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Research Article

Assessment Of Proximate Composition And Lipid Profiles Of Commercially Dried Crayfish From A Local Market.

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Abstract

This work evaluated the proximate composition, fatty acid profile, phospholipid composition and sterol profile of dried crayfish. Crayfish are freshwater crustaceans resembling small lobsters. The proximate analysis showed that dried crayfish contained 6.5% crude fat, 11.8% moisture, 14.9% ash, 65.9% crude protein, less than 0.01% crude fibre, and 0.9% carbohydrate. The high crude protein content indicates that dried crayfish is a concentrated source of dietary protein, while the relatively low moisture content suggests good storage stability when properly packaged. Fatty acid analysis revealed 21.9% saturated fatty acids (SFA), 32.1% monounsaturated fatty acids (MUFA) and approximately 45.9% polyunsaturated fatty acids (PUFA). Oleic acid (23.54%) was the predominant MUFA, while palmitic acid (16.3%) was the major SFA. Among the PUFA, eicosapentaenoic acid (EPA) was the most abundant fatty acid (20.1%), followed by arachidonic acid (9.63%), linoleic acid (7.86%) and docosahexaenoic acid (DHA) (4.28%). Total n-3 PUFA was 25.04%, while total n-6 PUFA was 20.9%, giving a high combined PUFA value of 45.9%. Phospholipid analysis showed phosphatidylcholine (PC) as the predominant phospholipid (46.4%), followed by phosphatidylethanolamine (PE) (38.2%), while lysophosphatidylcholine was present at a very low level (0.001%). Sterol analysis showed cholesterol as the dominant sterol at 69.6 mg/100 g, whereas the other sterols occurred only in trace quantities. Overall, the results demonstrate that dried crayfish is a protein-rich food with a favourable abundance of nutritionally important unsaturated fatty acids, particularly EPA and DHA, as well as substantial phospholipids. These characteristics support its nutritional importance as a dried seafood product.

Keywords: Dried crayfish, proximate, lipids, dietary-protein, seafood.

INTRODUCTION

Crayfish are aquatic crustaceans that are widely consumed because of their desirable taste and high nutritional value. They provide important nutrients, particularly proteins, lipids, minerals and biologically active fatty acids (Taylor and Schuster, 2010). Seafood is generally recognized as an important source of long-chain polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are important components of biological membranes and are involved in several physiological processes (Crandall and Fetzner, 1995). Crayfish, also called crawfish or crawdad, any of numerous crustaceans (order Decapoda, phylum Arthropoda) constituting the families Astacidae (Northern Hemisphere), Parastacidae, and Austroastracidae (Southern Hemisphere) (Johnson, 2008)).Crayfish are found in a range of habitats from open waters (lakes and streams) to wetlands, and in some cases in terrestrial habitats several kilometers from the nearest surface water (Hobbs, 1992). They also are a popular food for people in various regions of the world (Herbst, 2001). Drying is one of the traditional methods used to preserve crayfish and other aquatic products. Removal of water reduces the possibility of microbial growth and can extend shelf life. However, drying can also influence the chemical composition and nutritional quality of seafood (Rahman and Perera, 2007). Therefore, determination of the proximate composition of dried crayfish provides useful information about its nutritional density, while fatty acid analysis provides information on the quality and potential health significance of its lipid fraction (Rahman and Perera, 2007). The lipid fraction of seafood consists not only of neutral lipids but also of phospholipids and sterols. Phospholipids

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such as phosphatidylcholine and phosphatidylethanolamine are important structural components of cell membranes. Sterols, particularly cholesterol, also perform essential biological functions, although their concentration is an important consideration in assessing the overall nutritional characteristics of animal-derived foods. Previous studies have demonstrated substantial variation in the proximate and fatty acid composition of crayfish depending on species, habitat, feeding conditions and culture system (Harlioğlu et al., 2012). It was reported that wild crayfish had higher protein, ash and n-3 PUFA, particularly EPA and DHA, than captive crayfish, while differences in fatty acid composition were associated partly with dietary conditions (Harlioğlu et al., 2012). More recent studies have similarly demonstrated that crayfish can contain substantial amounts of EPA, DHA and other unsaturated fatty acids, although the proportions vary considerably among culture conditions and tissues (Harlioğlu, 2023). The present study therefore examined the proximate composition, fatty acid composition, phospholipid composition and sterol composition of dried crayfish in order to assess its nutritional characteristics and potential value as a food source.

