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EVALUATION OF NUTRITIONAL CONTENT OF CRAB AND PERIWINKLE IN LOBIA RIVER FROM BAYELSA STATE, NIGERIA.

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Abstract

The research work was carried out using gas chromatography to determine the nutritional status in Crab and Periwinkle from Bayelsa State. Base on the analysis the following results were obtained. Protein in crab 19.84% vitamin 10.064% fatty acid 100 and very high percentage of mineral while Periwinkle has protein of 22.95% fatty acid of 100% and vitamin of 6.37% and very high percentage of mineral. In conclusion, from the studies, it was observed that, despite oil exploitation activities in Bayelsa which may predispose it to pollution, crab and periwinkle from the study still contain high nutritional value Protein is an important macronutrient that every cell in the body needs. It helps build and repair cells and body tissues, including the skin, hair, muscle, and bone Polyunsaturated fatty acids (PUFAs) are fatty acids that contain more than one double bond in their backbone. This class includes many important compounds, such as essential fatty acids and those that give drying oils their characteristic property.

Keywords: *Gas Chromatography, Crab, Periwinkle, Protein, Vitamin, Fatty acid.*

INTRODUCTION

Crab and periwinkle offer an affordable way to meet protein needs, with their health benefits linked to their impressive nutritional content. They are common farmed in the Middle Eastern and African regions before gaining worldwide recognition after researchers documented their numerous nutritional advantages. Large-scale cultivation of crab and periwinkle presented significant challenges due to their specific environmental requirements for proper growth. Recent studies have raised alarms about potential heavy metal contamination.

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Crabs are versatile crustaceans inhabiting both land and water, predominantly in coastal areas. As arthropods closely related to lobsters and crayfish, they possess a tough exoskeleton composed of chitin protein. Their anatomy features eight walking legs and two prominent claws. Sexual dimorphism is evident, with males typically growing larger and yielding more meat than females.

Marine-derived foods offer exceptional nutritional profiles, containing approximately 20% protein content along with significant mineral concentrations (calcium, phosphorus, and iron) (Arino et al., 2013; Sartori & Amancio, 2021). These products are particularly abundant in fat-soluble vitamins (A and D) and B-complex vitamins, notably B12 (Vila Nova et al., 2008). Furthermore, crab and periwinkle stand out as excellent sources of omega-3 polyunsaturated fatty acids (PUFAs) (Li *et. al.,* 2018).

The elevated mineral content could potentially stem from the inclusion of crab shells and salmon bones as raw materials in protein concentrate production. Additionally, the mineral fortification observed in alfajores may be attributed to the inherent mineral composition of marine fish species, particularly their calcium, phosphorus, iron, and other trace element content (Arino *et. al.,* 2017).

Classification of Periwinkle and Crab

Periwinkle offers substantial nutritional value with a 22.95% protein content, making it a viable alternative to conventional protein sources like meat and poultry. Additionally, its omega-3 fatty acid content contributes to cardiovascular health through blood pressure regulation.

Crabs provide significant amounts of polyunsaturated fats, including both Omega-3 and Omega-6 fatty acids. They also serve as an excellent protein source while delivering substantial concentrations of essential vitamins and minerals that support overall health maintenance (Linnaeus, 2014).

Crabs are marine-dwelling creatures characterized by their distinctive flattened, circular body structure encased in a protective exoskeleton. They possess ten limbs, with the foremost pair developing into prominent claws, while displaying the unique sideways locomotion typical of their species. Their anatomy includes two sets of sensory antennae.

Crabs represent the short-tailed subgroup within the decapod crustaceans (Arthropoda), primarily comprising the Brachyura infraorder (true crabs), along with related forms like Anomura (hermit crabs). Decapods occupy diverse habitats including marine, freshwater, and terrestrial ecosystems, with approximately 10,000 identified species (Linnaeus,2022).

Periwinkles represent marine gastropod mollusks characterized by gill respiration and a protective operculum, taxonomically classified under the Littorinidae family.

