Journal of Food Technology 2 (2): 100-102, 2004
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Chemical Composition of some Pepper Varieties Commonly Grown in the Northern Guinea Savannah of Nigeria

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Abstract: Three 'tatasai' pepper varieties (*Capsicum annuum* L.) and one chilli variety (*Capsicum frutescence* L.) from diverse origin were grown for 2 years (1996 and 1997) in replicated field experiment. The pepper varieties were analysed for moisture, protein and trace elements. *C. annuum* (Pv_1, Pv_2 and Pv_3) had higher moisture content than *C. frutescence* (Pv_4). Percent proteins are higher in Pv_3 and Pv_4 using dry and wet digestion method, respectively. Cobalt, chromium, cadmium were low or absent in all the varieties. Zinc and copper are not in high quantity to harm both human and animals. Pv_4 had unusually high quantity of iron (18.63mg/100g). Manganese and lead are less than 7mg/100g in all the pepper varieties.

Key words: Capsicum species, moisture, crude protein, trace elements

Introduction

Pepper (*Capsicum annum* L.) is one of the most important vegetables commonly grown and used as condiments of soups and stews. Chilli and tatasai pepper varieties has varying degree of flavour, pungency and hotness. Pepper contributes substantially to human diet such as when eaten raw in salads and cooked in various form globally (purseglove, 1991; Messiaen, 1992; Fagbayide, 1997; Showemimo and Olarewaju, 2002).

In Nigeria pepper is the third most important vegetable after onions and tomatoes (Fawusi, 1978), it is widely grown in the Nigerian savanna especially northern guinea savanna where it is grown both under wet and dry (irrigation) cropping seasons. Nutritionally pepper especially the 'tatasai' contains more minerals and vitamins than other vegetables (Olaofe *et al.*, 1993; Showemimo and Olarewaju 2002). It is now established that pepper is an important source of capsaicin, vitamin A and C and carotene and mineral elements. Capsaicin contains capsainoid that act as counter irritants for treatment of lumbago and rheumatism in pharmacological preparations. Vitamins A, C and carotene helps in proper growth and function of human beings, while mineral elements helps the body withstand stress, cold and stimulates mucous that protects intestinal living from ulcer (Collier, 1975; Keshinro and Ketiku, 1983 and Olaofe *et al.*, 1993).

The mineral elements, especially trace elements; iron, managanese, lead, cobalt, chromium, cadmium, zinc and copper are classified as essential and unessential that are necessary in biochemical reactions. The unessential trace elements are further divided into toxic and non-toxic to living tissues. Deficiency and excess accumulation of some of these trace elements could cause preventable diseases in man (Underwood, 1977; Peck *et al.*, 1980 and Schroeder, 1986).

The objective of this investigation was to determine quantitatively the chemical composition of peppers commonly grown in Nigeria with the aim of improving the nutritive value.

Materials and Methods

Three 'tatasai' pepper varieties (*Capsicum annuum* L.) (Pv_1, Pv_2 and Pv_3) and one chilli pepper variety (*Capsicum frutescens* L.) (Pv_4) obtained from diverse origins with distinct agronomic traits but adapted to the northern guinea savanna of Nigeria (Table 1) were used for the experiments. Samples were taken from replicated field experiment conducted between July and September of 1996 and 1997 cropping season at the Institute for Agricultural Research, Samaru (11° 11′ N; 07° 38′E with altitude 686m above sea level). Recommended practices were followed to raise a successful crop (IAR, 1993).

Fresh fruit samples were used to determine moisture contest (%) using the formula:

$$\text{Moisture content (\%)} = \frac{\text{loss in weight on drying (g)}}{\text{Sample weight (g)}} \times 100$$

Crude protein was determined using micro Kjeldahl's method on dry and wet fruit samples and percent protein was estimated by multiplying nitrogen percent by 6.25. Wet digestion method was used to obtain aqueous solutions of the trace elements. The absorbance readings of the digested samples were made on an SP1900 Pye Unicam Atomic Spectrophotometer. Analysis of variance revealed non significant different between the 2 years of evaluation, therefore mean values were presented.

Table 1: Pedigree and agronomic traits of 4 pepper variety

Variety	Pedigree name	Origin	Agronomic trait
PV_1	Cayenne (Tatasai)	United State of America (USA)	Fruit long, tapering, pendulum red at maturity and medium maturing, yield between 0.6 and 1.9 t/ha.
PV_2	Cubanalla (Tatasai)	Italy	Thin and oval shaped fruit, high capsaicin at the base, medium maturing with stay grain attributes and yield between 0.4 and 1.3 t/ha
PV_3	Bellboy (Tatasai)	USA	Sweet pepper bell shaped fruit, upright, medium maturing, green pepper (stay green attributed) and yield between 0.5 and 1.6 t/ha.
PV_4	Dantsiga (Chilli)	Nigeria	Very high capsaicin, blood red collared fruit pendulum, medium maturing yield between 0.4 and 1.0 t/ha.

