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Comparative analysis of physicochemical and organoleptic properties of sun- and oven-dried small prawns in Bangladesh

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ABSTRACT

The main purpose of this investigation was to assess and compare the physicochemical and organoleptic qualities of dried small prawns prepared using conventional sun- and oven-drying methods. Organoleptic properties (colour, odour, texture, appearance, and overall acceptability) were evaluated using standard sensory evaluation protocols, and nutritional composition (lipid, protein, moisture, crude fibre, ash, and carbohydrate), along with selected minerals (calcium and iron), were determined by established analytical methods. The results demonstrated that oven-dried prawns exhibited significantly higher sensory scores (colour, appearance, and texture), with overall acceptability reaching 7.8 ± 0.67 compared to 7.13 ± 0.83 in sun-dried samples. Proximate analysis revealed that oven-dried prawns contained significantly higher levels of protein (57.69 ± 0.98%), lipid (13.65 ± 0.59%), and ash (11.01 ± 0.32%) compared to sun-dried samples. Sun-dried samples had significantly higher moisture content (17.27 ± 0.64%) and carbohydrate (1.28 ± 0.11%). pH levels in dried prawns did not differ significantly between drying methods. The calcium and iron contents ranged from 5.67 ± 0.72 mg/100g (sun-dried) to 6.48 ± 1.46 mg/100g (oven-dried) and 0.69 ± 0.26 mg/100g (sun-dried) to 1.51 ± 0.43 mg/100g (oven-dried), respectively. These findings provide practical guidance for processors and small-scale producers to adopt improved drying techniques for higher-quality, consumer-preferred products and enhance knowledge regarding more nutritious, safe, hygienic, and improved dried fish products for consumers.

Contribution/Originality: This study is one of the very few studies that have investigated the comparative effects of sun- and oven-drying on small prawns. The findings provide practical insights for processors and small-scale producers to optimize drying methods for enhanced product quality and consumer preference.

1. INTRODUCTION

Fish is a highly nutritious and important source of a wide range of vital nutrients, including polyunsaturated fatty acids, essential amino acids, vitamins, and minerals (Mohanty et al., 2019). Fish flesh is naturally tender, consisting of bundles of muscle fibres held together by delicate connective tissue that softens upon heating (Hatae, Yoshimatsu, & Matsumoto, 1984). It is also more easily digestible compared to beef and other animal protein sources

(Adebayo-Tayo, Onilude, & Patrick, 2008). Fish begins to spoil almost immediately after being caught, and in some cases, deterioration may even start before it is removed from the water. Without proper handling and preservation, the fish quality can deteriorate markedly between harvest and final consumption (Maulu, Hasimuna, Monde, & Mweemba, 2020). Spoilage is driven by a series of complex microbial, enzymatic, and chemical reactions that begin upon death, resulting in tissue softening and the development of characteristic off-odour (Wang, Ju, Diao, Zhao, & Yang, 2025). Due to the highly perishable nature of fish, appropriate handling and preservation are essential to extend its shelf life while maintaining quality and nutritive value. Therefore, it is imperative to preserve freshly harvested fish immediately after capture using appropriate methods such as brining or salting, sun drying, solar drying, and smoking in traditional or improved ways (Mustapha, Ajibola, Salako, & Ademola, 2014).

It is proven that one of the most well-known, traditional, economical, and efficient methods of preserving fish is drying, which involves reducing the moisture content to prevent the growth of microbes and enzymatic biochemical reactions (Rasul et al., 2021). In addition, proper preservation minimizes post-harvest losses and ensures the accessibility of fish products during periods of scarcity, thereby supporting a consistent supply of affordable protein for consumers (Mustapha et al., 2014). Various drying techniques are employed to produce dried fish products, including vacuum drying, oven drying, freeze-drying, rotary drying, sun drying, and solar tunnel drying (Rasul et al., 2021). Conventional sun drying, a low-cost preservation method that has been practiced for centuries, involves exposing fish to open air, where solar energy facilitates water evaporation and air currents remove the resulting moisture as vapor. However, this traditional technique has several drawbacks, including a lack of control over weather conditions, infestation by blowflies and other insects, poor sanitation, improper handling practices, and, in some cases, the use of harmful pesticides (Jain & Pathare, 2007). As a result, conventional sun drying often produces fish with poor physical, sensory, and chemical characteristics, making them unsuitable for human consumption (Jahan, Jerin, Kobra, & Kumar, 2024). To address the problems of sun drying, various improved techniques such as oven drying, solar drying, and other controlled procedures have been introduced to enhance the quality and safety of dried fish products.

