ELSEVIER

Food Chemistry 53 (1995) 239–241

0308-8146/95/$9.50

Nutrients and anti-nutrients in small snails (*Limicolaria aurora*)

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(Received 27 August 1993; revised version received and accepted 13 June 1994)

The proximate composition, toxic substances, mineral elements and amino acid compositions of fresh *Limicolaria aurora* were determined. The moisture content of the sample was 71·24 g/100 g (wet weight). Crude protein, crude fat, and ash contents were 51·0, 9·70 and 11·8 g/100 g DM (dry matter), respectively. Some anti-nutrients were also determined: total oxalate was 381 mg/100 g DM while hydrocyanic and tannic acids were 112 and 592 mg/100 g DM, respectively. Mineral element analysis showed that *L. aurora* is rich in sodium, potassium, calcium, magnesium, phosphorus and zinc. Among the essential amino acids assayed, the sulphur-containing amino acids with a chemical score of 46·0% appeared to be the most limiting when compared with the essential amino acid pattern of whole hen's egg. The potential of *L. aurora* as a source of food nutrients is discussed.

INTRODUCTION

In Nigeria today, protein consumption is limited because of the present economic situation. The potential for improving the situation through increased animal production is limited and the need for efficient utilisation of cheap and available food resources is inevitable. Umoh and Bassir (1977), Umoh *et al.* (1980) and Mba (1980) highlighted a good number of lesser known animal foods such as *Egreria radiata* (clam), *Pachymelania byronensis* (periwinkle) and *Vivapara quadrata* (land snail) whose consumption was limited to a small population owing to lack of adequate information about their nutritional potential.

Limicolaria aurora is a species of snail and belongs to the class gastropoda and the phylum mollusca. It is used as food by both rural and urban dwellers in the rain forest region of Nigeria. The mode of harvesting is by indiscriminate hunting. It is available all year round but more commonly between April and August. The shell is smooth and some display an infinite variety of beautiful colours, patterns and sculpturing. The shell is easily cut or broken with a knife, a stone or finger pressure. When dried and powdered, the shell can be used to increase the mineral element content of animal feeds. In the wake of modern curiosity about the nutritional status of local foods, this paper describes the results of a study on evaluation of the nutrient composition of *L. aurora*.

MATERIALS AND METHODS

Materials

Live samples of *Limicolaria aurora* were bought from the Uyo main market (Uyo, Akwa Ibom State, Nigeria). The shells were broken to remove the fleshy and edible portion. The samples were then dried to constant weight in an oven at 60°C. Dry samples were then milled into fine powder to pass through a 300-mesh sieve and stored until required for analysis.

Chemical analysis

Proximate composition was determined by the standard methods of AOAC as described by Horwitz (1980). A known mass of the dry powdered sample was ashed at 600°C in a muffle furnace for 4 h. The ash was dissolved in 6 M HCl solution (Horwitz, 1980) and the resulting solution was made to a definite volume and used for the determination of anti-nutrients and mineral elements. Phosphorus was determined by the molybdovanadate colorimetric method of Vogel (1969). Sodium and potassium were determined with a flame photometer (Jenway PF 7 Flame photometer, Essex, UK) while other mineral elements were determined using an atomic absorption spectrophotometer (AAS) (Unicam Analytical System, Model 919 Cambridge, UK). Amino acids were determined using an automatic

amino acid analyser using the principles of Moore (1963) and Spackman *et al.* (1958). Total oxalate was determined by the method of Dye (1956); hydrocyanic acid was determined by the alkaline titration method (Horwitz, 1980) while tannic acid was determined by following the colorimetric method of Burns (1971). Except for amino acids, all analyses were done in triplicate and mean values are presented.

RESULTS AND DISCUSSION

The proximate composition of fresh *Limicolaria aurora* is presented in Table 1. The crude protein value compares favourably with values reported by Mba (1980) for land snail (*Vivapara quadrata*) (63·4 g/100 g DM), periwinkle (*Pachymelania byronensis*) (55·0 g/100 g DM) and crayfish (*Paramonetes varians*) 69·5 g/100 g DM) and by Ifon and Umoh (1987) for clam (*Egreria radiata*) (61·0 g/100 g DM) and whole hen's egg (50·0 g/ 100 g DM) (Paul *et al.*, 1976). Hence, *L. aurora*, a cheaper meat item, can provide as much dietary protein as the more costly egg. The ash content of *L. aurora* also compares well with the value reported for *P. varians* (11·8 g/100 g DM), but is higher than that of *V. quadrata* (5·00 g/100 g DM). The ash content is a reflection of the amount of minerals contained in the sample. *Limicolaria aurora* is richer in fat than *V. quadrata* (2·66 g/100 g DM), *P. byronensis* (1·37 g/100 g DM) and *P. varians* (4·52 g/100 g DM).