Crab (locally called Ikole) and Periwinkle (known as Isammu in Ijaw) are saltwater-dwelling marine organisms. Both species possess protective hard exoskeletons and are frequently harvested in Southern Ijaw Local Government Area of Bayelsa State, Nigeria. As aquatic fauna, they primarily inhabit marine ecosystems.

Proteins

As an essential macronutrient, protein serves crucial functions in all bodily cells. It facilitates cellular regeneration and tissue maintenance throughout the musculoskeletal system, integumentary structures, and vital organs. Beyond structural roles, proteins enable critical physiological processes including hemostasis, endocrine signaling, enzymatic reactions, and immunological defenses. These complex biomolecules provide both architectural support and biochemical functionality at cellular and systemic levels (Johan Kjeldahl 2003-2017)

Poly Unsaturated Fatty Acid - Omega 3 Fatty Acid

Poly unsaturated fatty acid

Polyunsaturated fatty acids (PUFAs) are characterized by multiple carbon-carbon double bonds in their molecular structure. These biologically significant lipids encompass essential fatty acids and drying oil components, primarily categorized as omega-3 and omega-6 varieties. As the human body cannot synthesize these essential nutrients, dietary intake becomes crucial. Marine organisms obtain omega-3s through their diet of algae and plankton rather than endogenous production. Clinically, omega-3s demonstrate anti-inflammatory effects, triglyceride reduction, and protective benefits against cardiovascular disease, malignancies, and joint disorders. Their physiological roles extend to modulating blood pressure, coagulation parameters, glycemic control, and neural processes (Gavin 2016)

Minerals

Minerals represent essential inorganic elements derived from the earth and dietary sources that support normal physiological development and function. Nutritionally critical minerals comprise calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, iodine, chromium, copper, fluoride, molybdenum, manganese and selenium. Calcium dominates human mineral composition, accounting for 1.5-2% of total body mass. In adults, approximately 1,200 grams exist biologically, with over 99% residing in the skeletal system (Alexander 2018).

Calcium and phosphorus

As a vital dietary mineral, calcium is abundant in various food sources, particularly dairy. The skeletal system and dentition collectively store more than 99% of the body's calcium reserves. This mineral plays a critical role in the continuous bone remodeling process, though aging typically reduces calcium retention. Supplemental calcium supports bone regeneration and maintenance, while also serving crucial functions in cardiovascular, neurological, and coagulation physiology.

Potassium

A diet abundant in potassium offers numerous significant health advantages. Research indicates it can decrease hypertension and fluid retention while providing protection against cerebrovascular accidents, bone density loss, and renal calculi formation. Often overlooked, potassium serves as a vital electrolyte due to its water-soluble properties. When dissolved in aqueous solutions, it generates positive ions that enable electrical conductivity - a crucial mechanism for various physiological functions.

Sodium

As a crucial electrolyte, sodium plays vital roles in blood regulation and physiological functions. This highly reactive element exists in over 80 forms and maintains fluid balance while facilitating electrical nerve transmission. Unlike many nutrients, sodium remains heat-stable during cooking. It's essential for nerve conduction, muscle function, and cellular processes, requiring supplementation in cases of adrenal dysfunction, heat stroke, or excessive sweating. In nature, sodium always appears in compounds - this soft, silvery metal reacts with water to produce

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hydrogen gas and sodium hydroxide, with flammability depending on surface exposure.

Magnesium

This essential mineral plays crucial roles in numerous physiological processes, including proper muscular and neurological function, glycemic and blood pressure regulation, and the synthesis of proteins, skeletal tissue, and genetic material. Chronic magnesium deficiency may result in calcium and potassium imbalances. Adequate magnesium status supports healthy sleep patterns and emotional well-being while potentially reducing disease risk.

Iron

As an essential mineral, iron plays a fundamental role in physiological development and oxygen transport. The body utilizes iron to produce two critical oxygen-binding proteins: hemoglobin in erythrocytes (which transports oxygen from pulmonary tissues to systemic circulation) and myoglobin in muscle tissue (which facilitates oxygen storage and release in musculature).

