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Proximate and Mineral Element Composition of Bouillon Cubes Produced in Nigeria

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Abstract: Three commercial brands of bouillon cubes were analyzed for proximate and elemental composition. The moisture content of the samples was found to range between 2.25 and 2.92%. Crude protein, crude fat and ash contents were: 10.50-17.50; 5.50-5.70 and 48.15-63.20% dry matter (DM) respectively. Mineral element analysis showed that the bouillon cubes contain low levels of sodium, iron and zinc. The clinical and nutritive implications of these results are discussed.

Key words: Bouillon cubes, food fortification, minerals, proximate composition

Introduction

The bouillon cubes are taste enhancers. When added to foods they augment the taste properties of such foods. Elemo and Makinde (1984) reported that the major active ingredients in the bouillon cubes are sodium chloride and monosodium glutamate. In addition to these two compounds, the manufacturers, of bouillon cubes in Nigeria indicate the presence of vegetable fat, starch and spices in these products.

Monosodium glutamate (MSG) is a flavour enhancer which has been classified under GRAS (Generally Recognized As Safe) by the US Food and Drug Administration (FDA). The safety of MSG has been established by the WHO/FAO Joint Expert Committee on Food Additives (JECFA, 1988). Concerns have, however, been expressed concerning the sodium content of the bouillon cubes (Elemo and Makinde, 1984) against the backdrop of the reported link between sodium and hypertension (Topian, 1979; Aviv and Gardner, 1989).

In Nigeria, the bouillon cubes are used extensively in food preparation. The cubes are reported to have found their way to the most remote villages (Baptist *et al.*, 1980). The bouillon cubes were selected and ranked topmost among the potential food fortification vehicles for Nigeria (Nnanyelugo, 1999). Food fortification is a globally accepted and cost effective strategy to improve micronutrient status (Blum, 1997). Priority mineral nutrients in food fortification include iron and zinc (Blum, 1997; Nnanyelugo, 1999; Bowley, 2005).

This study was carried out to assess the extent of fortification of bouillon cubes with iron and zinc. The sodium content was determined because of the reported health effects of this mineral. Proximate analysis was also carried out so as to place the nutrient content of these cubes in perspective.

Materials and Methods

Three different brands of bouillon cubes were purchased from locations in the North, West and Southern Nigeria. Twenty cubes of each bouillon sample were ground into powder using a food blender and transferred into polyethylene bags. The bags were stored in a dessicator containing calcium chloride to keep the samples dry.

Proximate analysis for moisture, crude fat, crude protein and ash were carried out in accordance with the Official Methods of the Association of Official Analytical Chemists (AOAC, 1984). Total carbohydrates were estimated by difference: 100 - (% moisture + % crude protein + % crude fat + % ash content). Sodium was determined with a flame photometer (Jenway PF 7 Flame Photometer, Essex, UK) whereas iron and zinc were determined using an atomic absorption spectrophotometer (AAS) (Unicam Analytical System, Model 919, Cambridge, UK).

Results and Discussion

The results obtained from proximate analysis of the bouillon cubes are presented in Table 1. Moisture content was found to be low ranging in value between 2.25 and 2.92%. The crude protein content of the cubes ranged between 10.50 and 17.50% DM. These values for crude protein are comparable to those reported for traditional spices such as *Ocimum basillicum, Ocimum viride and Piper guineense* (Udosen, 1995). However, the bouillon cubes may not contribute substantially to the total daily intake of proteins because of the low level in which they are used in food preparation. Crude fat was found to be fairly high ranging between 5.50 and 5.90% DM. The ash content was also found to be high (48.15-64.20%). Ash is a reflection of the total inorganic matter present in a food sample.

Table 2. shows the level of sodium, iron and zinc in the bouillon cubes and their percentage contribution to the Recommended Dietary Allowances (RDA) (FNB, 1989). This Table shows that the sodium content was comparable in samples B and C whereas the level of sodium in sample A was significantly high ($P<0.05$).