Although drying methods present several problems, dried fish remains a cherished food across the world, valued for its distinctive flavour, taste, and texture that set it apart from fresh fish. In Bangladesh, especially in the central, coastal, and northeastern regions, it is regarded as a delicacy and an integral part of the local diet (Alam, 2007). Nutritionally, dried fish is packed with rich protein, valuable omega-3 fatty acids such as EPA and DHA, and an array of essential minerals including iodine, zinc, calcium, copper, and selenium (Siddhnath et al., 2022). Dried fish is widely consumed across all income groups, ranking fourth in global fish consumption (Food and Agriculture Organization of the United Nations, 2018). In Bangladesh, its production and export generate substantial foreign exchange and support the country's strong position in the fisheries market (Haque, Rabbani, & Hasan, 2015).

Chalan Beel, recognized as the largest and ecologically important watershed in northwestern Bangladesh, comprises numerous depressions interconnected by rivers that span three districts: Natore, Pabna, and Sirajganj (Rhaman, Hossain, Flowra, Dey, & Sultana, 2017). Despite considerable degradation over time, it continues to support a diverse ichthyofauna essential to the local economy and livelihoods (Rahman, Rahman, & Asaduzzaman, 2010). In addition to commercial operations, thousands of small-scale fishermen in Chalan Beel and surrounding areas produce dried fish for sale across various districts, especially during the winter season. In addition to its finfish diversity, Chalan Beel represents an important habitat for small prawns. Of the 37 marine shrimp species and 24 freshwater prawn species recorded in Bangladesh, including 10 species of *Macrobrachium*, many are found in the Chalan Beel area (Barua et al., 2023). Small prawns are also dried in the *beel* area and are a common processed food item for a wide range of consumers (Samad, Galib, & Flowra, 2009). Nowadays, consumers are more concerned about their well-being and the quality of food that has good nutritional and sensory qualities; it has become important to ensure the quality of dried fish and fishery products (Olatunde & Benjakul, 2018). Although numerous studies have examined the nutritional composition and biochemical attributes of economically important freshwater and marine fishes in raw and dried forms, similar research on dried small prawns is limited. Previous studies, including Azmi et al. (2024) and Adithya and Velumani (2024), have investigated the effects of drying methods on prawns, but they focus mainly on physicochemical or microbial characteristics. Comprehensive evaluations integrating sensory attributes, proximate composition, and mineral content remain scarce, and no such study has been conducted in Bangladesh, especially in the Chalan Beel area. Therefore, this study aims to assess and compare the physicochemical and organoleptic quality of small prawns from Chalan Beel under two different drying methods.

2. MATERIALS AND METHODS

2.1. Collection and Preparation of the Sample

The small prawns were selected for the study due to their popularity in dried and fresh conditions in Bangladesh, especially in the Chalan Beel area near Rajshahi, and were collected in February 2025 from the Chalan Beel neighborhood of Shingra Upazila, Natore district. The prawn samples were gathered, promptly iced, and transported to the Quality Control Laboratory, Department of Fisheries, University of Rajshahi. The total length (2.75 ± 0.62) and weight (1.11 ± 0.04) of the samples were measured using a measuring board and a digital weighing machine, respectively. All prawns were beheaded manually with a kitchen knife and rinsed thoroughly with tap water.

