International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Fatty Acid Profile of the Freshwater Crab, Paratelphusa Hydrodromous (Decapoda: Brachyura: Gecarcinucidae) From Gadilam River, Cuddalore, Tamil Nadu, India

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Keywords:
Freshwater Crab, Paratelphusa Hydrodromous, Proximate Composition, Fatty Acid Profile, Gadilam River

Abstract:
Freshwater Crabs Are Ecologically Significant And Locally Consumed Across South Asia, Yet Their Nutritional Composition Remains Inadequately Documented. This Study Investigated The Proximate Composition And Fatty Acid Profile Of Paratelphusa Hydrodromous, A Freshwater Crab Species Collected From The Gadilam River In Cuddalore District, Tamil Nadu, India. Claw And Body Meat Were Analyzed Separately Using Standard Analytical Methods. Proximate Analysis Revealed That Claw Meat Contained Significantly Higher Moisture (81.30±1.57%) And Protein (49.06±1.01 G/100g Dry Weight) Compared To Body Meat, While Body Meat Exhibited Higher Lipid Content (17.64±1.07%). Ash Content Was Also Elevated In Claw Meat (22.12±0.16%). Gas Chromatography Analysis Of Total Lipids Identified Twelve Fatty Acids, With Monounsaturated Fatty Acids (Mufas) Constituting The Largest Fraction (42.85%), Followed By Saturated Fatty Acids (Sfas) At 25.96% And Polyunsaturated Fatty Acids (Pufas) At 15.02%. Palmitic Acid (20.49%) Was The Predominant Saturated Fatty Acid. The High Protein Content And Favorable Fatty Acid Composition, Particularly The Substantial MUFA Fraction, Indicate That P. Hydrodromous Represents A Nutritionally Valuable Food Source. These Findings Provide Baseline Biochemical Data Essential For Nutritional Evaluation And Sustainable Utilization Of Freshwater Crab Resources In The Region.

1. INTRODUCTION

Lipids, Particularly Fatty Acids Are Indispensable Biomolecules That Play Central Roles In Human Physiology. They Not Only Provide Metabolic Energy But Also Facilitate The Absorption Of Fat-Soluble Vitamins (A, D, E And K), Regulate Cellular Signalling And Contribute To The Maintenance Of Membrane Integrity And Fluidity (Lazarus Et Al., 2009, Smith Et.Al., 2011). Since

These Essential Fatty Acids Cannot Be Synthesized De No Va By Human , Dietary Sources - Particularly Aquatic Animals Are Of Considerable Nutritional Significance.

Seafood Is Widely Regarded As A Beneficial Component Of The Human Diet Because Of Its High Levels Of Pufas, As Well As Trace Elements Such As Zinc, Selenium And Iodine. In Crustaceans, The Hepatopancreas Serves As The Principal Lipid Storage Organ, While Muscle Tissue Contains Appreciable Amounts Of Nutritionally Valuable Fatty Acids, Freshwater Crabs, In Particular, Occupy An Intermediate Position In Aquatic And Terrestrial Food Webs, Functioning As Both Predators Detritivores Their Ability To Bioaccumulate Nutrients And Contaminants Alike Also Makes Them Useful Bio-Indicators Of Ecosystem Health. Moreover, Freshwater Crabs Are Consumed In Many Parts Of Asia, Not Only As A Source Of Protein And Micronutrients But Also For Their Purported Medicinal Properties, Including Applications In Traditional Remedies For Gastrointestinal And Wound - Healing Ailments.

Despite Their Ecological And Economic Significance, Freshwater Crabs Remain Comparatively Under-Studied With Respect To Their Biochemical Composition, Especially When Compared To Marine Crabs And Other Shellfish. In India, Crabs Contribute Substantially To Fisheries Resources, Yet Most Studies Have Focused On Commercially Important Portunid Crabs Such As Portunus Pelagicus, P. Sanguinolentus And Scylla And Serrata, Which Dominate Marine Exports (Mohammed And Rahavan, 2001; Ramesh Kumar Et Al.,2009). By Contrast, The Nutrient And Fatty Acid Profiles Of Freshwater Species Remain Poorly Documented, Despite Their Availability For Local Consumption And Potential Role In Food Security.