MATERIALS AND METHODS

Periwinkle and Crab Material

The fresh periwinkle and crab selected for the study was harvested from Lobia in Southern Ijaw Local Government and the crab from Igboma, Brass Local Government in Bayelsa State on 5th October 2021.

The samples were harvested and stored in the refrigerator for a couple of days. The samples were washed thoroughly with fresh water, then was now dried in worm ovum.

Apparatus:

i. Laboratory mortal and pestle
ii. Volumetric flask
iii. Ovum
iv. Conical flask
v. Incubator
vi. Borosilicate glass container
vii. Gas Chromatography
viii. Soxhlet Arrangement
ix. Assorted Glassware
x. Agilent 6890 coupled with FID/PPPD
xi. Software Chemstation
xii. Data Interpretation System, etc.

Reagent:

i. Delonised water
ii. Dichloro methane
iii. Petroicum spirit
iv. Amino Acid Standards
v. Sodium Carbonate
vi. Ethylchloroformate

Amino acid

Extraction and Analysis

The extraction and instrumental analysis procedures were performed according to an adapted protocol combining AOAC Method 982.30 (2006) with the chromatographic technique described by Danka et al. in their 2012 publication "Simultaneous Identification and Determination of Total Amino Acid Content in Food Supplement Tablets Using Gas Chromatography" (Asian Journal of Pharmaceutical and Clinical Research, 5(S2)).

Procedure:

The dehydrated, powdered sample was thoroughly dried to constant weight to ensure complete moisture removal. Exactly 0.5g of the prepared sample was transferred to a 250ml conical flask. Lipid components were extracted through triple treatment with 30ml petroleum ether using a Soxhlet apparatus fitted with an extraction thimble. Subsequent acid hydrolysis was performed in three successive stages to ensure complete protein breakdown and maximum amino acid liberation.

The defatted, powdered sample underwent alkaline treatment with 30 mL of 1M KOH solution in sealed borosilicate vessels at 110°C for 48 hours. Following hydrolysis, the mixture was pH-adjusted to 2.5-5.0 through neutralization. Subsequent purification employed cation-exchange SPE cartridges, with recovered amino acids then derivatized using ethyl chloroformate via standard reaction protocols.

Derivation Mechanism

Amino acid derivatization using ethyl chloroformate was performed to enhance volatility for subsequent GC analysis, following established reaction protocols. For vitamin analysis, frozen samples were transferred from the <4°C storage unit and equilibrated to ambient laboratory conditions prior to processing.

Extraction of water-soluble vitamins:

The sample was homogenized using a laboratory mortar and pestle. Precisely 0.100 g of the resulting powder was transferred to a 100 ml volumetric flask, followed by the addition of 80 ml deionized water. Following a 15-minute ultrasonic extraction process, the solution was diluted to the final volume mark with additional water.

Extraction of fat-soluble vitamins:

A precisely measured 0.125 g aliquot of homogenized sample was introduced into a 10 ml volumetric flask, followed by the addition of 8 ml methanol-dichloromethane (1:1 v/v) solvent mixture. Following 15 minutes of ultrasonic-assisted extraction, the solution was brought to final volume with additional methanol-dichloromethane (1:1 w/v) solvent. The prepared extract was protected from light and diluted as required prior to analysis.

Before chromatographic analysis, all sample solutions underwent membrane filtration (0.2 µm, Millex-GN). The optimized separation protocol employed a multi-dimensional approach combining: (1) valve switching technology, (2) dual injection methodology, (3) envelope injection technique, and (4) dynamic wavelength adjustment to achieve concurrent resolution of both hydrophilic and lipophilic

Column:

Acclaim PA, 3um, 120 A, 3.0 X 150mm for fat soluble Acclaim C18, 3um, 120 A, 3.0 X150 mm for water soluble. Column Temp: 25°C

Mobile phase:

For water-soluble vitamin determination: A) 25mM Phosphate buffer (dissolve 3.4 g KH2PO4 in 1000 ml water, and adjust pH to 3.6 with H3PO4), B) CH3CN-Mobile Phase A (7:3, v/v)

For fat-soluble vitamin determination: A) CH3OH-CH3CN (8:2, v/v), B) Methyl tert-butyl ether (MTBE). Inj. Volume: 10 µL

Reference:

Determination of Water- and Fat-Soluble Vitamins by HPLC, DIONEX, Technical Note 89.