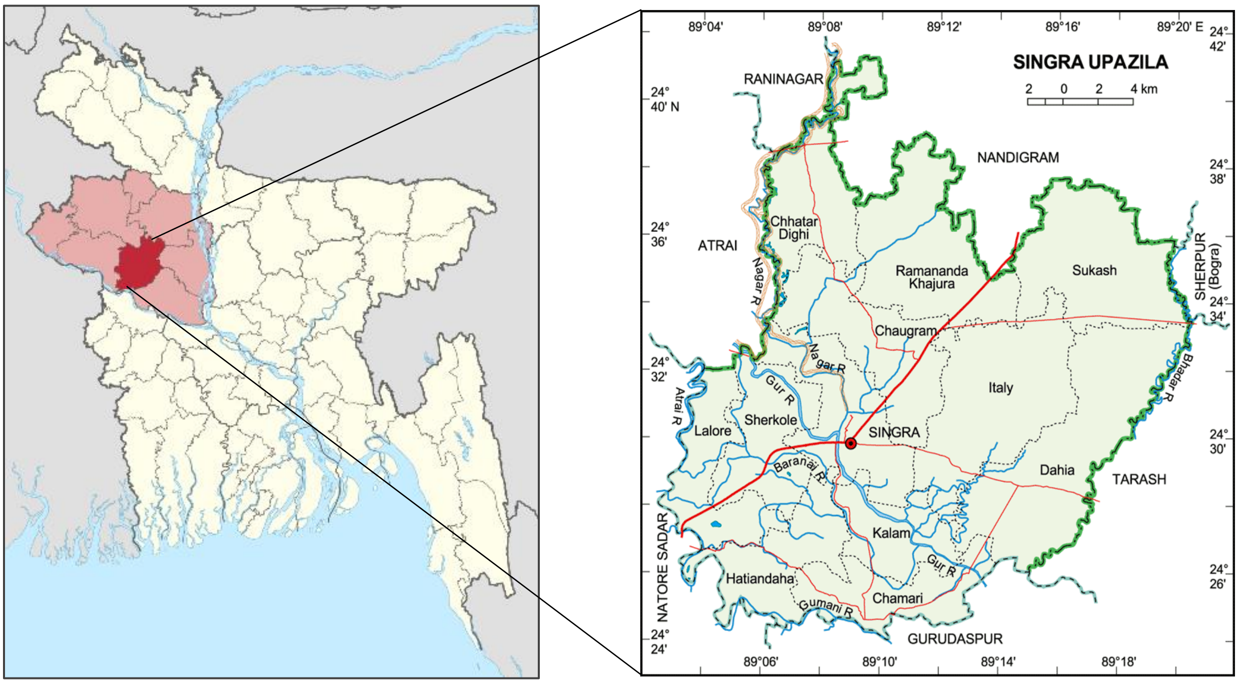

Figure 1. Illustrates the study area.

2.2. Drying Procedure

Sun drying: Beheaded prawns were placed under the sunlight and allowed to dry. A small-meshed net was used to protect prawns from insects. The temperature and humidity of the air were measured during drying using a thermohydrometer (HI 9564, Hanna Institute, USA). The average temperature was 40°C, and the relative humidity was 75%.

Oven drying: Similar to sun-drying, the beheaded small prawns were also dried in an oven (MS2342D/00, Poleko, Poland) at 55°C. The dried prawns were preserved at room temperature in pre-cleaned plastic containers for subsequent analysis.

2.3. Organoleptic Evaluation

Following the sun- and oven-drying of small prawns, organoleptic tests were conducted by a panel of consumers. All of the dried prawns were placed on a tray and evaluated on a scale of 1 to 9 (9 for excellent, 7 for good, 6 for acceptable, and less than 4 for bad or undesirable) for product appearance, colour, texture, and odour according to methods described by Meenatchisundaram et al. (2016).

2.4. Proximate Composition Analysis

Dried prawns were ground in an electric grinder and sieved with a 2 mm-meshed sieve. Then the samples were analyzed to determine the proximate compositions of the dried products, including protein, lipid, ash, moisture, carbohydrate, and crude fibre, following standard methods (Association of Official Analytical Chemists (AOAC), 2000). The protein content was measured using a micro-Kjeldahl apparatus (VELP Scientifica, Italy) and was computed using the following Equation 1.

$$\% \text{ Protein} = \text{Nitrogen content } (\%) \times \text{Protein conversion factor } (6.25) \quad (1)$$

Here, Nitrogen content = Volume of titrant × Normality of H_2SO_4 × ml equivalent of N_2

Lipid content was estimated by ether extraction using a Soxhlet apparatus (Wincom, China). The percent of lipid was calculated by the following Equation 2.

$$\% \text{ Lipid} = \frac{\text{Weight of extracted lipid}}{\text{Weight of sample(g)}} \times 100 \quad (2)$$

Ash content of the samples was measured by incinerating the samples in a muffle furnace (Nabertherm, Germany) at 600°C for 12 hours and calculated using the following Equation 3

$$\% \text{ Ash} = \frac{(\text{Weight of ash and crucible} - \text{weight of crucible})}{\text{Weight of sample}} \times 100 \quad (3)$$