MATERIALS AND METHODS

Sample collection

The dried crayfish samples were obtained from Igbokoda local seafood market, Ese-Odo, Ilaje Local, Government, Ondo State, Nigeria. The samples were placed in clean, labelled polyethylene bags and transported to the laboratory for analysis. Foreign materials and visible contaminants were removed manually. The dried crayfish was ground into a relatively uniform powder using a clean laboratory grinder. The samples were subsequently homogenized to obtain a representative sample for the different analyses. The homogenized sample was stored in airtight containers prior to analysis to prevent moisture uptake and oxidative deterioration of the lipid fraction. Separate portions of the homogenized sample were used for proximate, fatty acid, phospholipid and sterol analyses.

Methods

The proximate composition of the dried crayfish was determined using standard analytical procedures. The parameters determined were moisture, crude protein, crude fat, crude fibre, ash and carbohydrate.

Crude Fat

250 ml capacity extracting flask was dried in the oven at 1050C, transferred to the dedicator to cool to the laboratory temperature and the weight of the flask was measured (W0). 2.5g of the sample was weighed into the labelled porous thimble. 200ml of the petroleum ether was measured and then added to the dried 250ml capacity flask. The covered porous thimble with the sample was placed in the condenser of the Soxhlet extractor arrangement that has been assembled. The sample was extracted for five (5) hours. The porous thimble was removed with care and the petroleum ether in the top container (tube) was collected for recycling for reuse. The extraction flask was removed from the heating mantle arrangement when it was almost free of petroleum ether. The extraction flask with the oil was oven dried at 1050C for the period of one (1) hour. The flask containing the dried oil was cooled in the dedicator and the weighed (W_3) of the cooled flask with the dried oil was taken (AOAC, 2006).

Calculation

$$\text{Total crude fat (\%)} = \frac{W3-W2}{W1-Wo} x100$$

W_0 = Weight of the empty porous thimble, W1 = Weight of the thimble + sample

W_2 = Weight of the extraction flask, W3 = Weight of the extraction flask + ether

Fatty Acids Methyl Ester Analysis

50mg of the extracted fat content of the sample was saponified (esterified) for five (5) minutes at 950C with 3.4ml of 0.5M KOH in dry methanol. The mixture was neutralized by using 0.7M HCl. Three ml (3ml) of 14% boron triflouride in methanol was added. The mixture was heated for 5 minutes at the temperature of 900C to achieve complete methylation process. The fatty Acid Methyl Esters were thrice extracted from the mixture with redistilled n-hexane. The content was concentrated to 1ml for gas chromatography analysis and 1µl was injected into the injection port of GC.

Phospholipids Analysis

Modified method of Raheja et al. (1973) was employed in the analysis of the extracted oil phospholipids content determination. 0.01g of extracted fat was added to the test tubes. To ensure complete dryness of the oil for phospholipids analysis, the solvent was completely removed by passing stream of nitrogen gas on the oil. 0.40ml of chloroform was added to the content of the tube and it was followed by the addition of 0.10ml chromo-genic solution. The content of the tube was heated at the temperature of 1000C in a water bath for about 1 minute 20 seconds. The content was allowed to cool to the laboratory temperature and 5ml of hexane was added and the tube with its content shaken gently several times. The solvent and the aqueous layers were allowed to be separated. The hexane layer recovered and allowed to be concentrated to 1.0ml for gas chromatography analysis using pulse flame photometric detector (Raheja *et al*., 1973).

Zoosterols

The zoosterol extraction and analysis were carried out by following the modified method of AOAC 994.10 and 970.51 official methods (AOAC, 2006). 5.00g of the powdered sample was weighed and transferred to Stoppard flask and treated with petroleum ether until the powder was fully soaked. The flask was shaken every hour for the first six hours and then it was kept aside and shaken after 24 hours. This process was repeated for three days and then the extract was filtered. The extract was collected and evaporated to dryness by using nitrogen stream (AOAC, 2006).

0.5g of the extract from the sample was added to the screw-capped test tube. The sample was saponified at 950C for 30 minutes by using 3ml of 10% KOH in ethanol to which 0.20ml of benzene had been added to ensure miscibility. Three ml (3ml) of de-ionized water was added and 2ml of hexane was used in extracting the non-saponifiable materials, e.g., sterols. Three extractions, each with 2ml of hexane were carried out for 1 hour, 30mins and 39mins respectively to achieve complete extraction of the sterols. The hexane was concentrated to 2ml in Agilent vial for gas chromatography analysis (AOAC, 2006).