The Freshwater Crab Paratelphusa Hydrodromous Is Distributed In South Indian Rivers And Streams, Where It Plays A Vital Ecological Role And Is Locally Harvested As Food. However, Systematic Information On Its Lipid And Fatty Acid Composition Is Scarce. Given The Growing Recognition Of Freshwater Crabs As A Protein And PUFA Rich Food Source, Establishing Baseline Biochemical Data Is Essential For Both Nutritional And Evaluation And Sustainable Utilization.

Accordingly, The Present Study Investigates The Fatty Acid Composition Of Paratelphusa Hydrodromous Collected From The Gadilam River In Cuddalore District, Tamilnadu, India. By Characterizing Its Lipid Profile, This Study Seeks To Provide Insights Into Its Nutritional Potential And To Contribute To The Limited Database On Freshwater Crabs Of South Asia.

2. **Materials And Methods**.

Sample Collection And Preparation

Freshwater Crabs (Paratelphusa Hydrodromous) Were Obtained From Local Fishermen Operating In The Gadilam River, Cuddalore District, Tamilnadu, India,In February 2024. Specimen Were Captured Using Traditional Fishing Gears And As Well As By Manual Collection.

The Collected Specimens Were Transported Live To The Laboratory, Where They Were Thoroughly Rinsed With Running Tap Water To Remove External Debris And Sediment. Meat From The Claws And Cephalothorax Was Carefully Excised, Pooled Separately To Form Composite Samples For Each Tissue Type, And Subsequently Dried In An Electric Oven At 60°C For 24 Hours. The Dried Samples Were Ground Into A Fine Homogeneous Powder Using A Mortar And Pestle. The Powdered Samples Were Stored In Airtight Containers At -20°C Until Further Analysis For Proximate Composition And Fatty Acid Profiling.

Paratelphusa Hydrodromous

Proximate Composition Analysis

The Proximate Composition Including Moisture, Crabs Meat Powder Was Determined In Triplicate Using Standard Analytical Methods. Moisture Content Was Determined Using An Automatic Moisture Analyzer (RADWAG, MAC50/NH, Germany). Briefly 1-2g Of Sample Was Evenly Distributed On The Analyzer Pan And The Result Was Recorded Upon Completion Of The Automated Drying Cycle.

Crude Protein Content Was Qualified By The Kjeldahl Method (30). The Percentage Of Total Nitrogen Was Determined And Converted To Crude Protein Using A Factor 6.25. Total Lipid Content Was Determined By Soxhlet Extraction With Petroleum Ether As The Solvent, Following Standard Protocol(30). Ash Content Was Determined By Incinerating The Samples In A Muffle Furnace At 550°C Until A Constant Weight Was Achieved, According To The AOAC Method (30).

Lipid Extraction And Fatty Acid Analysis

Total Lipids Were Extracted From The Whole Crab Powder Using A Chloroform Methanol Mixture (2:1,V/V) Containing 0.1mg/100g Of Butylated Hydroxytoluene As An Antioxidant. The Extracted Lipids Were Converted Into Fatty Acid Methyl Esters Via Transesterification According To The Procedure Described By Metcalfe Et Al (33).

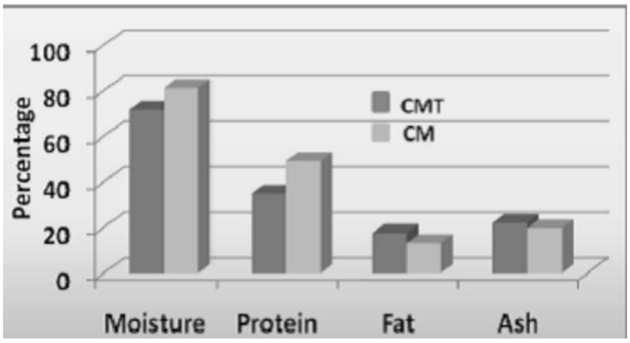
TABLE I: Proximate Composition Of Crab Claw And Body Meat (Dry Weight Basis).

