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Technical Sheet of Contribution to the Study and Valorization of the Therapeutic Potential of Pepper *Capsicum frutescens var. soudanais* used in the Traditional Pharmacopoeia in Côte d'Ivoire

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Abstract: ***Capsicum frutescens var. soudanais is one of the most used peppers, especially in traditional medicine by healers to treat various infections and pathologies in Côte d'Ivoire. The objective of this study was to evaluate the nutritional and therapeutic potential of Capsicum frutescens var. soudanais (C. frutescens var. soudanais) to help show consumers and consumers the benefits of consuming this widely used vegetable. The determination of beta carotene (vitamin A) and ascorbic acid (vitamin C) (antioxidants) was carried out using standard extraction methods, thin layer chromatography (TLC) and high performance liquid chromatography (HPLC). The various extracts (petroleum ether, acetone, dichloromethane and methanol) showed contents ranging from 68.47 to 535.98 µg in beta-carotene and from 86.38 to 96.62 mg of ascorbic acid (antioxidants) per 100 g of fruits of C. frutescens var. soudanais. These extracts were also rich in bioactive compounds such as steroids, terpenes, flavonoids, polyphenols and quinones which are molecules endowed with preventive powers of various diseases, anti-inflammatory, analgesic, antimicrobial and strengthening of the immune system. Thus, the consumption and use of peppers C. frutescens var. soudanais in the treatment of certain diseases and infections of microbial origin would be beneficial because they could contribute more to the nutritional and health needs of consumers.***

Keywords: *Capsicum frutescens var. soudanais*; Bioactive compounds; Beta-carotene; Ascorbic acid; Antioxidant; Abidjan

1. Introduction

The increasing growth of microbial infections and food-borne diseases encourage researchers and scientists to seek out new bioactive molecules that may be secondary metabolites such as phenolic compounds, terpenoids, steroids and alkaloids [1, 2]. Fruits and vegetables are important sources of bioactive compounds and antioxidants known for their potential effects on human infections and degenerative diseases [3, 4, 5].

The *Capsicum* pepper of the Solanaceae family is a popular vegetable of South American and central tropical agricultural crops, containing the species *Capsicum annuum*, *Capsicum frutescens*, *Capsicum baccatum*, *Capsicum pubescens* and *Capsicum chinens* [2, 5]. The pepper is grown for economic needs but especially for its flavor, aroma, nutritional and sanitary effects [5, 6, 7]. The fruits of pepper can be used and eaten at different stages of maturation : unripe (green), ripe (red or yellow) or not too ripe.

In Côte d'Ivoire, many varieties and species of pepper are grown. However, the species *Capsicum annum* and *Capsicum frutescens* are widely known for their consumption, flavor, burning sensation or pungent effects conferred by components such as capsaicinoids and their wide range of applications in traditional therapies [5, 7, 8]. Fruits of the genus *Capsicum* are rich in carotenoids (Vitamins A) and antioxidants (Vitamin C). Carotenoids function as antioxidants at low oxygen pressure and can protect against damage caused by free radicals and peroxidation [8, 10]. Carotenoids also play an important role in the elimination of free radicals, the prevention of certain types of cancers, cardiovascular diseases, ocular vision disorders, skin degeneration and aging [5].

The fruits of *Capsicum frutescens var. soudanais* (*C. frutescens var. soudanais*), in Côte d'Ivoire, are used extensively by traditional healers and households to treat infections and post-partum care through rectal or oral colon enemas.

The aim of this study is to show the bioactive compounds and vitamins with antioxidant activities of ripe and dry fruits, as well as the potential therapeutic and antimicrobial effects of the species of *Capsicum frutescens var. soudanais* used in Côte d'Ivoire in traditional therapy.

2. Material and Methods

2.1 Plant material

The plant material, that is to say, the fresh, dried and rendered fruits of *C. frutescens var. soudanais* was collected on four local markets in Abobo, Adjamé, Treichville and Koumassi communes in Abidjan, Côte d'Ivoire (Figure 1). The samples of *C. frutescens var. soudanais* were transported fresh to the laboratory and then identified by the National Floristic Center (Felix Houphouët-Boigny University, Abidjan-Côte d'Ivoire).