RESULTS AND DISCUSSION

The proximate composition of dried crayfish are presented in **table 1**.the following values was obtained crude protein (65.9%), crude fat (6.5%), ash (14.9%), moisture (11.8%) and carbohydrate (CHO) and crude fiber having values less than one (<1) respectively for the dried crayfish. The ash content in the sample indicate the level of minerals, or organic component of the dried crayfish sample. The crude protein value of 65.9% was the most prominent component of the proximate composition. This indicates that dried crayfish is a highly concentrated source of protein. The high protein concentration is expected in dried seafood because removal of water concentrates the remaining nutrients. Protein is particularly important because crayfish provides essential amino acids required for growth, tissue maintenance and other physiological functions. The high protein content obtained in this study is consistent with the general observation that crayfish meat is protein-rich. Studies on crayfish have also reported substantial protein concentrations, although differences may occur because of species, tissue examined, feeding conditions, maturity, processing and moisture content. However, the present protein report is higher than those reported in beef (18%), lamp (16%), pork (10%), haddock (17%), sardine (20%), mackerel (17%) and Oyster (11%) (Abdullahi and Abolude, 2002; Bhuiyan et al., 1986; Brain and Allan, 1977). The fat content (6.5%) in this report is higher than the value (3.15%) of Gymnarchus niloticus (Adeyeye and Adamu, 2005) and that of sea foods (Ogunlade et al., 2005; Adeyeye and Adubiaro, 2004). The dried Crayfish is a good source of protein. The crude fat content of 6.5% indicates that the dried crayfish is not a highly fatty food in terms of total lipid concentration. Nevertheless, the relatively modest total fat content should not be interpreted as indicating poor lipid quality because the subsequent fatty acid analysis revealed a high proportion of nutritionally important unsaturated fatty acids. The moisture content of 11.8% is relatively low and is consistent with the preservation objective of drying. Reduction of moisture limits conditions favourable for microbial growth and enzymatic deterioration and therefore contributes to improved shelf stability. However, storage conditions remain important because dried seafood can still absorb moisture from the environment if inadequately packaged. The ash content of 14.9% was relatively high. This may reflect the mineral-rich nature of crayfish and could also be influenced by the presence of small amounts of shell or exoskeletal material in the dried sample. Crustaceans contain considerable mineral matter, particularly in their exoskeleton. Thus, the high ash content suggests that dried crayfish may contribute minerals to the diet. Crude fibre was less than 0.01%, which is expected because animal tissues generally contain negligible dietary fibre. The carbohydrate content was also low at 0.9%, indicating that protein and minerals rather than carbohydrate constitute the major non-water components of the sample.

Table 1. Proximate compositions of dried crayfish (DCF) (%).

Parameter	DCF
Moisture (%)	11.8
Crude Protein (%)	65.9
Crude Fat (%)	6.5
Crude Fiber (%)	<0.01
ASH (%)	14.9
CHO (%)	0.9

The fatty acid compositions of the dried crayfish are listed in **Table 2**. The data showed that the amount of the constituent fatty acid varied among the sample. This fatty acid value in the dried crayfish fish sample ranges (%): 0 - 23.5. Palmitic acid (C16:0) had the highest value among the saturated fatty acids and is significantly present in the sample (16.3%) which is lower than the report of Adeyeye et al., (2018) in catfish (26.3%). Oleic acid C18:1(cis-9) had the highest value in the sample (23.5%) this is comparatively close to the report of Olaleye and Olatoye (2017) on soldier termite. The unsaturated chain fatty acids influence lower melting point, lower cholesterol level, provides energy and form an integral part of biomembrane. Higher level of palmitoleic 16:1 (cis-9) acid have been described as a characteristic of fresh water fish (Akman, 1967), which is also comparable to the result in this dried cray fish sample with palmitoleic acid (2.23%)

coming after Arachidonic C20:4(cis-5, 8, 11, 14) (9.63%). Linoleic acid C18:2 (cis-912) (7.86%) had the fourth highest value in the sample followed by stearic acid C20:4(cis-5, 8, 11, 14) (5.23%). Timnodonic acid (EPA) C20:5(cis-5, 8, 11, 14, 17) had the second highest values recorded in the report with the value of 20.1%. Elaidic acid, C18:1 (trans- 9) (0.0001%) had the lowest value in all fatty acid except in C6:0 (Caproic acid), C8:0 (Caprylic acid) and C10:0 (Capric acid) that all recorded 0.00% in the samples.