Name Of Specimen	**Crude Protein**	**Male**	**Female**
Paratelphusa Hydrodromous	75.48 ± 6.14	79.31 ± 2.30	74.63 ± 0.54
	22.50 ± 6.91	25.50 ± 6.94	67.22 ± 4.62

Fig:1 Proximate Composition Of Crab Claw And Body Meat (Dry Weight Basis).

Paratelphusa Hydrodromous

Paratelphusa Hydrodromous



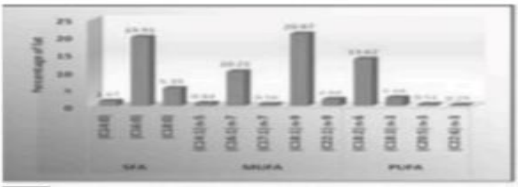


Fig:2 Fatty acid profile of cephalothorax (CTF).

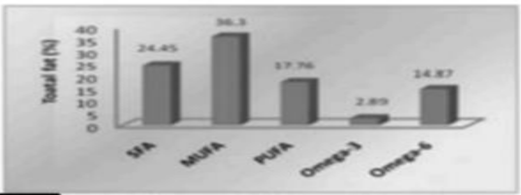


Fig:5 Fatty acid types and their amounts in cheliped.

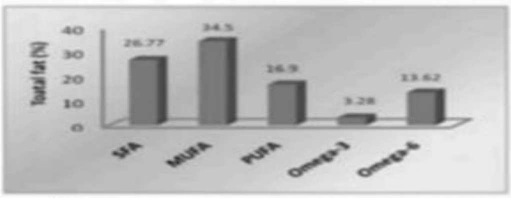


Fig:3 Fatty acid types and their amount in cephalothorax (CTF).

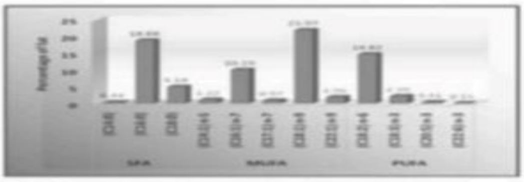


Fig:6 Fatty acid composition of leg fat (LF).

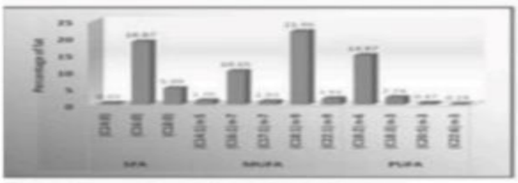


Fig:4 Fatty acid profile of cheliped (ChF).

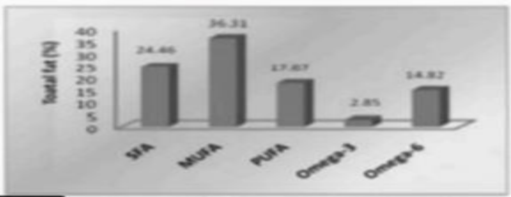


Fig:7 Fatty types and their amounts in leg (LF).

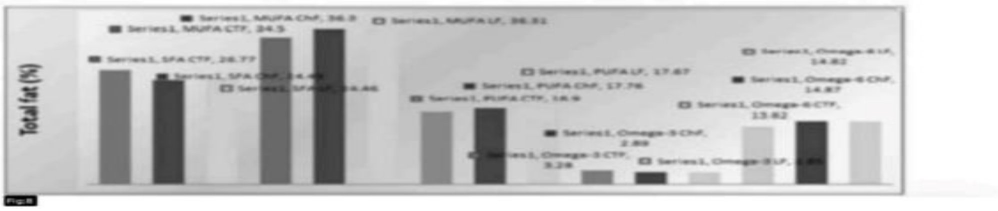


Fig:8

3. **Result And Discussion**

The Proximate Composition Of Claw And Body Meat From Paratelphusa Hydrodromous Collected From The Gadilam River Is Presented In Table 1 And Illustrated In Figure 8. The Analysis Revealed Distinct Compositional Differences Between The Two Meat Types.

The Moisture Content Was Significantly Higher In Claw Meat (81.30%$\pm$1.57%) Compared To Body Meat (71.72%$\pm$0.75%). This Findings Align With The Observations Of Priya Et Al, Who Reported Similar Moisture Distribution In The Same Species.

