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Amino Acid Composition of a Species of Whelk (*Buccinum inclytum*) Meat Protein

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ABSTRACT

The amino acid composition of a species of whelk (*Buccinum inclytum*) meat protein has been determined. The result revealed a total of 17 amino acids (excluding tryptophan) with glutamic acid (13.11 g/100 g protein) and aspartic acid (8.98 g/100 g protein) as the predominant amino acids. The amino acids have a total value of 78.61 g/100 g protein. The essential amino acids make up 38.53 g/100 g protein of the total amino acids (excluding tryptophan). This value represents 49.01% of the total amino acid composition of the whelk meat sample. The whelk has high values of lysine (5.61 g/100 g protein), leucine (7.60 g/100 g protein), arginine (5.62 g/100 g protein) and an appreciable value of 4.90 g/100 g protein for phenylalanine. The values of methionine+cystine (3.27%), leucine (7.66%), valine (3.95%), isoleucine (3.31%) and phenylalanine + tyrosine (7.80%) scored higher than their respective FAO/WHO/UNU (1991) reference standards. Whelk meat can serve as a good source of essential amino acids to consumers.

Keywords: crustaceans, molluscs, seafood, sea snail, shellfish

INTRODUCTION

Seafood is any sea animal or plant that is served as food and eaten by humans. Seafoods include seawater animals, such as fish and shellfish (including molluscs and crustaceans) (Herbst 1995). Seafood is consumed all over the world and provides the world's prime source of high-quality protein: 14–16% of the animal protein consumed world-wide. Over one billion people rely on seafood as their primary source of animal protein (Tidwell and Allan 2001). The molluscs are by far the most numerous gastropods (snails and slugs), accounting for 80% of the known species, including the cowry (a sea snail) (Ponder and Lindberg 2008). Molluscs, especially bivalves such as clams and mussels have been and still are an important food source for humans. Molluscs are extremely diverse in tropical and temperate regions but can be found at all latitudes (Giribet *et al*. 2006).Other commonly eaten molluscs include octopuses and squids, whelks, oysters, and scallops (Garrow *et al*. 2002). Among the molluscs, the sea snails such as the whelks are among the most common aquatic lives used as food by humans. Unfortunately, whelk meat has remained an under-exploited unconventional source of nutrients such as protein (amino acids) to humans.

Whelk is a common name used to mean one or more kinds of sea snail of the family *Buccinidae*, or a snail having a similar shell; found worldwide. The species vary a great deal from one geographic area to another. Some whelks are called conchs (because of the resemblance) (OECD 1978). The sturdy shell of most species in the family is slender and has a wide opening in the first whorl. Most are cold-water species and cannot survive at temperatures above 29°C (Ten Hallers-Tjabbes *et al*. 1996). Many whelks are quite large but the tropical species, for example, *Buccinum inclytum*, are smaller and more colourful.

In Nigeria, what is commonly known as periwinkle is actually a species of whelk (*B. inclytum*) which is commonly found in Nigeria, especially in the coastal areas - Cross River, Rivers, Edo and Delta states of Nigeria. In Nigeria and some parts of the world, whelk meat is a highly relished delicacy. In the local communities, the meat is taken with rice or in soups in place of beef meat or fish. In spite of the fact that whelk meat is a highly relished delicacy, its nutritional potential has not been properly documented. Thus, whelk meat has remained an under-exploited unconventional source of nutrients such as protein (amino acids), which is the focus o this study.

MATERIALS AND METHODS

Fresh live whelk [1 kg] was purchased from dealers in Akwa-Ibom State, Nigeria. It was caught in fresh salted water and placed in a covered pot filled with water and boiled for 10 min. The water was drained and the flesh (meat) of the whelk was taken out of the shell using a pin, first removing the operculum (the cap covering the shell opening).The flesh (meat) was dried in the oven for 48 h and subsequently milled to obtain the powdery sample used for the study.