Table 2. Fatty Acid composition (%) of dried crayfish (% total fatty acids)

Fatty acids	%
Caproic acid C6:0	0
Caprylic acid C8:0	0
Capric acid C10:0	0
Dodecanoic acid C12:0	0.0013
Myristic acid C14:0	0.007
Myristoleic acid C14:1(cis-9)	0.0004
Palmitic acid C16:0	16.3
Palmitoleic acid C16:1(cis-9)	2.23
Stearic acid C18:0	5.63
Trans-petroselinic acid C18:1(trans-6)	0.001
Petroselinic acid C18:1(cis-6)	4.085
Elaidic acid C18:1(trans-9)	0.0001
Oleic acid C18:1(cis-9)	23.54
Vaccenic acid C18:1(trans-11)	0.000883
Linoleic acid C18:2(cis-9,12)	7.86
Rumenic acid C18:2(trans-9,12)	0.00132
Arachidic acid C20:0	0.00312
Gama -linoleic acid C18:3(cis-6,9,12)	0.871
Gandoic acid C20:1(cis-11)	2.222
Alpha-linolenoic acid (ALA) C18:3(cis-9,12,15)	0.691
Eicosadienoic acid C20:2(cis-11,14)	2.463
Behenic acid C22:0	0.0029
Dihomo-gamma-linoleic acid (DGLA) C20:3(cis-8,11,14)	0.0187
Erucic acid C22:1(cis-13)	0.0301
Eicosatrienoic acid (ETE) C20:3(cis-11,14,17)	0.00191
Arachidonic C20:4(cis-5,8,11,14)	9.63
Docosadienoic C22:2(cis-13,16)	0.022
Lignoceric acid C24:0	0.00036
Timnodonic acid (EPA) C20:5(cis-5,8,11,14,17)	20.1
Nervonic acid C24:1(cis-15)	0.00035
Cervonic acid (DHA) C22:6(cis-4,7,10,13,16,19)	4.282
Total	99.9

Table 3 further demonstrates that saturated fatty acid (SFA) constituted 21.9%, mainly from two saturated fatty acids C16:0 (palmitic acid) (16.3%), and C18:0 (Stearic acid) (5.63%) while cis-(monounsaturated fatty acid) MUFA accounted for approximately 32.1% of the total fatty.. The relatively high MUFA content, especially oleic acid, contributes to the overall unsaturated nature of the lipid fraction. The combined SFA and MUFA values account for approximately 54.0% of the total fatty acids, while PUFA accounts for approximately 45.9%. Therefore, the dried crayfish lipid profile can be described as predominantly unsaturated. The C12:0, C14:0 and C16:0 SFA in these samples constitute a total value of 30.5% which are higher than the 25% required minimum values for animal. The SFA in these results is higher than the one in Pandalus borealis shrimp whole organism (18.3%), shell (19.6%) and flesh (18.8%) (Adeyeye, 2017) but comparably close to what was reported by Adeyeye (2012) in brains of bull and hen. C16:0 (palmitic acid) is most significant with 71.1% in the total SFA showing it's pre-eminence in the total SFA. Generally, it has been advised to remove as much as possible SFA from the diet (Hayes, 2002). The small amount of trans-MUFA detected indicates that trans fatty acids were not a significant component of the lipid profile.

Table 3. Saturated and Monounsaturated fatty acid of dried crayfish (% total fatty acid).

Fatty Acids	%
Caproic acid C6:0	0
Caprylic acid C8:0	0
Capric acid C10:0	0
Dodecanoic acid C12:0	0.0013
Myristic acid C14:0	0.007
Palmitic acid C16:0	16.3
Stearic acid C18:0	5.63
Arachidic acid C20:0	0.0031
Behenic acidC22:0	0.0028
Lignoceric acid C24:0	0.00036
SFA (Total)	21.9
Myristoleic acid C14:1(cis 9)	0.0004
Palmitoleic acid C16:1(cis -9)	2.23
Petrolselinic acid C18:1(cis-6)	4.09
Oleic acid C18:1(cis -9)	23.5
Gadoleic acid C20:1(cis -11)	2.22
Erucic acid C22:1(cis -13)	0.03
Nervonic acid C24:1(cis -15)	0.0004
MUFA(cis)	32.1
Trans-petroselinic acid C18:1 (trans-6)	0.011
Elaidic acid C18:1(trans-9)	0.0001
Vaccenic acid C18:1(trans-11)	0.00088
MUFA (trans)	0.012
MUFA (Total)	32.1