Table 1: Proximate Composition of bouillon cubes (Mean + SD; n=6)

Brand (Code)	Moisture Content	Ash	Crude Fat	Crude protein	Total carbohydrate	Energy value (kilojoules/100g)
A	2.25±002	48.15±0.04	5.90±0.45	17.50±0.16	26.20±0.26	967.10±0.36
B	2.87±0.05	63.20±0.15	5.65±0.13	10.85±0.06	17.43±0.24	695.46±0,43
C	2.92±0.02	62.35±0.11	5.50±0.27	10.50±0.04	18.73±0.32	705.91±0.28

Table 2: Sodium, iron and zinc content of the bouillon cubes

Brand (Code)	Sodium			Iron			Zinc		
	X	Y	Z	X	Y	Z	X	Y	Z
A	66.20±0.13	1.92	0.17	1114±0.45	0.32	3.2	2.69±0.03	0.08	0.53
B	16.96±0.18	0.44	0.44	17.10±0.22	0.44	4.4	2.73±0.06	0.07	0.50
C	14.60±0.14	0.05	0.04	13.10±0.17	0.41	4.1	1.15±0.04	0.04	0.30

X = mg/100g (mean ± SD; n=6). Y = mg/cube. Z = % contribution of each cube of bouillon to RDA (FNB, 1989).

Sodium is an extracellular cation involved in the regulation of plasma volume, acid-base balance, nerve and muscle contraction. High dietary sodium has been associated with essential hypertension (Topian, 1979; Aviv and Gardner, 1989; Latham, 1997). Elemo and Makinde (1984) reported high levels of sodium in bouillon cubes contributing 26.80-29.00% of the RDA for this element. Conversely, the present study shows that the level of sodium in the cubes are low, contributing only 0.04-0.17% to the RDA for sodium. Apparently, the manufacturers have reduced the sodium content of bouillon so as to accommodate the more conventional sources of sodium in the diet such as sodium chloride (Latham, 1997).

Iron is an important trace element in the human body. It plays crucial roles in haemopoiesis, control of infection and cell mediated immunity (Bhaskaram, 2001; Beard, 2001). The deficiency of iron has been described as the most prevalent nutritional deficiency, and iron deficiency anemia is estimated to affect more than one billion people worldwide (Trowbridge and Martorell, 2002) The consequences of iron deficiency include reduced work capacity, impaired body temperature and regulation, impairments in behaviour and intellectual performance, and decreased resistance to infections (Dixon *et al.*, 2004). The Nigerian Food Consumption and Nutrition survey 2001-2003, shows that 27.45% of children less than five years; 24.3% of mothers and 35.3% of pregnant women are at different stages iron deficiency (Dixon *et al.*, 2004). Efforts to combat iron deficiency include the fortification of foods with iron (Blum, 1997). The present study, however, indicates that the bouillon cubes, a potential food fortification vehicle, contain 11.14-17.10 mg of iron per 100g of sample, contributing 3.2-4.4% of the RDA for iron in males. These values are low and do not support a successful fortification of bouillon cubes with iron.

Zinc is an essential micronutrient for human growth and immune functions (Brown and Wuehler, 2000; Black, 2003). An estimated 20% of the world population is reported to be at risk of inadequate zinc intake (Hotz and Brown, 2004). Studies on Nigeria show that zinc deficiency affects 20% of children less than five years; 28.1% of mothers and 43.9% of pregnant women (Dixon *et al.*, 2004). There has been suggestions for the inclusion of zinc as a food fortificant to improve intake (Bowley, 2005). Nevertheless, the present study has demonstrated low levels of zinc in the bouillon cubes. The values obtained range between 1.15 and 2.73 mg of zinc per 100g of sample contributing 0.3-0.5% of the RDA for this element.

Conclusion: The present study has shown that bouillon cubes contain substantial amounts of ash, fat and protein but may not contribute significantly to the daily intake of these nutrients because of the low level in which the cubes are used in food preparation. The bouillon cubes were also found to contain low levels of sodium, iron and zinc. The low level of sodium is desirable against the backdrop of reported health effects of high sodium intake. Conversely, the low levels of iron and zinc indicate that these cubes have not yet been successfully fortified with these two elements despite an earlier choice of bouillon as a food fortification vehicle for Nigeria.

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