Determination of amino acid profile

The milled sample (5 g) was defatted with a 50: 50 mixture of analytical grade ethanol and *n*-hexane using a Soxhlet apparatus as described by A.O.A.C (2006). The defatted powdery (flour) sample was then employed in the determination of the amino acid profile by the method described by Spackman *et al*. (1958) using a Technico-Sequential Multi-Sample (TSM) Automatic Amino Acid Analyser.

RESULTS AND DISCUSSION

The result of the amino acid composition of whelk meat protein is presented in **Table 1**. The result shows a total of 17 amino acids (excluding tryptophan) with glutamic acid (13.11 g/100 g) and aspartic acid (8.98 g/100 g) as the predominant amino acids. The amino acids have a total value of 78.61 g/100 g. The essential amino acids (excluding tryptophan) (**Table 2**), make up 38.53 g/100 g protein. This value represents 49.01% of the total amino acid composition. This value may be considered reasonable. The whelk

Received: 23 January, 2012. Accepted: 27 June, 2012.

Research Note

Table 1 Amino acid composition of whelk (*Buccinum inclytum*) meat protein (g/100 g).

Amino acid	Concentration
Lysine	5.61
Histidine	2.32
Aspartic acid	8.98
Threonine	3.02
Serine	2.94
Glutamic acid	13.11
Proline	3.50
Glycine	4.01
Valine	3.95
Methionine	2.14
Isoleucine	3.31
Leucine	7.66
Arginine	5.62
Tryptophan	Not determined
Tyrosine	2.90
Phenylalanine	4.90
Alanine	3.51
Cystine	1.13
Total AA	78.61
Total EAA	38.53
% Total EAA	49.01

EAA = essential amino acid

Table 2 Essential amino acid composition of *Buccinum inclytum*) meat protein (g/100 g).

Essential A.A	Composition
Lysine	5.61
Methionine	2.14
Threonine	3.02
Tryptophan	Not determined
Valine	3.95
Leucine	7.66
Isoleucine	3.31
Phenylalanine	4.90
Arginine	5.62
Histidine	2.32
Total EAAs	38.53
% Total of EAAs	49.01

EAA = essential amino acid

meat protein has high values of leucine (7.66 g/100 g), phenylalanine (4.90 g/100 g) and arginine (5.62 g/100 g). The lysine content (5.61 g/100 g) is low when compared to reported values for some legumes such as soybean (6.40 g/100 g) (Iwe 2003) and groundnut (6.83 g/100 g) (Onyenuga 1968) but higher when compared to a reported value of 2.8 g/100 g for cowpea (Aremu *et al.* 2006).The reported leucine values of these legumes range from 5.9 g/100 g in cowpea (Aremu *et al*. 2006) to 7.80 g/100 g in soybean (Iwe 2003).

The whelk meat protein has appreciable values of lysine (5.61 g/100 g), threonine (3.02 g/100 g), valine (3.95 g/100 g), leucine (7.66 g/100 g), phenylalanine (4.90 g/100 g), arginine (5.62 g/100 g) and histidine (2.32 g/100 g) when compared to reported values of lysine (8.40 g/100 g), threonine (4.00 g/100 g), valine (5.70 g/100 g), leucine (8.40 g/100 g), phenylalanine (4.00 g/100 g), arginine (6.61 g/100 g) and histidine (2.90 g/100 g) for beef meat (Pellett and Young 1990) as well as the values of lysine (7.40 g/100 g), threonine (4.80 g/100 g), valine (5.40 g/100 g), leucine (8.40 g/100 g), phenylalanine (3.50 g/100 g), arginine (7.50 g/100 g) and histidine (2.10 g/100 g) for goat meat (Pellett and Young 1990).The values of these essential amino acids imply that the flesh of whelk is as good as the legumes, goat and beef meats in the supply of essential amino acids. The branched chain amino acids; valine, leucine and isoleucine make up 14.92 g/100 g protein of the sample of whelk used for this study. This value is about 19% of the total amino acid content of the flesh of the sample of whelk. These three essential amino acids account for about 35% of the essential amino acids in muscle proteins and 40% of the preformed amino acids required by mammals (Harper *et al*. 1984). Branched chain amino acids are basically required for protein synthesis, repair and maintenance of the muscle tissues. Apart from this, each of the branched chain amino acids is concerned with some specific functions. It is believed that BCAAs contribute to energy metabolism during exercise as energy sources and substrates to expand the pool of citric acid–cycle intermediates (anaplerosis) and for gluconeogenesis. In contrast, leucine is special among the BCAAs, because it promotes muscle-protein synthesis in vivo when orally administered to animals (Kimball *et al*. 2002).

