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Short communication

Evaluation of the quality of Nigerian chillies for pharmaceutical formulations

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1. Introduction

Chillies are red or orange–red peppers derived from various *Capsicum* species. According to Heiser [1], about 20 wild species of *Capsicum* (*Solanaceae*), mostly of South American origin, have been distinguished. Five cultivated species which are now commonly known are *C. annuum* var. *annuum*, *C. frutescens*, *C. baccatum* var. *pendulum*, *C. chinense* and *C. pubescens* [1–3].

Capsicum fruits are known to contain fixed oil (responsible for the rancidity of capsicum extracts on storage), a little steam-volatile oil (responsible for the aroma), carotenoid and other pigments [4], vitamins, especially vitamin C, and vanillyl-amide pungent principles, predominantly capsaicin [5–8]. Purseglove et al. [3] reported a gradual increase in capsaicin levels as the fruit matured. Chillie quality is determined by the level of pungency (calculated as the capsaicin content), the bright red colour, and the flavour (due to volatile oil). These criteria only apply to fresh ripe chillies [3]. The traditional drying method for preserving the peppers is known to cause marked loss of β-carotene [9] and flavour [10]. Red peppers are of importance as a rubefacient, as a counter-irritant, for rheumatic pains and in traditional medicine [11].

Oleoresin from an unknown Indian *Capsicum* species is imported for certain pharmaceutical formulations. An appraisal of the capsaicin levels of Nigerian chillies with a view to identifying the appropriate chillie for oleoresin preparation, and hence as a possible substitute for imported oleoresin, is therefore pertinent.

2. Experimental

2.1. Preparation of chillies for extraction

Fresh chillies of the four varieties were obtained from a local market, cut into small pieces, dried in an air-circulating oven (45°C) and ground into a moderately coarse powder. Ground chillies were stored at ambient conditions before extractions. The commercially dried varieties were ground and stored.

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2.2. Moisture determination

10 g of each chillie variety was cut into small pieces and dried in an air-circulating oven (Gallenkamp) at 105°C to constant weight. The amount of moisture (%) was determined with reference to the standard initial fresh weight (10 g) of the samples using a Gallenkamp Mettler H7 analytical balance. The average result of five determinations per sample was recorded.

2.3. Extraction of chillies for pungency

5 g of each variety was extracted in a Soxhlet apparatus using dehydrated methanol. Methanolic extracts were reduced in vacuo to 100 ml volumes using a Buchi Rotavapor R 110, transferred into stoppered 100 ml volumetric flasks and used for spectrophotometric analysis.

2.4. Determination of capsaicin content

10 ml of the 100 ml methanolic extract was extracted for capsaicin in duplicate using the method described in the British Pharmaceutical Codex (BPC) [12]. This aliquot was treated with NaCl, rendered alkaline using NaOH (0.1 N) and successively mixture-extracted with distilled petroleum ether (80–100°C). Combined aqueous extracts were filtered through cotton wool and concentrated on an electric water bath (100°C) to about 5 ml. The cooled residue was diluted to 50 ml with distilled water and the pH was adjusted to 7–7.5 using HCl (0.1 N) with the aid of a Kent E1L 7045/46 pH meter. This aqueous solution was successively extracted with redistilled anaesthetic ether and the latter, after washing with water, was evaporated on an electric water bath to about 1 ml after addition of some methanol. The residual ethereal extract was made up to 100 ml with distilled methanol, decolourised using charcoal and filtered through a Whatman No. 1 filter paper into a 100 ml volumetric flask. Duplicate 10 ml aliquots of this methanolic solution were rendered alkaline and measured for capsaicin in triplicate against a corresponding acidic solution using the single-beam Hitachi (100–40) spectrophotometer at both 248 nm and 296 nm. Capsaicin content was then calculated as the average result at the two wavelengths.

3. Results and discussion

3.1. Nigerian chillies

Four varieties of chillies are sold on the Nigerian market. They include the small-fruited types (*C. frutescens* cultivars "ata were" and "sombo") and the large-fruited types (*C. annuum* cultivars "rodo" and "tatase"). All these varieties are sold in local markets nationwide. *C. frutescens* cv "sombo" and "rodo" are cultivated throughout the country, *C. annuum* cv. "tatase" is cultivated in the northern region and *C. frutescens* cv. "ata were" is cultivated in western and eastern regions. All these varieties are available fresh in the rainy season (April–September) and dry in the dry season (December–March).

3.2. Pungency of Nigerian chillies

Capsaicin levels in *C. frutescens* chillies were higher than those in *C. annuum* (Table 1), and this agrees with previous reports [3]. Nigerian chillies can be classified into four categries on the basis of their pungency: (i) pungent chillies (capsaicin $\approx 0.5\%$); (ii) moderately pungent chillies (capsaicin $\approx 0.4\%$); (iii) mildly pungent chillies (capsaicin $\approx 0.3\%$); and (iv) non-pungent chillies (capsaicin ≈ 0.02–0.2%) (Table 1). *C. frutescens* cv. "ata were" falls within the pungency limit (0.5–0.9%) prescribed by the BPC, and hence was recommended for oleoresin production. It is apparent from this study that differences in geographical location had no influence on the pungency of the chillies (compare Yoruba and Hausa cultivars of *C. annuum* cv. "rodo", and similar cultivars of *C. frutescens* cv. "sombo") (Table 1). As reported by Matthew et al. [13], certain cultivars of unknown Indian *Capsicum* species yielded 0.23–0.36% capsaicin (moderately