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RESULTS

Table 1: Vitamin Profile in Crab

Name of Vitamin	Amount(mg/100g)
Vitamin B3	1.79
Vitamin B6	2.28
Vitamin C	4.96
Vitamin A	6.32
Vitamin B1	6.05
Vitamin B2	8.35
Vitamin D	3.88
Vitamin E	2.38
Vitamin B9	4.33
Vitamin K	3.63
Vitamin B5	5.24
Vitamin B12	1.17
TOTAL	**10.065**

From the table above, the value of vitamin B2(8.35mg/100g) is significantly higher as compare to other vitamins in the study. Vitamin B12(1.17mg/100g) is significantly lower as compare to other vitamins in the study. There is no significant different in the value of vitamin A (6.32) and Vitamin B1(6.05).

Table 2: Vitamin Profile in Periwinkle

Name of Vitamin	Amount(mg/100g)
Vitamin B3	3.12
Vitamin B6	1.06
Vitamin C	9.93
Vitamin A	8.50
Vitamin B1	3.02
Vitamin B2	4.14
Vitamin D	8.35
Vitamin E	1.31
Vitamin B9	4.25
Vitamin K	1.81
Vitamin B5	9.05
Vitamin B12	2.35
TOTAL	**6.38**

From the table above, the value of vitamin C (9.93mg/100g) is significantly higher as compare to other vitamins in the study. Vitamin C (1.06mg/100g) is significantly lower as compare to other vitamins in the study. There is no significant different in the value of vitamin E (1.31mg/100g) and Vitamin K (1.81mg/100g).

Table 3: Mineral Profile in Periwinkle

NAME OF MINERAL	CON(PPM)
MAGNESIUM	0.35
IRON	0.05
COPPER	11.11
SELENIUM	0.88
MANGANESE	58.77
PHOSPHORUS	2906.52
SODIUM	3.68
CALCIUM	0.34
POTASSIUM	2.71
ZINC	0.02

From the table above, the value of PHOSPHORUS (2906.52ppm) is significantly higher as compare to other minerals in the study. ZINC (0.02ppm) is significantly lower as compare to other minerals in the study. There is no significant different in the value of MAGNESIUM (0.35ppm) and CALCIUM (0.34).

Table 4: Mineral Profile in Crab

MINERAL	CON (ppm)
MAGNESIUM	0.49
IRON	0.03
COPPER	16.40
SELENIUM	0.54
MANGANESE	29.39
PHOSPHORUS	2314.21
SODIUM	6.28
CALCIUM	0.48
POTASSIUM	2.26
ZINC	0.06

From the table above, the value of PHOSPHORUS (2314.21ppm) is significantly higher as compare to other minerals in the study. IRON (0.03ppm) is significantly lower as compare to other minerals in the study. There is no significant different in the value of IRON (0.03ppm) and ZINC (0.06).

Table 5: Fatty Acid Profile in Periwinkle

Name of Compound	Percentage of Fatty Acid	Number of Carbon
HEXANOIC	0.04	C6:0
OCTANOIC	0.03	C8:0
DECANOIC	0.04	C10:0
DODECANOIC	0.05	C12:0
TETRADECANOIC	9.49	C14:0
CIS 9-TETRADECANOIC	1.32	C14:1(cis-9)

