per capita is regularly increasing in these countries. In parallel, health problems associated to obesity, type 2 diabetes and vitamin A deficiency are booming [2]. The production of artisanal CPO, sold on the informal market out of any quality control, is rising due to the development of small-scale mills in the southern Cameroon. In such a context, it seemed necessary to assess the chemical and physical quality of artisanal CPO and to relate the recorded quality differences to producing conditions.

Material



Ripe bunches of oil palms (*Elaeis guineensis)*



Artisanal Crude Palm Oil extraction



Oils samples

32 artisanal producers from 4 different production regions were interviewed, and 32 samples collected. One oil sample was also collected from a local industrial as a reference.

Methods

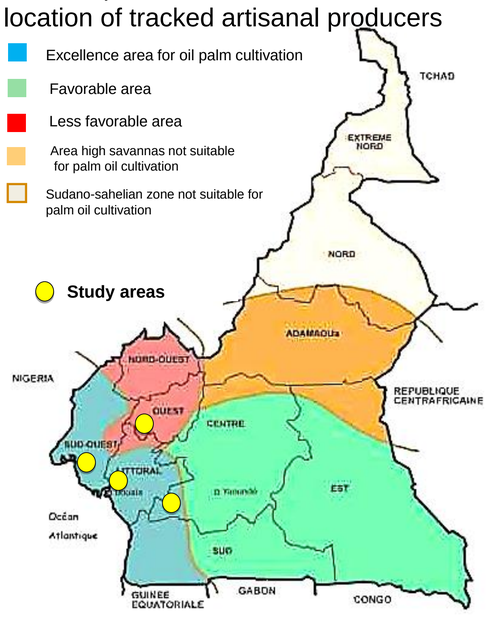
1. Survey in palm oil production areas:
Information on the plant material and the detailed process of oil extraction ; June to July 2015.

2. Physicochemical properties

Nutritional composition [4]:
- Carotene content (UV-Vis spectroscopy)
- Tocopherol and tocotrienol content (HPLC-fluo)
- Fatty acid composition (GC of FAME)

Lipolysis and oxidation levels:
- Free fatty acid content (NF T60-204, 1985)
- Peroxide value (NF T60-220, 1968)
- Malondialdehyde (MDA: HPLC-DAD of MDA(TBA)$_2$ adduct) [5]

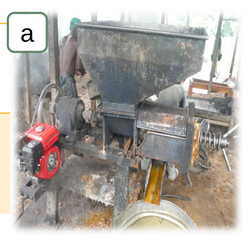
Palm oil production areas in Cameroon and location of tracked artisanal producers



Results 1. Identification of CPO samples and processes

Table: planting material and extraction processes.

Factors		Regions			
		CENTER	LITTORAL	SOUTH-EST	WEST
Planting material	Selected *tenera* type (Pamol, IRAD)	X	X	X	
	Unselected open pollinated progenies	X	X	X	X
	Unselected *dura* type			X	X
Press type	Motorized Caltech (a)	X	X	X	
	Manual Caltech (b)	X	X	X	
	Hydraulic cage press (c)			X	
	Motorized water extractor (d)				X
Method of storage	Bunch/fruits	Shed	open air, shed and bags	open air, shed and bags	Bags and bags in the rain









The storage time between harvesting and treatment of palm fruit ranged from **2** to **14** days depending their availability or demand on the market.

Results 2. Effect of production processes on :

a. Carotene content

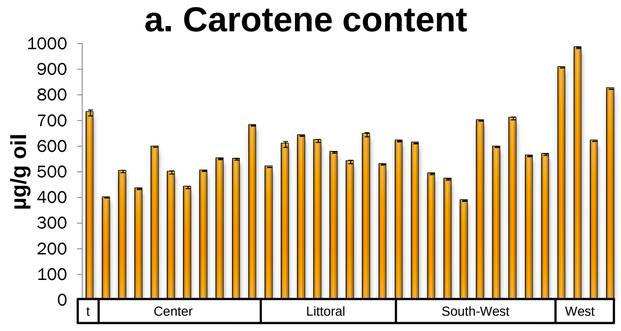


Figure 1: Carotene content of artisanal CPOs

- The **Western region** had the highest carotene content; this is due to the presence of unselected *dura* type planting material.