Results and Discussion

Moisture and protein content of pepper verities used are presented in Table 2. Moisture content ranged between 75.9% in chilli and 88.1% in tatasai. Moisture content of pepper may be influenced by environmental variation or genetic composition or both of them; in this study the environmental influence (or yearly influence) is not significant from the result of analysis of variance. Thus the variation is mainly due to genetic composition of the diverse varieties. The moisture content is often an index of stability, quality and yield of food solids. Pv_2 (88.1%), Pv_3 (85.3%) and Pv_1 (82.7%) will store well in refrigerator only in the fresh form due to high moisture content otherwise these tatasai pepper could be dried before storage because high moisture content had low keeping quality similar result had been reported by Kumar and Kapoor (1984) in cereal and legume and Batten, (1994) in wheat.

Using the dry digestion method the percent protein of tatasai pepper are Pv_1 (15.76%), Pv_2 (16.97%) and Pv_3 (18.88%), while that of chilli pepper Pv_4 is 13.53% (Table 2). Pv_4 had the least amount of water and percent crude protein (dry digestion) but had the highest percent crude protein of 6.02% using the wet digestion method. This is partly due to presence of large amount of capsaicin that has linear relationship with percent crude protein. According to Cebula, (1989) high moisture content has direct relationship with percent protein content using dry digestion method while inverse relationship using wet digestion method. Table 2 also revealed significant difference between the dry and wet digestion methods for all the pepper varieties.

The provision of mineral elements is the most important contributions of vegetables (Solanaceae family) especially *Capsicum annuum* L.) and *Capsicum frutescens* L. to human growth became it aids proper functioning of the body system. Total values of the essential trace elements analysed are presented in Table 3. The three tatasai varieties had low iron; Pv_1 (6.36mg/100g), Pv_2 (14.63mg/100g) and Pv_3 (10.33mg/100g), thus an average of 10.44mg/100g but chilli had high iron (Fe) content (Pv_4 = 18.63mg/100g). The high Fe could be due to genetic and physiological composition of the variety, meanwhile Fe is needed for blood formation and is rarely available in such high proportion in natural form. Manganese and lead was low in all the pepper variety except Pv_4 (5.71mg/100g) in manganese and Pv_3 (2.66mg/100g) in lead that are appreciable, the low manganese and lead are important because high concentration is known to produce diverse disease symptom that lead to depression (Kumar and Kapoor, 1984). Cobalt, chromium and cadmium were generally low or absent in the pepper samples.

Table 2: Moisture and protein content of the pepper varieties

Variety	Moisture (%) ±SE	Protein (%)		
		Dry	Wet	LSD 0.01
PV_1	82.7±0.31	15.76	2.53	0.22
PV_2	88.1±0.21	16.97	2.13	0.31
PV_3	85.3±0.18	18.88	2.98	0.19
PV_4	75.9±0.29	13.53	6.02	0.41

Table 3: Trace elements' content of 4 pepper varieties

Variety	Iron Mg100g	Manganese Mg/100g	Lead mg/100g	Cobalt mg/100g	Chromium mg/100g	Cadmium mg/100g	Zinc mg/100g	Copper mg/100g
PV_1	6.36±0.04	2.01±0.05	0.31±0.04	Nil	Nil	0.13±0.05	2.26±0.11	1.07±0.03
PV_2	14.63±0.16	1.90±0.01	1.90±0.01	Nil	Nil	Nil	2.71±0.04	1.31±0.04
PV_3	10.33±0.21	3.54±0.14	3.54±0.14	Nil	Nil	Nil	4.41±0.16	0.99±0.10
PV_4	18.63±31.6	5.71±0.21	5.71±0.21	0.41±0.03	1.42±0.07	0.72±0.04	1.57±0.21	2.63±0.33

The low occurrence or absence of these elements was desirable due to the harmful effect in the human body when in high concentration; they cause blockage of metabolic pathways in human, while very little amount of cobalt with aid of bacterial activities help synthesize vitamin B_{12} in animals. These results conform to those of Schroeder (1986); Cebula (1989) and Rodov *et al.* (1995). Zinc and copper occurred in traces, the value of zinc in Pv_3 (4.41mg/100g) was higher then the rest variety while copper was higher in Pv_4 2.63mg/100g) than the rest variety. The quantity of zinc and copper recorded in this study is enough to activate enzymatic activities in both human and animals without toxic effect (Murthy *et al.*, 1971 and Liener, 1989).

Conclusion

The results of this study show that peppers contain significant amount of protein and moisture content except the chilli. The trace elements analyses revealed fair amount of essential elements, iron is high in chilli pepper (Pv_4). Absence or low levels of cobalt, chromium and cadmium are desirable in activating enzymatic activities in both animals and human. The pepper samples contain relatively safe amount of manganese, lead, zinc and copper.

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