

OPEN ACCESS

Volume: 12

Special Issue: 2

Month: February

Year: 2024

E-ISSN: 2582-6190

Impact Factor: 4.118

Received: 19.12.2023

Accepted: 18.01.2024

Published: 14.02.2024

Citation:

Mathangi, S., and N. Kaviya Sri. "Isolation of Protein from Prawn Shell to Enhance Athletic Performance." *ComFin Research*, vol. 12, no. S2, 2024, pp. 67–72.

DOI:

<https://doi.org/10.34293/commerce.v12iS2-Feb.7564>



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0

Isolation of Protein from Prawn Shell to Enhance Athletic Performance

S. Mathangi*Assistant Professor, Department of Home Science**V.V. Vanniaperumal College for Women, Virudhunagar, Tamil Nadu, India***N. Kaviya Sri***II M.Sc. Home Science- Nutrition and Dietetics**V.V. Vanniaperumal College for Women, Virudhunagar, Tamil Nadu, India*

Abstract

Prawns, also known as shrimp, are not only a popular seafood delicacy but also a powerhouse of protein. They boast impressive nutritional profiles, making them a valuable dietary element for both general health and athletic performance. This study explores the potential of protein from white shrimp (*Penaeus vannamei*) as a natural supplement for athletes. The study used two drying methods: sun-drying for 48 hours and cabinet-drying at 90°C for 8 hours. Higher protein levels were found in the sun-dried samples, making them a potential candidate for superior athletic protein supplementation. Protein was subsequently isolated from this sample. Protein-fortified chocolate was developed to optimize protein consumption. The study reveals the potential of sun-dried Prawnshell (Protein) as a potent and natural muscle-building supplement, aligning with sustainable practices and athlete nutrition.

Keywords: *Penaeus Vannamei*, Protein Isolation, Protein-fortified Chocolate, Optimization, Athletes, Muscle Mass.

Introduction

Sport and nutrition are key components of living a healthy lifestyle. Certain sports disciplines mandate the administration of supplements that enhance athletic performance, in addition to the nutrients obtained from a regular diet. Consuming protein is crucial for many areas of health, and recent research indicates that certain athletes may need higher protein intakes. (Phillips, S. M., & Van Loon, L. J. 2013). To live a healthy life and age well, it is critical to be able to reduce health risks. Increased physical activity and a good diet are necessary to accomplish this. (Ari, Y., & Cakir, E. (2021).

Penaeus vannamei is a penaeid shrimp. (https://invasions.si.edu/nemesis/species_summary/551682). Most of the time, this species is grown in semi-intensive systems close to the shore. (Araneda, M., Pérez, E. P., & Gasca-Leyva, E. 2008). Following pruning, between 40 and 50 percent of the shrimp are finally discarded as tail, tentacles, head, and legs. An estimate states that 30,000 tons of shrimp trash are dumped annually by the nation's shrimp processing companies. (Khan, M., & Nowsad, A. K. M. A. 2012).

According to U.S. and Canadian dietary reference, intake of 0.8 g protein kg⁻¹ d. Protein recommendations for endurance athletes are 1.2 to 1.4g/kg body weight. (Phillips, S. M., Moore, D. R., & Tang, J. E. 2007). Dietary proteins are primarily used by the body’s numerous anabolic activities. Hoffman, (J. R., & Falvo, M. J. 2004). Protein is essential for muscle growth, recuperation, and optimal performance, making it the foundation of any athlete’s diet. (<https://www.americansportandfitness.com/blogs/fitness-blog/the-importance-of-protein-for-athletes>). In addition to aiding in the creation of new tissue, protein is required for the mending of any muscle fibres that may have been harmed by exercise. (<https://www.nutritionx.co.uk/nutrition-hub/nutrition/why-do-athletes-need-protein/>).

Chocolate is made from the seed of the tropical Theobroma cacao tree and is recognized as a special kind of psychoactive food. (SY, W., & PL, L.2011). Chocolate is a widely consumed delicacy that has long been linked to happiness and pleasure. It is also well known that chocolate affects mood. Chocolate is thought to have interactions with neurotransmitters which contribute to mood modulation and appetite regulation. This innovative fortification not only boosts the overall protein content of the chocolate but also caters specifically to athletes seeking a readily available source of muscle-building nutrients. The protein, readily absorbed by the body, provides essential amino acids that aid in recovery and performance, making this fortified chocolate a compelling choice for fitness enthusiasts looking for a delicious and convenient way to fuel their training.

Objectives

The objectives set forth for the present study entitled “Isolation of Protein from Prawn Shell to Enhance Athletic Performance”

- To obtain the prawn shell powder using two different drying methods. (Sun-drying, Cabinet-drying)
- To isolate the protein from prawn shell powder.
- To develop and standardize the protein enriched chocolate for athletes.