- **ANCOVA**: 69% of the variability of these data are explained by time and method of storage of bunches/fruit before oil extraction. Each day of storage significantly reduced by 14 points carotene content.

b. Free fatty acid (FFA) content

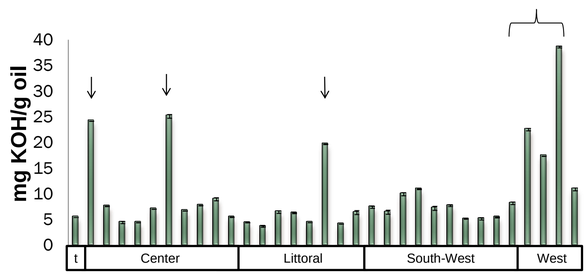


Figure 2: Acidity of artisanal CPOs

- **Center and Littoral**: sample with high FFA content were stored for more than 12 days.

- **West**: the high levels are related to the storage of fruit in bags because the storage time is less than 6 days.

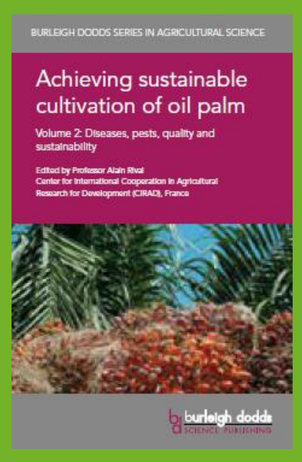
- **ANCOVA**: Each day of storage significantly increased by 1.5 point FFA content.

c. Oxidation markers

- **Peroxide value**: 0 - 8,62 meq. O_2/kg oil ; **MDA** : 0 - 11 nmol/g oil.

According to Codex Alimentarius [6], the artisanal palm oils were not oxidized.

Conclusions: In agreement with previous studies [3, 7] artisanal CPOs produced in Cameroon present FFA contents superior to current edible oil standards. This is related to the time and method of storage of bunches or fruit before oil extraction. These oils are also characterized by high variations in carotene content linked to the type of planting material and length of storage between harvest and oil extraction.
The role played by FFA in typicality of artisanal CPOs and functional role in the achievement of local dishes should be explored.



References [1] Cheyns & Rafflegeau, 2005. Family agriculture and the sustainable development issue : possible approaches from the African oil palm sector. The example of Ivory Coast and Cameroon. *OCL. Oléagineux Corps gras Lipides*, 12,111-120. **[2]** WHO 2009 Global prevalency of Vitamin A deficiency in populations at risk 1995-2005. Geneva. **[3]** Rafflegeau, Nanda & Genot, 2018 Artisanal mills and local production of palm oil by smallholders *in* Rival, A. (ed.), ***Achieving sustainable cultivation of oil palm Volume 2*** Burleigh Dodds Sci. Pub., Cambridge, UK. **[4]** Kabri et al. 2013. Formulation of stable phospholipid-based food-grade sub-micron emulsions with DHA located either in triglycerides or in the phospholipids. Eur J. Lipid Sci. Technol. 115,1294–1308 ; Fogang Mba, et al. 2018. Growing conditions and morphotypes of African palm weevil (*Rhynchophorus phoenicis*) larvae influence their lipophilic nutrient but not their amino acid compositions. *J, Food Comp. Anal*. 69,87-97. **[5]** Kenmogne-Domguia, et al 2012., Lipid oxidation in food emulsions under gastrointestinal-simulated conditions: The key role of endogenous tocopherols and initiator. Food Dig., 3, 46–52**. [6]** Codex Alimentarius Commission/FAO/WHO food standards 2011. Standard for named vegetable oils CODEX-STAN 210, Ed. FAO/WHO. **[7]** Ngando et *al*., 2011. Assessment of the quality of crude palm oil from smallholders in Cameroon. J.Stored Prod. Postharvest Res. 2,52-58. ; Kansci G., Genot C. et al. 2003. Composition et niveau d'oxydation de quelques huiles végétales consommées au Cameroun. *Sci. Aliments*, 23 (3), 425-441.

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