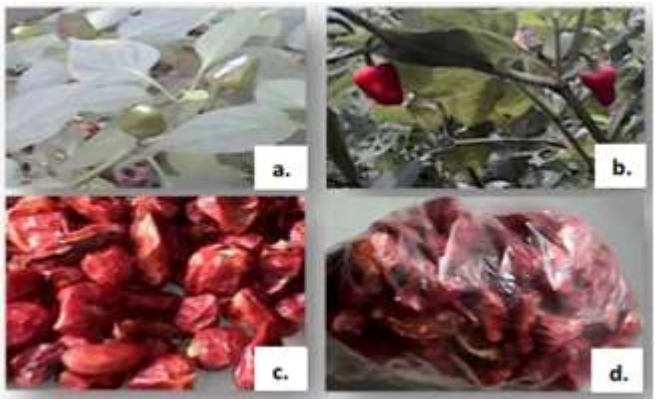

Figure 1: Organs of the pepper *C. frutescens var. soudanais* a) plant, leaves and fruits non-ripe (green color) ; (b) plant, leaves and fruits ripe (red color) ; c) fruits ripe and dry ; d) Packaging 100 g of ripe, dried fruit

The species of peppers of *C. frutescens var. soudanais* has several names according to certain ethnic groups in Côte d'Ivoire (Table 1).

Table 1: Different names of pepper of *C. frutescens var. soudanais* by ethnic group in Côte d'Ivoire

Ethnic group	Local name
Abè	Makou
Abouré	Aissa mouklou
Abron	Téyssan
Agni	Mocloua
Baoulé	Boharé mancoun
Malinké	Frotofiè

2.2 Methods

Extracts or mixtures of *C. frutescens var. soudanais* in traditional medicine are generally prepared according to the method described above (Figure 2). Fresh or dried ripe fruits of *C. frutescens var. soudanais* (10 to 30 g sometimes) are rinsed with potable water or soaked for a few minutes. Then the rehydrated fruits are crushed using a pebble (with the possibility of adding other ingredients such as leaves to therapeutic virtue). The paste obtained is suspended with warm water or cold water. It is also possible to slightly warm the mixture, an empirical form of pasteurization and increase the extraction of biactive compounds. Finally, an enema bulb is used to administer the mixture rectally (Figure 2).

The research and the determinations of the bioactive molecules of the pepper *C. frutescens var.soudanais* were carried out by thin layer chromatography and then by high performance liquid chromatography (HPLC). The various extracts studied were obtained with solvents such as petroleum ether, dichloromethane, acetone and methanol. The beta-carotene of the sample was extracted according to the method described in [9, 12] and the ascorbic acid was extracted according to the method described in [13, 14].

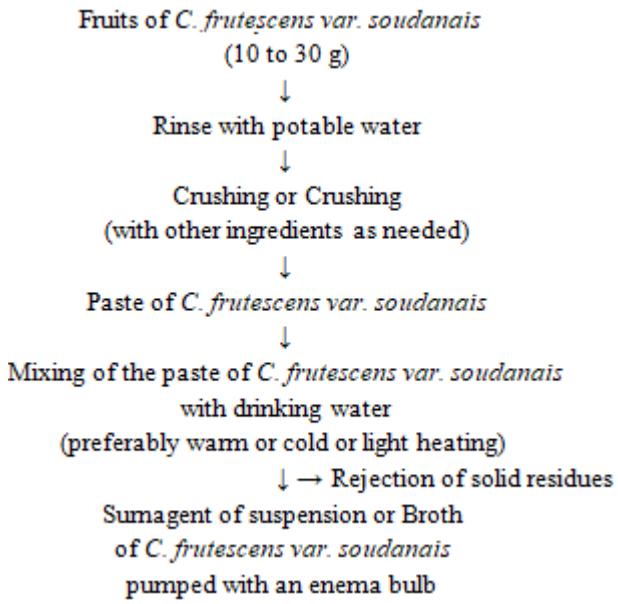

Figure 2: Standard traditional method of preparing the suspension of *C. frutescens var. soudanais* for enema