Polyunsaturated Fatty Acids; MUFA= Monounsaturated fatty acid; SFA= Saturated Fatty Acid

Table 4 shows that the total polyunsaturated fatty acids (n-6 PUFA) was 20.9% and (n-3 PUFA) was 25.0%. The principal n-6 fatty acids were linoleic acid (7.86%) and arachidonic acid (9.63%). Gamma-linolenic acid contributed 0.871%,

while the remaining n-6 fatty acids were present in smaller amounts. The n-3 and n-6 PUFA are precursors of potent lipid mediator known as eicosanoid which play an important role in regulation of inflammation (Akman, 1967). Among the n-3 fatty acids, EPA was overwhelmingly predominant at 20.1%, followed by DHA at 4.28% and ALA at 0.691%. Thus, EPA and DHA together contributed approximately 24.4% of the total fatty acids. This is an important finding because EPA and DHA are characteristic long-chain n-3 fatty acids in marine and aquatic foods. Crayfish studies have similarly shown substantial variation in EPA and DHA depending on species, culture system and diet. The high concentration of EPA in the present dried crayfish sample is particularly noteworthy and may contribute significantly to its nutritional value. However, because the values represent percentages of total fatty acids rather than grams of EPA per 100 g of edible product, they should not be interpreted directly as the absolute EPA intake.

Table 4. PUFA n-6 and n-3 fatty acids profiles of dried crayfish.

Fatty acids	%
Linoleic acid C18:2(cis-9,12)	7.86
Gamma-linoleic acid C18:3(cis-6,9,12,)	0.871
Eicosadienoic acid C20:2(cis-11,14)	2.46
DGLA C20:3(cis-8,11,14)	0.0187
Arachidonic acid C20:4(cis-5,8,11,14)	9.63
Docosadienoic acid C22:2(cis-13,16)	0.022
n-6 PUFA(cis)	20.8
Rumenic acid C18:2(trans-9,12)	0.0013
n-6 PUFA(total)	20.9
Alpha-linoleic acid C18:3(cis-9,12,15)	0.691
EPA C20:5(cis-5,8,11,14,17)	20.07
DHA C22:6(cis-4,7,10,13,16,19)	4.28
n-3PUFA (total)	25.041
n-3+ n-6 PUFA	45.904

Table 5 showed the phospholipids level of the dried crayfish. Phospholipid exhibits a well-documented nutritional and theoretical benefit (Gurr, 1999; Schneider, 2001). Among the phospholipids present in the samples, phosphatidylcholine (PC) was the most concentrated with the values 949.3mg/100g (46.4%) followed by phosphatidylethanolamine (PE) with value of 782.1 mg/100g (38.2%). Phosphatidylethanolamine is the second highest in mammals after phosphatidylcholine (PC) with values of 20-50% of total phospholipid. PE is found in all living cells although in human physiology it is found particularly in nervous tissue like nerves, spinal cord, brain and neural tissue (Gurr, 2008). The dominance of PC and PE is biologically reasonable because these phospholipids are major structural components of cellular membranes. Their abundance demonstrates that the lipid fraction of crayfish is not composed exclusively of storage lipids but also contains substantial structural membrane lipids. Therefore, the high proportion of PC and PE in the dried crayfish adds to its nutritional importance and indicates a lipid fraction with considerable structural and functional components. Other lipids like phosphatidylinositol (PI) accounted for 6.11% (125.5mg/100g), sphingomyelin for 5.09% (104.1 mg/100g), and phosphatidylserine (PS) for 3.99% (36.6 mg/100g). Phosphatidic acid represented only 0.173%, while lysophosphatidylcholine was extremely low at approximately 0.001% (0.141mg/100g). Phosphatidylserine (PS) is usually kept on the inner leaflet, the cytositic side of cell membrane by an enzyme called fllippase (Adeyeye, 2011). PS has been demonstrated to speed up recovery, prevent muscle soreness, improve well-being and might possess ergogenic properties in athletes involved in cycling, weight training and endurance running (Adeyeye, 2011). PI is a negatively charged phospholipid and minor component in the cystosolic side of encryptic cell membrane (Adeyeye, 2011). The inositol can be phosphorylated to form phosphatidylinositol phosphate (PIP), LPC anti-cancer ability is special since they do not target the cell DNA but insert into the plasma membrane and cause apoptosis through influencing several signal pathways. LPC processing has been discovered to be an essential component of normal human brain development (Munder et al., 1979). However, the substantial concentration of phospholipid in the sample may also help to explain the presence of long-chain PUFA such as EPA and DHA, because these fatty acids can be incorporated into membrane phospholipids. Research on crayfish has shown that dietary phospholipid levels can influence the fatty acid composition of crayfish tissues, including changes in EPA and DHA.