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HEXADECANOIC	35.20	C16:0
CIS 9- HEXADECANOIC	10.15	C16:1(cis-9)
OCTADECANOIC	6.43	C18:0
TRANS 6-OCTADECANOIC	0.01	C18:1(trans-6)
CIS 6- OCTADECANOIC	0.03	C18:1(cis-6)
TRANS 9-OCTADECANOIC	0.0014	C18:1(trans-9)
CIS 9- OCTADECANOIC	13.94	C18:1(cis-9)
TRANS 11-OCTADECANOIC	0.02	C18:1(trans-11)
TRANS 9, CIS 13-OCTADECANOIC	0.02	C18:1(cis-9,13)
CIS 6- OCTADECANOIC	3.33	C18:2(cis-6)
TRANS 9, TRANS 12 -OCTADECANOIC	0.02	C18:2(trans-9,12)
EICOSAPENTAENOIC	0.04	C20:0
ALL-CIS 6,9,12 -OCTADECANOIC	0.12	C18:3(cis-6,9,12)
CIS 11-EICOSAPENTAENOIC	1.82	C20:1(cis-11)
ALL-CIS 9, 12, 15-OCTADECANOIC	0.07	C18:3(cis-9,12,15
OCTADECATRIENOIC	2.96	C18:3n3
CIS 11, 14-EICOSAPENTANOIC	0.006	C20:2(cis-11,14)
DOCOSAPENTAENOIC	1.79	C22:0
CIS 9-DOCOSAPENTAENOIC	0.06	C22:1n9
ALL-CIS 8, 11,14-EICOSAPENTAENOIC	0.06	C20:3(cis-8,11,14)
CIS 13-DOCOSAPENTAENOIC	0.05	C22:1(cis-13)
ALL-CIS-11, 14, 17-EICOSAPENTANOIC	0.02	C20:(cis-11,14,17)
CIS 6-EICOSAPENTANOIC	4.70	C20:4n6
ALL-CIS 5,8,11,14-EICOSAPENTANOIC	0.007	C20:4(cis-5,8,11,14)
CIS 13,16-DOCOSAPENTAENOIC	0.02	C22:2(cis-13,16)
	0.005	C24:0
ALL-CIS 5,8,11,14,17-EICOSAPENTANOIC	6.04	C20:5(cis-5,8,11,14,17)n3
	0.005	C24:1(cis-15)
ALL-CIS 4,7,10,13,16,19-	1.97	C22:6(cis-
DOCOSAPENTAENOIC		4,7,10,13,16,19)n3
TOTAL	**100.000000**	

From the table above, the value of fatty acid HEXADECANOIC (35.20) is significantly higher as compare to other fatty acids in the study. Fatty acid OCTADECANOIC (0.01) is significantly lower as compare to other fatty acids in the study. There is no significant different in the value of fatty acid HEXANOIC (0.04) and OCTANOIC (0.03)

Table 6: Fatty Acid Profile in Crab

Name of Compound	Fatty Acid in Percentage	Number of Carbon
HEXANOIC	0.04	C6:0
OCTANOIC	0.04	C8:0
DECANOIC	0.05	C10:0
DODECANOIC	0.12	C12:0
TETRADECANOIC	4.06	C14:0
CIS 9-TETRADECANOIC	0.02	C14:1(cis-9)
HEXADECANOIC	21.53	C16:0
CIS 9- HEXADECANOIC	3.56	C16:1(cis-9)
OCTADECANOIC	3.80	C18:0
TRANS 6-OCTADECANOIC	0.01	C18:1(trans-6)
CIS 6- OCTADECANOIC	0.05	C18:1(cis-6)
TRANS 9-OCTADECANOIC	0.001	C18:1(trans-9)
CIS 9- OCTADECANOIC	27.45	C18:1(cis-9)
TRANS 11-OCTADECANOIC	0.03	C18:1(trans-11)
TRANS 9, CIS 13-OCTADECANOIC	0.03	C18:1(Cis-9,13)
CIS 6- OCTADECANOIC	3.69	C18:2(cis-6)
TRANS 9, TRANS 12 -OCTADECANOIC	0.02	C18:2(trans-9,12)
CIS 11-EICOSAPENTAENOIC	0.05	C20:0 (cis-11)
ALL-CIS 6,9,12 -OCTADECANOIC	0.15	C18:3(cis-6,9,12)
CIS 11-EICOSAPENTAENOIC	0.13	C20:1(cis-11)
ALL-CIS 9, 12, 15-OCTADECANOIC	0.09	C18:3(cis-9,12,15
OCTADECATRIENOIC	3.24	C18:3n3
CIS 11, 14-EICOSAPENTANOIC	0.007	C20:2(cis-11,14)
DOCOSAPENTAENOIC	0.09	C22:0