Table 1
Capsaicin content of Nigerian chillies

Sample No.	Chillie variety	% Capsaicin[a] (±SD[b])	Moisture content	Classification[c]
1	*C. frutescens* cv. "ata were"	0.49 ± 0.01	77.7	Pungent
2	*C. annuum* cv. "Yoruba rodo"	0.38 ± 0.01	85.6	Moderately pungent
3	*C. annuum* cv. "Hausa rodo"	0.37 ± 0.07	86.0	
4	*C. frutescens* c.v. "dried ata were"	0.37 ± 0.03	N.A.[d]	
5	*C. frutescens* cv. "Yoruba sombo"	0.31 ± 0.004	74.3	Mildly pungent
6	*C. frutescens* cv. "Hausa sombo"	0.29 ± 0.002	74.7	
7	*C. frutescens* cv. "dried Yoruba sombo"	0.27 ± 0.004	N.A.	
8	*C. annuum* cv. "tatase"	0.17 ± 0.01	85.6	Non pungent
9	*C. annuum* cv. "dried tatase"	0.02 ± 0.01	N.A.	Non pungent

[a] On moisture-free basis (% w/w).
[b] Six replicates.
[c] With reference to limits prescribed by the BPC.
[d] N.A. = not applicable.

pungent). Also, a sample of Nigerian Funtua chillies (unidentified *Capsicum* species) was found to contain 0.41% capsicum [3]; this Funtua chillie can be described as moderately pungent.

The result of the present investigation corroborates the pungency rating reported by Purseglove et al. [3] for *Capsicum* species worldwide in which Nigerian capsicums were rated higher than those of India and other Asian countries. Oleoresin capsicum (African capsicum oleoresin), which is prepared from the most pungent, small-fruited chillies grown in Africa, is known to yield 3.9–14% capsaicin [3]. For the purpose of oleoresin extraction, the small-fruited, fresh and most pungent Nigerian chillies (*C. frutescens* c.v. "ata were") are recommended.

3.3. Effect of drying

Fresh peppers of both *Capsicum* species were observed to be more pungent than the corresponding commercially dried peppers. The traditional process of soaking fresh chillies in boiling water for a while before sundrying is believed to be responsible for the extraction of some pungent materials and is probably responsible for the comparatively low levels of capsaicin in the commercially dried cultivars of *C. frutescens* cv. "ata were", "sombo", and *C. annuum* cv. "tatase" (Table 1). This finding corroborates those of Agboola [10] and Pruthi [14]. The large-fruited chillies—*C. annuum* cv. "tatase" and "rodo"—contained more moisture (85.6 and 85.8% respectively) than the small-fruited varieties—*C. frutescens* cv. "sombo" and "ata were" (74.5 and 77.7% respectively)—but the moisture content of the chillies has no direct relationship with the capsaicin content.

3.4. Effect of extracting solvent

Water-miscible solvents are generally known to extract more pungent principles than water-immiscible solvents. Ethanol and acetone are recommended [12] for both capsaicin and oleoresin extraction. Matthew et al. [13] reported that

ethanol, especially when hot, gives a product which is semi-solid instead of a free flowing product. A comparison of the efficiency of methanol and acetone for capsaicin extraction indicated comparable results, although methanol was slightly more efficient ($\approx 108\%$).

4. Conclusion

From the results presented it is probable that Nigerian oleoresin capsicum is more pungent than Indian oleoresin, and hence may be able to serve as a substitute for the imported Indian oleoresin capsicum for use in certain pharmaceutical preparations.

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References

[1] C.B. Heiser, Taxon, 18 (1969) 36–45.
[2] F. Rosengartan, in Book of Spices, Pyramid Communications Inc., New York, 1973.
[3] J.W. Purseglove, E.C. Brown, C.L. Green and S.R.J. Robbins, in Spices, Vol. 1, Longmans, Harlow, UK, 1981 pp, 331–433.
[4] W.C. Evans, in Trease and Evan's Pharmacognosy, 13th edn., Tindall Bailliere, London, 1989, pp. 384–386.
[5] D.J. Bennett and G.W. Kirby, J Chem. Soc. C, (1968) 442–446.
[6] E. Leete and M.C.L. Loudon, J Am. Chem. Soc., 90 (1968) 6837–6841.
[7] K. Jentzch, H. Pock, W. Kubelka and O. Saiko, Monatsh Chem., 99 (1968) 661–663.
[8] S. Kosuge and M. Furata, Agric. Biol. Chem., 34 (1970) 248–258.
[9] R. DeLar Mar and F.J. Francis, J. Food Sci., 34 (1969) 287–290.
[10] S.D. Agboola, Trop. Sci., 15 (1973) 279–286.
[11] J.M. Dalziel, in The Useful Plants of West Tropical Africa, Crown Agents, London, 1955.
[12] British Pharmaceutical Codex. The Pharmaceutical Press, London, 1973.
[13] A.G. Matthew, Y.S. Lewis, R. Jagadischan, E.S. Nambudri and N. Krishnamurthy, Flavour Ind., (1971) 23–26.
[14] J.S. Pruthi, Adv Food Res., (suppl. 4) (1969).