Table 5. Phospholipids composition of dried crayfish samples (mg/100g).

Phospholipid	mg/100g	%
Phosphatidylethanolamine (PE)	782.1	38.2
Phosphatidylcholine (PC)	949.3	46.4
Phosphatidylserine (PS)	81.7	3.99
Lysophosphatidylcholine (LPC)	0.031	0.001
Sphingomylein	104.1	5.09
Phosphatidylinsitol (PI)	125.0	6.11
Phosphatidic Acid	3.54	0.173
Total	2045.9	100

Table 6 showed the results of sterols compositions in the dried crayfish sample. From this Table, cholesterol was the only sterol present in the samples in a reasonable and significant amount. The level of cholesterol among the sterol in the sample is 99.99% (almost 100%). Cholesterol displays highest value. Cholestanol was detected at only 0.0012 mg/100 g, while ergosterol, campesterol, stigmasterol, avenasterol and sitosterol occurred at trace levels. All other sterols in the samples contributed the total average of 0.00044%. The

total sterol concentration was approximately 69.6 mg/100 g, indicating that virtually all of the measured sterol was cholesterol. This is expected in animal-derived foods because cholesterol is the principal sterol in animal tissues. The presence of cholesterol does not negate the nutritional value of the dried crayfish. Cholesterol is an essential structural component of animal cell membranes and is also involved in the synthesis of steroid hormones and bile acids. However, its concentration should be considered when dried crayfish is consumed as part of diets requiring control of cholesterol intake. The observed cholesterol content also demonstrates why nutritional evaluation of seafood should consider not only total fat but also the specific lipid classes present. Although the crude fat content was only 6.5%, the sample contained considerable amounts of phospholipids and cholesterol together with a high proportion of PUFA. Previous research on crayfish has also specifically evaluated cholesterol alongside fatty acids and found differences associated with species, habitat and culture conditions (Crandall and Fetzner, 1995). The America Health Association recommends that the average daily intake of dietary cholesterol should be less than 300mg (Bender, 1992). The cholesterol level in these samples is far lower (24% of the recommended value) than the daily intake recommendation (Bender, 1992). This implies that cholesterol in dried crayfish is good.

Table 6. Sterols composition of dried crayfish samples (mg/100g).

Sterols	mg/100g
Cholesterol	69.6
Cholestanol	0.0012
Ergosterol	0.00098
Campsterol	0.000019
Stig-Masterol	0.0000054
5avenasterol	0.0000048
Sitosterol	0.0000025
Total	69.6

CONCLUSION

The results demonstrate that dried crayfish is a nutritionally valuable seafood product characterized by high protein content, moderate fat content, low carbohydrate content and substantial mineral matter. The high crude protein value of 65.9% indicates that dried crayfish can serve as an important concentrated source of dietary protein. The fatty acid profile was particularly note-worthy. The high levels of EPA (20.10%) and DHA (4.28%), together with total n-3 PUFA of 25.04%, demonstrate that dried crayfish is a valuable source of nutritionally important long-chain omega-3 fatty acids. Cholesterol was the major sterol, while the remaining sterols occurred only in trace quantities. Therefore, although dried crayfish provides substantial nutritional benefits, its cholesterol content should be considered in overall dietary assessment. In general, the work indicate that dried crayfish possesses a high nutritional potential, particularly as a source of protein, EPA, DHA, other unsaturated fatty acids and phospholipids. The product can therefore contribute meaningfully to dietary nutrient intake when consumed as part of a balanced diet. Nevertheless, variation in species, habitat, feeding conditions, processing and drying methods should be considered when comparing these results with those from other crayfish products.

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