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CIS 9-DOCOSAPENTAENOIC	0.07	C22:1n9
ALL-CIS 8, 11,14-EICOSAPENTAENOIC	0.07	C20:3(cis-8,11,14)
CIS 13-DOCOSAPENTAENOIC	0.07	C22:1(cis-13)
ALL-CIS-11, 14, 17-EICOSAPENTANOIC	0.03	C20:(cis-11,14,17)
CIS 6-EICOSAPENTANOIC	3.16	C20:4n6
ALL-CIS 5,8,11,14-EICOSAPENTANOIC	0.008	C20:4(cis-5,8,11,14)
CIS 13,16-DOCOSAPENTAENOIC	0.03	C22:2(cis-13,16)
	0.006	C24:0
ALL-CIS 5,8,11,14,17-EICOSAPENTANOIC	11.70	C20:5(cis-5,8,11,14,17)n3
	0.006	C24:1(cis-15)
ALL-CIS 4,7,10,13,16,19-DOCOSAPENTAENOIC	16.48	C22:6(cis-4,7,10,13,16,19)n3
TOTAL	100.000000	

From the table above, the value of fatty acid OCTADECANOIC (27.45) is significantly higher as compare to other fatty acids in the study. Fatty acid OCTADECANOIC (0.01) is significantly lower as compare to other fatty acids in the study. There is no significant different in the value of fatty acid HEXANOIC (0.04) and CIS 11-EICOSAPENTAENOIC (0.05).

Table 7: Protein Profile of Crab and Periwinkle

S/N	Parameter	Protein (%) (wet)
1	CRAB	19.84
2	PERIWINKLE	22.95

From the table, it shows that crab and periwinkle contain high percentage of protein. The result shown above is in line with other noble works carried out by other researchers on seafood such as Oyster, luster and shrimp which help to build and repair body tissue and muscle.

Table 8: Omega-3 Fatty Acid in Crab

Names of Compound	Fatty Acid in Percentage	Number of Carbon
ALL-CIS 6,9,12 - OCTADECANOIC	0.15	C18:3(cis-6,9,12)
ALL-CIS 9, 12, 15-OCTADECANOIC	0.09	C18:3(cis-9,12,15
ALL-CIS 8, 11,14-EICOSAPENTAENOIC	0.07	C20:3(cis-8,11,14)

From the table above, the value of fatty acid ALL-CIS 6,9,12 - OCTADECANOIC (0.15) is significantly higher as compare to other fatty acids in the study. Fatty acid ALL-CIS 8, 11,14-EICOSAPENTAENOIC (0.07) is significantly lower as compare to other fatty acids in the study. There is no significant different in the value of fatty acid ALL-CIS 8, 11,14- EICOSAPENTAENOIC (0.07) and ALL-CIS 8, 11,14- EICOSAPENTAENOIC (0.09)

The table above shows the percentage of Omega-3 fatty acid in Crab and it's a clear indication that Crab contains Omega-3 fatty acid which is responsible for proper brain functioning and cell growth.

Table 9: Omega-6 Fatty Acid in Crab

S/N	Fatty Acid in Percentage	Number of Carbon
ALL-CIS 4,7,10,13,16,19-DOCOSAPENTAENOIC	16.48	C22:6(cis-4,7,10,13,16,19)n3

The table above shows the percentage of Omega-6 fatty acid in Periwinkle and it shows that crab contains Omega-6 fatty acid which reduces chronic heart disease and arthritis.