Moisture content was determined by oven-drying the samples at 105°C for 24 hours, and the percentage of moisture content (%) was calculated using Equation 4.

$$\% \text{ Moisture} = \frac{\text{Weight loss after dehydration}}{\text{Weight of sample(g)}} \text{ x } 100 \quad (4)$$

The Weende method (Joslyn, 1970) was used to determine the crude fibre content in the samples. The percentage (%) of fibre was calculated by the following Equation 5.

$$\% \text{ Crude fibre} = \frac{\text{Loss weight after ignition}}{\text{Weight of sample}} \text{ x } 100 \quad (5)$$

The carbohydrate content was calculated by difference, subtracting the combined percentages of crude protein, lipid, moisture, ash, and crude fibre from 100. Triplicates of each analysis were performed.

2.5. Mineral Component Analysis

A flame atomic absorption spectrophotometric method was used to quantify the calcium and iron levels using an atomic spectrophotometer (model 372).

2.6. pH Value

Ten (10) grams of powdered prawn sample were mixed with 50 mL of distilled water, and the resulting homogenate's pH was measured using a pH meter (H12002-Edge, Hanna Instruments, USA).

2.7. Data Analysis

All data obtained from the study were analyzed using SPSS version 22 (Statistical Package for Social Sciences, USA) and R (version 4.5.1). Comparisons between sun-dried and oven-dried samples used Welch's two-sample t-test for unequal variances, with significance at $p < 0.05$. Measurements were in triplicate. Limitations include a small sample size and raw material variability, affecting generalizability.

3. RESULTS

3.1. Time Duration of Sun Drying and Oven Drying

Sun drying takes a longer time than oven drying to dry small prawns. In the case of sun-dried prawns, it took 36 ± 0.58 hours, while oven drying took 30 ± 0.015 hours to dry.

3.2. Organoleptic Test

The consumer acceptability of dried small prawns, determined through organoleptic tests, showed that the colour score of oven-dried prawns was significantly ($p < 0.05$) higher (7.8 ± 0.78) than that of sun-dried prawns (6.6 ± 0.81). The odour scores were slightly higher (7.5 ± 0.5) in oven-dried prawns, but the difference between drying methods was not significant. Oven-dried prawns also showed significantly better appearance (7.73 ± 0.79) and texture (7.66 ± 0.48), and differed significantly ($p < 0.05$) from the sun-dried products. Overall acceptability was higher for oven-dried prawns (7.8 ± 0.67) than sun-dried prawns (7.13 ± 0.83) (Table 1, Figure 2).

Table 1. Organoleptic properties of the sun-dried and oven-dried small prawns.

Parameter	Organoleptic test score (mean ± SD)		p-value
	Sun-dried	Oven-dried	
Colour	6.6 ± 0.81	7.8 ± 0.78	0.048
Odour	7.2 ± 1.15	7.5 ± 0.5	0.056
Appearance	6.67 ± 1.12	7.73 ± 0.79	0.035
Texture	6.6 ± 1.18	7.66 ± 0.48	0.038

Note: Data are presented as mean ± standard deviation within the same row differ significantly at ($p < 0.05$) between two different drying methods. Score (1 to 9): 9 for excellent, 7 for good, 6 for acceptable, and below 4 for bad or unacceptable.