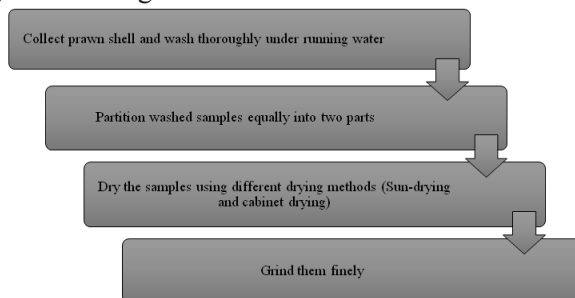
Materials and Methods

Collection of Ingredients

White shrimps (*Penaeus vannamei*) subjected to various processing techniques was purchased from the Royal Marine wholesale point (Bapatla, Andhra Pradesh). All shells were obtained from a single shrimp species.

Drying of Prawn Shells using Different Methods

The prawn shells were dried using two methods: sun drying for 2 days and cabinet drying at 90 degree for 8 hours. They were then ground.



Low Chart 1: Process of Drying Prawn Shells

Analysis of Proximal Composition

Prawn shells dried using two methods-sun-dried for two days and cabinet-dried at 90 degrees for eight hours-were subjected to nutrient analysis using the following standard procedure.

Estimation of Protein

The amount of protein present was calculated from the nitrogen concentration in the prepared prawn shell powder. In this study protein content was determined by Lowry 's Method.

Estimation of Calcium

In this study, calcium content was determined for prawn shell powder, dried and ground. All the mineral solutions were prepared according to AOAC method.

Isolation of Protein

Protein was isolated using affinity chromatography, following standard procedures, from cabinet-dried prawn shells. This choice of source material was based on the high protein content of prawn shells, as demonstrated by prior protein estimation.

Development of the Isolated Protein Incorporated Chocolate

The isolated protein was added into the ratio of 2%, 4% and 6% to make chocolate and the acceptability test was done by 10 panel members. The ingredients used for the preparation of chocolate are given in table.

Table 1 (Ingredients used for The Preparation of The Isolated Protein Incorporated Chocolate)

Ingredients Used	Control Sample	Experimental Sample A	Experimental Sample B	Experimental Sample C
Cocoa Powder (g)	45	43	41	39
Milk Powder (g)	25	25	25	25
Sugar (g)	25	25	25	25
Butter (g)	5	5	5	5
Isolated protein (g)	-	2	4	6

Sensory Evaluation of the Isolated Protein Incorporated Chocolate

For evaluating the sensory characteristics, the three different formulations of the chocolate incorporated with isolated protein were assessed by 10 panel members. The panellist was asked to determine the sensory attributes based on 5-point hedonic scale and they were scored based on sensory qualities such as appearance, colour, taste, texture, and odour. The overall acceptability was evaluated by the mean score of all the attributes. Figure 1 Isolated Protein Incorporated Chocolate

Results and Discussion

Analysis of Proximal Composition

Estimation of Protein Content of Prawn Shell Powder

Table 2 (Protein Content of Prawn Shell Powder)

S. No	Drying Method	Protein Value(g)
1	Sun-dried	43.26
2	Cabinet-dried	48.6

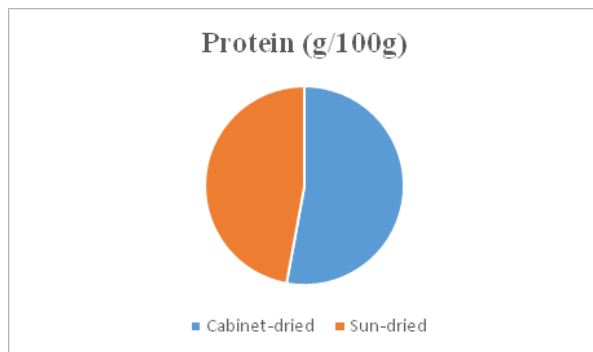


Figure 2 (Comparison of Protein Present in Sun-Dried and Cabinet Dried Prawn Shell)

Table 2 and Figure 2 shows that the protein content of prawn shell dried using different methods. The result found that the cabinet dried prawn shell had high protein content compared to sun drying.