Table 10: Omega-3 Fatty Acid in Periwinkle

Name of Fatty Acid	Fatty Acid in Percentage	Number of Carbon
ALL-CIS 6,9,12 - OCTADECANOIC	0.12	C18:3(cis-6,9,12)
ALL-CIS 9, 12, 15-OCTADECANOIC	0.07	C18:3(cis-9,12,15
OCTADECATRIENOIC	2.96	C18:3n3
ALL-CIS 8, 11,14-EICOSAPENTAENOIC	0.06	C20:3(cis-8,11,14)

From the table above, the value of fatty acid OCTADECATRIENOIC (2.96) is significantly higher as compare to other fatty acids in the study. Fatty acid ALL-CIS 8, 11,14-EICOSAPENTAENOIC (0.06) is significantly lower as compare to other fatty acids in the study. There is no significant different in the value of fatty acid ALL-CIS 8, 11,14- EICOSAPENTAENOIC (0.06) and ALL-CIS 9, 12, 15- OCTADECANOIC (0.07)

The table above shows the percentage of Omega-3 fatty acid in Periwinkle and it a clear indication that Periwinkle contains Omega-3 fatty acid which is responsible for proper brain functioning and cell growth.

Table 11: Omega-6 Fatty Acid in Periwinkle

Name of Fatty Acid	Fatty Acid in Percentage	Number of Carbon
ALL-CIS 4,7,10,13,16,19-DOCOSAPENTAENOIC	1.97	C22:6(cis-4,7,10,13,16,19)n3

The table above shows the percentage of Omega-6 fatty acid in Periwinkle and it shows that Periwinkle contains Omega-6 fatty acid which reduces chronic heart disease and arthritis.

DISCUSSION

Protein in Crab and Periwinkle

The purpose of this research work was to find out the nutrition content which include protein, vitamin, mineral and polyunsaturated fatty acid in crab and periwinkle. I want to discuss the result at different segment.

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Protein

The research findings include the protein content of crab actually provide an answer to the finding of protein content in crab. Protein are very important component essential for the maintenance of the body structure and proper functioning of all living organisms and crab which contain 19.84% of protein gotten from my analysis could build and maintain the body system of human.

The result 19.84% gotten in crab is a very authenticated result, which is an average content of other seafood protein content. The protein content of crab has been compared to other seafood such as shrimp which contain the content of 24% and this is a clear indication crab which contain the protein content of 19.84% could carry out the functions of protein in the body.

Periwinkle-derived proteins represent biologically significant macromolecules composed of amino acid chains. These complex biomolecules serve essential physiological functions including structural support, cellular regulation, and maintenance of tissue and organ systems throughout the body (U.S National Library of Medicine). The research carried out on the protein content in periwinkle actually give a convincing result of 22.95% which could be capable of carrying out critical role in the body such as regulation of body tissue and organs.

The result gotten from this research work which shows 22.95% of protein is equivalent to the protein content of other seafood such as luster which contain the protein the protein content of 22.1% and of no doubt the protein of periwinkle which was one of the major aim of this research work is capable of carrying out the regulation of the body system.

Vitamin in Crab

Vitamins represent a class of crucial organic micronutrients required in minute amounts to support normal metabolic processes in living organisms (MedlinePlus). These essential compounds facilitate various biochemical functions necessary for physiological maintenance. This investigation identified a comprehensive vitamin profile in crab specimens, revealing the presence of: B-complex vitamins (B1, B2, B3, B5, B6, B9, B12), along with vitamins A, C, D, E, and K. The study successfully achieved its primary objective of vitamin characterization in this crustacean species.

The analytical results confirm crabs contain the aforementioned vitamin spectrum, with particular neurological significance attributed to vitamin B12's role in neural integrity maintenance. Comparative analysis with crayfish specimens demonstrated consistent nutritional profiles, validating the reliability of these findings.

Vitamin in Periwinkle

Vitamins represent essential micronutrients crucial for cellular metabolism, physiological development, and maintaining optimal bodily functions. These organic compounds facilitate fundamental biological processes required for organismal homeostasis.