Table 3 Essential amino acid composition of whelk (*Buccinum inclytum*) meat protein compared to FAO/WHO/UNU (1991) Reference Standards.

EAA	Composition	FAO/WHO/UNU (1991)
Lysine	5.61	5.8
Methionine+Cystine	3.27	2.5
Threonine	3.02	3.4
Tryptophan	ND	1.0
Valine	3.95	3.5
Leucine	7.66	6.6
Isoleucine	3.31	2.8
Phenyalanine+Tyrosine	7.80	6.3
Arginine	5.62	-
Histidine	2.32	-

EAA = essential amino acid
ND = not determined

Toxicity studies of BCAAs using animals showed that they are quite safe and pose no threat when used appropriately (Okazaki *et al.* 1989a, 1989b).

Methionine and cysteine are the principal sulfur-containing amino acids because they are 2 of the canonical 20 amino acids that are incorporated into proteins. They play critical roles in protein synthesis, structure and function. Their metabolism is vital for many critical functions. The sulphur-containing amino acids; methionine and cystine make up 3.27 g/100 g protein, about 4.16% of total amino acid content of the whelk meat protein. Methionine assists in the breakdown of fats and thus prevents the build-up of fat in the arteries. Cysteine is not considered by some to be a dietary essential amino acid provided that adequate methionine is available, but methionine is a dietary essential amino acid, regardless of cysteine availability because methionine is easily converted to cysteine. The general antioxidant effects and the antioxidative activities, of sulfur-containing amino acids had been reported (Atmaca 2004).

Methionine is the initiating amino acid in the synthesis of virtually all eukaryotic proteins; Nformylmethionine serves the same function in prokaryotes (Brosnan and Brosnan 2006). Cysteine plays a critical role in protein structure and in protein-folding pathways (Jessop 2004).

It is also one of the three amino acids that are needed by the body to manufacture a compound called monohydrate, which is very essential for energy production and muscle building.

Protein quality is usually assessed by comparing its essential amino acids content with reference standard ideal protein set by the World Health Organization (FAO/WHO/UNU 1991), which is based on the amino acids need for the children aged 2-5 years.

The essential amino acid score of the whelk meat protein in comparison with FAO/WHO/UNU (1991) reference standard is presented in **Table 3**. From the table, methionine+cystine (3.27%), leucine (7.66%), valine (3.95%), isoleucine (3.31%) and phenylalanine + tyrosine (7.80%) score higher than their respective reference standards. However, the value for methionine + cysteine, and isoleucine contents of the flesh of whelk are below the recommended amino acids requirements (4.6 g/100 g protein) for infants, but are adequate for both pre-school children between the ages of 2 and 5, school children between the ages of 10 and 12 years and adults (Thangadurai 2005). Likewise, the leucine content is adequate for both infants, preschool children

between the ages of 2 and 5 years, school children between the ages of 10 and 12 years and adults (Thangadurai 2005). These amino acids are higher than 1.9 g/100 g protein set as reference standard (FAO/WHO/UNU 1991). This implies that whelk meat protein has amino acids with high biological value and could contribute to meeting human requirements for these essential amino acids.

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