Protein, A Crucial Biochemical Component In Crustaceans Was Found In Its Highest Concentration In Claw Meat (49.06+1.01g/100g Dry Weight), With Body Meat Containing Substantially Less (35.01+1.03g/100g). This Trend Of Elevated Protein In Claw Meat Is Consistent With Previous Studies On Various Crab Species (22,34,35,36) Reinforcing The Notion That Claw Muscle, Being A More Active Tissue, Possesses A Higher Protein Density.

Conversely, The Lipid Content Demonstrated An Inverse Relationship. Body Meat Contained A Significantly Higher Lipid Percentage (17.64%+1.07%) Than Claw Meat (13.24%+0.80%). This Result Is Notably Higher (Approximately 2-3 Times) For P. Hydrodromous And Related Species Like P.Masoniana (X,Y), Where Lipid Contents Typically Ranged From 3.38% To 5.15% (X,Yxz). Lipid Serve As A Primary Energy Reserve, And Their Deposition In The Body Cavity Is Likely Responsible For Their Observed Difference.

The Ash Content, Representing The Total Mineral Fraction, Was Also Higher In The Claw Meat (22.12%+0.16%) Than In Body Meat (19.62%+0.86%). This Value Is Approximately Two Fold Higher Than Those Reported In Earlier Studies On Portunid Crabs [X,Y) Which May Be Attributed To Species-Specific Mineral Accumulation Or The Mineral Profile Of The Gadilam River Ecosystem.

The Disparities Between The Present Results And Those In The Existing Literature Can Be Attributed To Several Factors. Proximate Composition In Crustaceans Is Highly Variable And Influenced By Species, Sex, Season, Water, Temperature, Dietary Availability And The Spawing Cycle (X,Y). Furthermore, The Basis Of Result Expression (Dry Weight Vs. Wet Weight) Is A Critical Factor That Can Lead To Significant Differences In Reported Values Must Be Considered During Comparative Analysis.

Fatty Acid Profile

The Fatty Acid Profile Of The Total Lipids From Paratelphusa Hydrodromous, As Determined By GC-FID Analysis Is Summarised In Table1 And Depicted In Figure 2. A Total Of Twelve Fatty Acids Were Identified And Quantified.

The Distribution Revealed That Mono Unsaturated Fatty Acids (Mufas) Were The Most Prevalent Class, Accounting For 42.85% Of The Total Lipids. This Was Followed By Saturated Fatty Acids (Sfas) At 25.96% And Polyunsaturated Fatty Acids At 15.02%. The High MUFA Content Is Significant As These Fatty Acids Are Often Associated With Beneficial Nutritional Properties.

Among The Sfas, Palmitic Acid (16.0) Was The Dominant Constituent At 20.49%, Followed By Stearic Acid (18.0) At 3.89% And Myristic Acid (14.0) At 1.58%. The Predominance Of Palmitic Acid Is A Common Feature In Crustacean Lipids. However, Our Results Show A Higher Proportion Of Palmitic Acid Compared To The 13.4% Reported In Dungeness Crab (Cancer Magister) By King Et Al(40) And The 4.98% In Portunus Pelagicus Reported By Ramamoorthy Et Al(X). Conversely, Our Measured Stearic Acid Content Was Lower Than The 10.86% Found In P.Pelagicus (X) But Similar To Other Species. These Variations Highlight The Species-Specific Nature Of Fatty Acid Biosynthesis And The Influence Of Dietary Intake From The Local Aquatic Environment.

The PUFA Fraction, Through The Smallest Of The Three Classes, Is Nutritionally Vital. The Specific PUFA Profile Is A Key Indicator Of The Nutritional Quality Of The Crab Lipid. The Relatively Balanced SFA/MUFA/PUFA Ratio Suggests That P.Hydrodromous From The Gadilam River Could Be A Valuable Source Of Dietary Fats.

The Observed Compositional Variations Between Tissue Types Provide Insights Into The Physiological Specialization Of Different Body Parts, Reflecting Their Functional Roles In Locomotion, Energy Storage And Metabolic Processes. These Findings Contribute To Our Understanding Of Crustacean Biochemistry And Support The Sustainable Utilization Of Freshwater Crab Resources In Agriculture And Food Security Initiative.

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