Minerals in Crab and Periwinkle

As fundamental inorganic components, minerals provide structural integrity to calcified tissues including bones and dentition. These micronutrients additionally serve crucial physiological functions in osmoregulation, modulating fluid balance and solute transport across biological membranes.

Determination of mineral content was one of the major focus on this research work and the result obtain shows that periwinkle and crab contain reasonable amount of the following minerals which could help greatly in the proper functioning of the body. The mineral content in Periwinkle and Crab was compare to other relative work on seafood such as shrimp and oyster and it was relatively the same, therefore the mineral content in crab and periwinkle mention this work are reliable and crab and periwinkle are therefore rich in minerals which is essential for the connection of tissues.

Fatty Acid in Periwinkle

Fatty acids serve as fundamental structural components of dietary and biological lipids. Following ingestion, enzymatic hydrolysis converts fat molecules into absorbable fatty acid units that enter systemic circulation for metabolic utilization.

Omega-3 Fatty Acid

This research particularly focuses on profiling omega-3 and omega-6 fatty acids, both of which are present in crab and periwinkle specimens. These essential polyunsaturated fatty acids represent a key analytical target in the current research.

Functions of omega-3 are as follows:

i. Blood clothing
ii. Fertility
iii. Helps in Cell Division and growth

While functions of omega-6 are as follows:

- Neurological development and cognitive maintenance
- Standard physiological growth processes
- Follicular stimulation for keratin production
- Osseous tissue preservation
- Metabolic pathway modulation
- Reproductive system homeostasis

Omega-3 and Omega-6 Fatty Acid in Crab and Periwinkle

These essential fatty acids are structurally distinguished by the position of their initial double bond - located either three (omega-3/n-3) or six (omega-6/n-6) carbon atoms from the methyl terminus of their hydrocarbon chain.

These essential polyunsaturated fatty acids serve dual biological roles as both structural components of cellular membranes and metabolic substrates. Their cardioprotective and immunomodulatory functions maintain cardiovascular and immune homeostasis. Analytical data confirm that periwinkle and crab represent significant dietary sources of omega-3 and omega-6 fatty acids, supporting their potential in promoting systemic physiological balance. Comparative analysis revealed that periwinkle and crab exhibit omega-3/6 fatty acid profiles comparable to other premium shellfish including lobster, oyster, and shrimp. These findings confirm that both species serve as nutritionally significant sources of omega-6 fatty acids in particular.

Conclusion

Crab and periwinkle represent economical and accessible sources of premium nutrition. When properly cooked, they offer excellent flavor while delivering complete proteins, essential micronutrients, and beneficial lipids that support cellular development and optimal physiological functioning.

As fundamental biomolecules, proteins play indispensable roles in structural maintenance and physiological processes across all life forms. Analytical data reveal crab (19.84%) and periwinkle (22.95%) contain protein concentrations comparable to premium

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seafood like shrimp (24g) and lobster (22.1g), confirming their significant potential in supporting tissue development and systemic functions.

Vitamin in Crab and Periwinkle

From the result above, it shows that crab and periwinkle are rich in vitamin, especially vitamin A, which serve as anti-oxidant that help in fighting against cancer from studies shown and it also function as immune competence, cell Division and Growth of specialized cells such as sperms and maintenance of cell integrity.

The result shows that periwinkle contains 6.37mg which include vitamin B5 which serves as Co-enzyme and help in maintaining Depigmentation and desquamation of skin.

Therefore, I will advise everyone to consume crab and periwinkle for proper functioning of the body.

Periwinkles and Crabs represent excellent sources of complete proteins while providing a comprehensive nutrient profile including essential vitamins and both saturated and unsaturated fatty acids. Notably, they contain significant amounts of EPA and DHA omega-3 PUFAs, which are crucial for neurodevelopment and visual acuity while offering cardioprotective benefits through anti-inflammatory effects, blood pressure modulation, and antithrombotic activity. Their consumption also supports renal and immune function, though moderation is advised due to cholesterol content.

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