The mineral element composition of *L. aurora* is shown in Table 2. The values for all the mineral elements reported in the table are higher than those reported for *L. littorea* (Umoh & Bassir, 1977), *Vivapara quadrata*, *P. byronensis*, *P. varians* (Mba, 1980) and *E. radiata* (Ifon & Umoh, 1987). *Limicolaria aurora* is thus rich in mineral elements and can act as a good source of these for man.

Table 3 shows the amino acid pattern of *L. aurora* as compared with that of whole hen's egg reported by Paul *et al.* (1976). *Limicolaria aurora* contained all the amino acids naturally present in proteins. The most limiting essential amino was the combined sulphur-containing amino acids with a chemical score of 46% when compared with the essential amino acid pattern of whole hen's egg. Although the levels of most of the other essential amino acids are higher than in the egg, the chemical score is low. This, however, does not mean that *L. aurora* may not make an important contribution to the protein of the diet since it is rich in lysine, which is potentially limited in a predominantly cereal diet which is very common in Nigeria.

Table 4 shows the levels of some anti-nutrients in *L. aurora*. The lethal dose of oxalate to man has been reported as between 2 and 5 g (Oke, 1969). Much higher values of total oxalate were reported for carrot (1211 mg/100 g DM), red pepper (1982 mg/100 g DM) and baobab leaves (1212 mg/100 g DM) (Eka, 1977)

Table 1. Proximate composition of *Limicolaria aurora* (mean ± SD, *n* = 3)

Constituent	Content (g/100 g DM)
Moisture (wet weight)	71·24 ± 1·55
Ash	11·76 ± 0·55
Crude protein	51·4 ± 0·35
Crude fat	9·70 ± 0·47
Carbohydrate	27·1 ± 1·81
Caloric value (kcal/100 g)	34·9 ± 1·43

Table 2. Mineral element composition of *Limicolaria aurora* (mean ± SD, *n* = 3)

Mineral element	Content (mg/100 g DM)
Na	178 ± 1·41
K	533 ± 0·05
Mg	771 ± 0·01
Ca	401 ± 0·08
P	636 ± 0·02
Zn	259 ± 1·79
Fe	ND[a]
Cr	ND
Pb	ND

[a]ND, not detected.

Table 3. Amino acid composition of *Limicolaria aurora* compared with whole hen's egg (g/16 g N)

Amino acid	*L. aurora*	Whole hen's egg, Paul *et al.* (1976)	Amino acid score (%)
Isoleucine	7·3	5·6	130
Leucine	11·5	8·3	139
Lysine	7·2	6·2	116
Methionine	1·4	3·2	43·8
Cystine	0·9	1·8	50·0
Phenylalanine	6·7	5·1	131
Tyrosine	5·9	4·0	148
Threonine	3·9	5·1	76·5
Tryptophan	ND[a]	1·8	—
Valine	7·6	7·5	101
Met + cys	2·3	5·0	46·0
Phe + tyr	12·6	9·1	139
Arginine	0·3	6·1	4·9
Histidine	3·7	2·4	154
Alanine	6·9	5·4	128
Aspartic acid	7·8	10·7	72·9
Glutamic acid	13·5	12·0	113
Glycine	6·5	3·0	217
Proline	5·6	3·8	147
Serine	4·0	7·9	50·6

[a]ND, not determined.

Table 4. Levels of anti-nutrients in *Limicolaria aurora* (mean ± SD, n = 3)

Anti-nutrients	Content (mg/100 g DM)
Total oxalates	381 ± 0·06
Hydrocyanic acid	112 ± 0·15
Tannic acid	592 ± 0·12
Phytic acid	ND[a]

[a]ND, not detected.

and rice, maize and sorghum (2000 mg/100 g DM each) (Oke, 1965). These cereals are consumed at any time in larger quantities than is likely for *L. aurora*.

It is therefore concluded that *L. aurora*, if consumed in adequate quantities, would help to alleviate nutrient deficiency which is prevalent in large sections of Nigeria. Also, home-breeding of the animal could contribute significantly to its supply all year round.

ACKNOWLEDGEMENT

The authors are grateful to Messrs F. K. Bona and N. A. Udofia who helped in carrying out some analysis.

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