3. Results and Discussion

Fruits of pepper *C. frutescens var. soudanais* are used in the traditional pharmacopoeia and in the human food in different forms of:

- Fresh fruit to maturity, ripe or unripe, cut or rendered in paste,
- Dried ripe fruit.

On the local markets, the fruits of *C. frutescens var. soudanais* are sold in dried form. However, the bag of 15 kilograms of dried fruits of *C. frutescens var. soudanais* is sold in bulk, at an estimated price of 25,000 F. CFA. Retail prices are shown in (Table 2).

Table 2: Economic and food value of stems sold

Price of the tide	*Mass (g)*
100 f. CFA	20 g
500 f. CFA	100 g
25 000 f. CFA	15 Kg (15 000 g.)

Bioactive compounds in varieties *C. frutescens var. soudanais*

Chromatographic processing methods have revealed many bioactive compounds. Total bioactive compounds were determined in the analyzed samples (Table 3). The extracts of *C. frutescens var. soudanais* analytes contain beta-carotenes, ascorbic acid and metabolites such as steroids, terpenes, flavonoids, polyphenols and quinones.

The levels of beta carotenes (pro vitamin A) and ascorbic acid (vitamin C) of *Capsicum frutescens var. soudanais* varied between 68.47 to 535.98 µg of beta-carotene and 86.38 to 96.62 mg of ascorbic acid per 100 g of fruit respectively.

Table 3: Bioactive metabolites from *C. frutescens var. soudanais* identified by HPLC

	Bioactive metabolites identified from the variety of *Capsicum frutescens var. soudanais*						
Extraction solvents used	Alkaloids	Quinones	Tannins	Stéroids	Terpenes	Flavonoids	Polyphénols
Petroleum ether	+	+	-	+	+	+	+
Dichloro-methane	+	+	-	+	+	+	+
Acetone	+	+	-	+	+	+	+
Methanol	+	+	+	+	+	+	+

+ : presence of the title compound ; -: absence of the compound title

Carotenoids behave like antioxidants and could protect the tissues against damage caused by free radicals and also intervene in the prevention of cardiovascular diseases, cancer, ophthalmic diseases and in the fight against aging [10]. As for ascorbic acid, it strengthens the immune system and plays a role in the state of health [11].

The presence of different bioactive metabolites would explain the wide use of the peppers of the genus *Capsicum frutescens var. soudanais* in the traditional Ivorian pharmacopoeia to treat many intestinal disorders and diseases such as gastroenteritis and also prevent infections in women after childbirth.

Apart from its use in oral feeding, the main route of administration in traditional therapy is the rectal route by suppositories or enemas. Indeed, bioactive compounds such as tannins, steroids, polyphenols, terpenes and quinones play a preventive role in diseases and possess antimicrobial activity [18]. Fruit consumption of *C. frutescens var. soudanais* would be beneficial for health as tannins would play an important role in the treatment and prevention of certain degenerative diseases such as cancer [3]. Alkaloids act as an anti-inflammatory, analgesic and also fight against asthma [15] while flavonoids in the diet also reduce the risk of cancers and heart disease as well as the symptoms of menopause [5,16, 17].

4. Conclusion

It is clear from this study that *Capsicum frutescens var. soudanais* is a major source of potential for bioactive compounds. The results obtained are important for informing actors (traditional healers) and promoters of traditional medicine in Côte d'Ivoire.

The study of the antimicrobial activity of extracts of bioactive compounds of this vegetable could contribute to the knowledge of new molecules derived from phytotherapy which is increasingly topical to help fight against the resistance of microorganisms to antibiotic therapy uncontrolled.

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