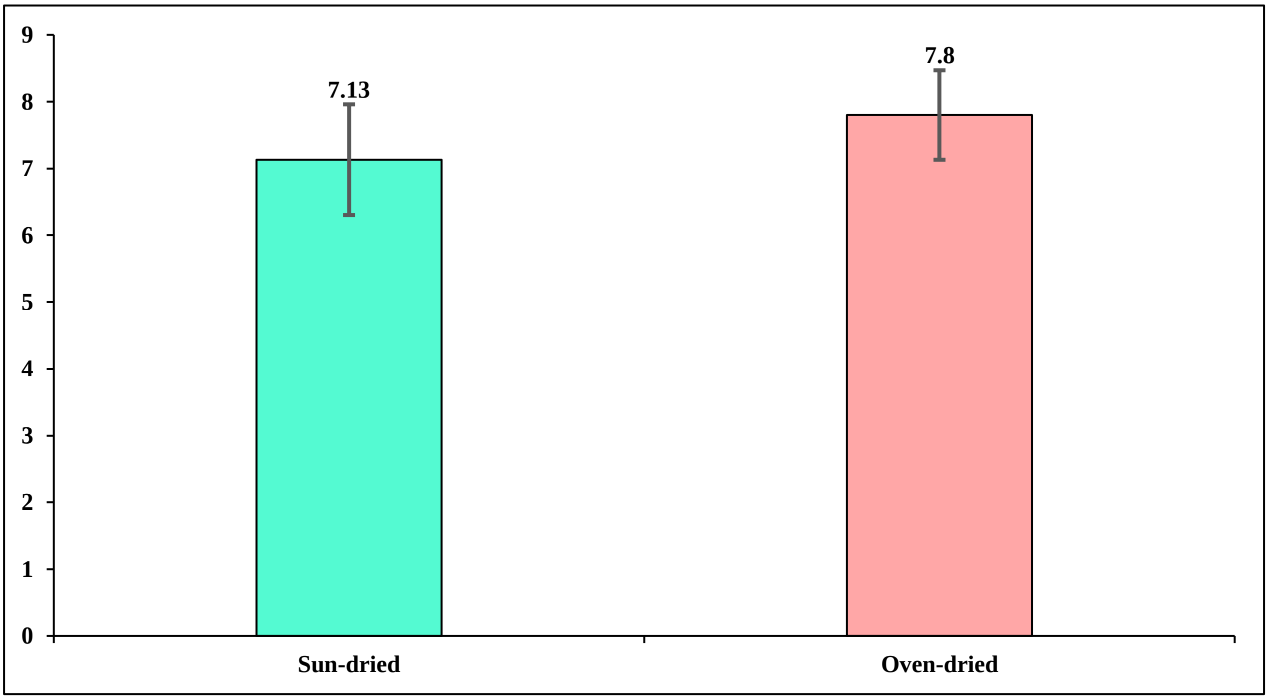

Figure 2. The overall acceptability score of sun-dried and oven-dried small prawns.

3.3. Correlation Between the Organoleptic Quality of Sundried and Oven-Dried Small Prawns

This study focused on comparing the sun-dried and oven-dried techniques for small prawns sourced from Chalan Beel, with respect to their organoleptic quality. This comparison is illustrated in Figure 3, which presents the distribution, box plot, and scatter plot individually, along with the overall correlation coefficient for the two drying methods. The correlation between the drying method and parameters such as colour, appearance, and texture was found to be significant (Figure 3). The relation between odour and overall acceptability was also significant (Figure 3).