Estimation of Calcium Content of Prawn Shell Powder

Table 3 (Calcium Content of Prawn Shell Powder)

S. No	Drying method	Calcium (mg)
1	Sun-dried	1600
2	Cabinet-dried	2200

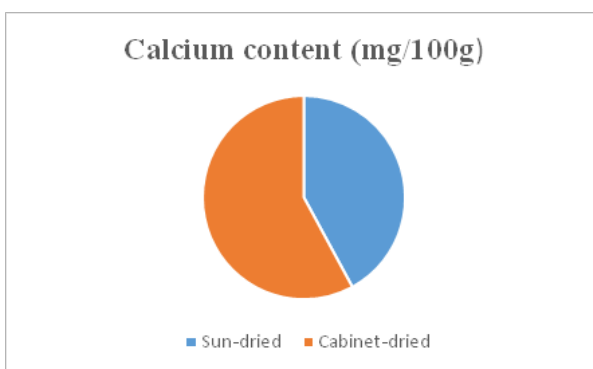


Figure 3 (Comparison of Calcium Present in Sun-Dried and Cabinet Dried Prawn Shell)

Table 3 and Figure 3 shows that the calcium content of prawn shell dried using different methods. The result found that the cabinet-dried prawn shell had high calcium content compared to sun-drying.

Sensory Evaluation of the Isolated Protein Incorporated Chocolate

The isolated protein was incorporated in the ratio of 2%, 4%, and 6% to make chocolate. They were subjected to sensory evaluation by 10 panel members and then the mean scores were obtained and analysed statistically.

Table 4 (Mean Scores of The Isolated Protein Incorporated Chocolate)

Characteristics	Control	Experimental Sample A	Experimental Sample B	Experimental Sample C
Flavour	4.2±0.5	3.8±0.3	4.6±0.8	4.1±0.3
Taste	4.4±0.37	3.6±0.2	4.8±0.3	4.2±0.74
Colour	4.5±0.44	3.9±0.8	4.8±0.24	4.4±0.8
Texture	4.5±0.45	3.4±0.5	4.9±0.4	4.2±0.7
Overall acceptability	4.5±0.8	3.7±0.74	4.7±0.39	4.2±0.4

Table 4 shows the mean score of the isolated protein incorporated chocolate. Evaluation of organoleptic attributes of the isolated protein incorporated chocolate for colour, texture, flavour, taste, and overall acceptability of 4% isolated protein incorporated chocolate was excellent with the mean score of 4.7±0.39 than the other two variations.

Conclusion

Beneath discarded prawn shells lies a hidden champion: a natural source of protein and calcium optimized for athletic performance. Cabinet drying unlocks this potential, revealing a bounty of these vital nutrients, ready to fuel muscle growth, fortify bones and bolster athletes against injury. The chitin-protein combo in prawn shells is a nature-made marvel, giving prawns both strength and flexibility to thrive in water. These biomaterials also hold potential for humans, boosting gut health by acting as prebiotics, wound healing, and even fighting cholesterol. This sustainable approach not only empowers individual performance, but also fosters environmental responsibility. From improved power and recovery to enhanced endurance, consuming prawn shell protein offers a natural edge with far-reaching benefits. But the journey does not end there. Future research promises to refine extraction methods, develop delicious options, and delve into the potential of bioactive compounds within the shells, paving the way for even greater health advancements. By championing prawn shells, we not only elevate athletic potential, but also cultivate a world where innovation and sustainability go together, shaping a healthier, more resilient future.

References

1. Phillips, S. M., & Van Loon, L. J. (2013). Dietary protein for athletes: from requirements to optimum adaptation. *Food, Nutrition and Sports Performance III*, 29-38.
2. Arı, Y., & Çakır, E. (2021). Correlation between participation in physical activity and healthy nutrition: An example of a sports science faculty. *Baltic Journal of Health & Physical Activity*, 13(3).

3. Araneda, M., Pérez, E. P., & Gasca-Leyva, E. (2008). White shrimp *Penaeus vannamei* culture in freshwater at three densities: condition state based on length and weight. *Aquaculture*, 283(1-4), 13-18.
4. Khan, M., & Nowsad, A. K. M. A. (2012). Development of protein enriched shrimp crackers from shrimp shell wastes. *Journal of the Bangladesh Agricultural University*, 10(452-2016-35651), 367-374.
5. https://invasions.si.edu/nemesis/species_summary/551682
6. Phillips, S. M., Moore, D. R., & Tang, J. E. (2007). A critical examination of dietary protein requirements, benefits, and excesses in athletes. *International journal of sport nutrition and exercise metabolism*, 17(s1), S58-S76.
7. Hoffman, J. R., & Falvo, M. J. (2004). Protein—which is best? *Journal of sports science & medicine*, 3(3), 118.
8. <https://www.americansportandfitness.com/blogs/fitness-blog/the-importance-of-protein-for-athletes>.
9. <https://www.nutritionx.co.uk/nutrition-hub/nutrition/why-do-athletes-need-protein/>.
10. SY, W., & PL, L. (2011). Chocolate: food for moods. *Malaysian journal of nutrition*, 17(2).