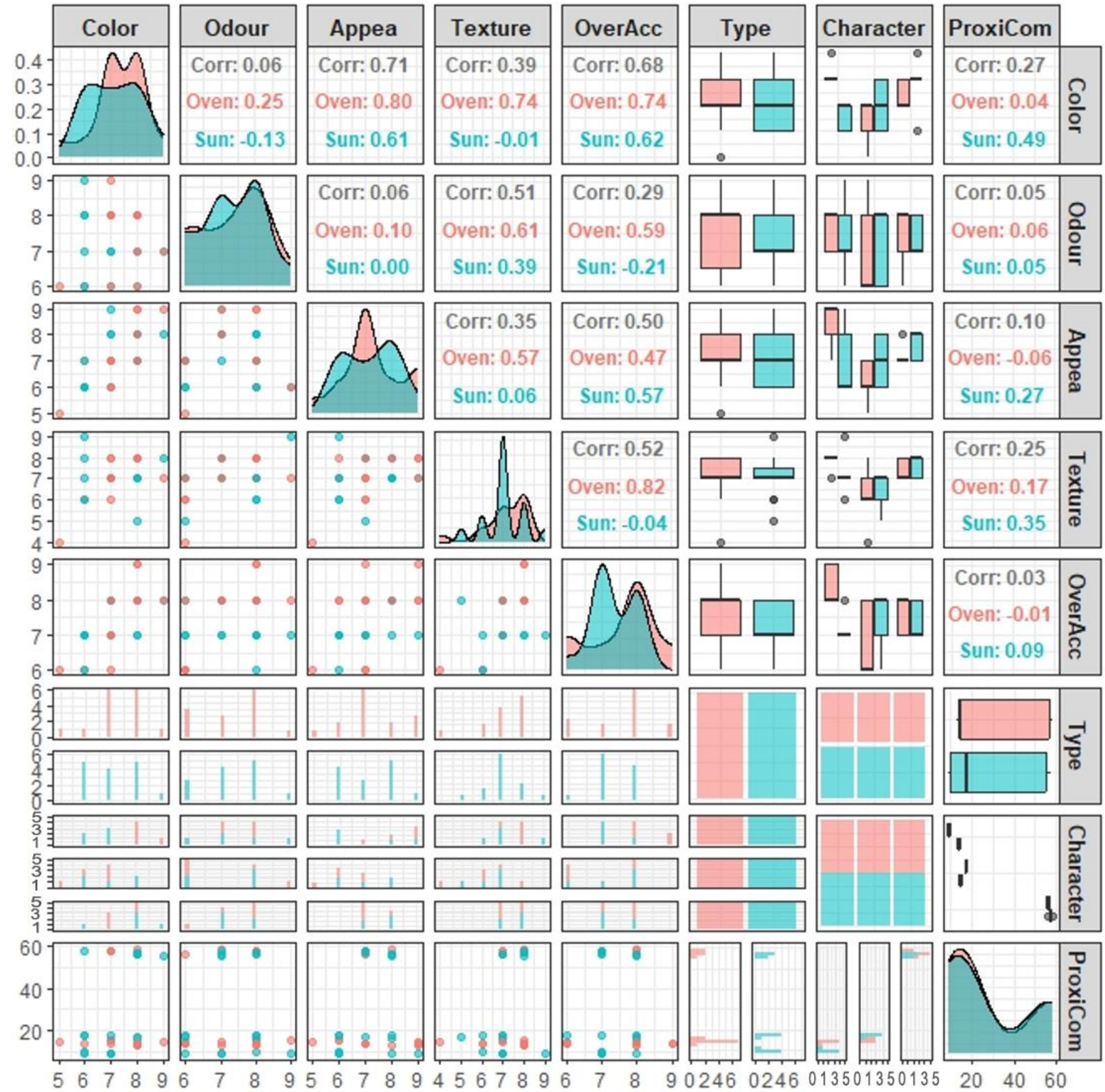

Figure 3. The correlation between the organoleptic properties of sun-dried and oven-dried small prawns.

Note: The red colour represents the oven-drying method, while the blue colour signifies the sun-drying method. The overall correlation depicted by single, double, and triple stars reveals significance at the 10%, 5%, and 1% levels.

3.4. Proximate Composition of Small Prawn

The proximate composition of small prawns varied significantly depending on the drying method (Table 2, Figure 4). Oven-dried prawns had significantly ($p < 0.05$) higher protein (57.69 ± 0.98), lipid (13.65 ± 0.59), and ash content (11.01 ± 0.32) and significantly lower ($p > 0.05$) moisture (14.66 ± 0.63) and carbohydrate (0.43 ± 0.14) content compared to sun-dried prawns. No significant variances were noticed in crude fibre contents ($p > 0.05$).

Table 2. Proximate composition of sun-dried and oven-dried small prawns.

Parameter	Sun-dried		Oven-dried		p-value
	Mean ± SD	Range	Mean ± SD	Range	
Lipid	11.25 ± 0.39	8.89-12.86	13.65 ± 0.59	12.90-14.40	0.019
Protein	56.36 ± 0.79	55.40-57.46	57.69 ± 0.98	56.12-58.79	0.020
Moisture	17.27 ± 0.64	16.42-17.98	14.66 ± 0.63	14.00-15.38	0.024
Ash	8.89 ± 0.05	8.84-8.97	11.01 ± 0.32	10.69-11.52	0.013
Crude fibre	1.18 ± 0.03	1.14-1.22	1.24 ± 0.09	1.12-1.32	0.507
Carbohydrate	1.28 ± 0.11	1.10-1.39	0.43 ± 0.14	0.24-0.62	0.005

Note: Data are presented as mean ± standard deviation within the same row differ significantly at ($p < 0.05$) between two different drying methods.

3.5. Correlation Between the Proximate Parameters of Sun-Dried and Oven-Dried Small Prawns

Negative correlations existed between Lipid and carbohydrates, ash and carbohydrates, and ash, whereas moisture and carbohydrates were positively correlated. There was a negative correlation between moisture and lipids. A positive correlation between ash and moisture, and crude fibre and moisture (Figure 4).

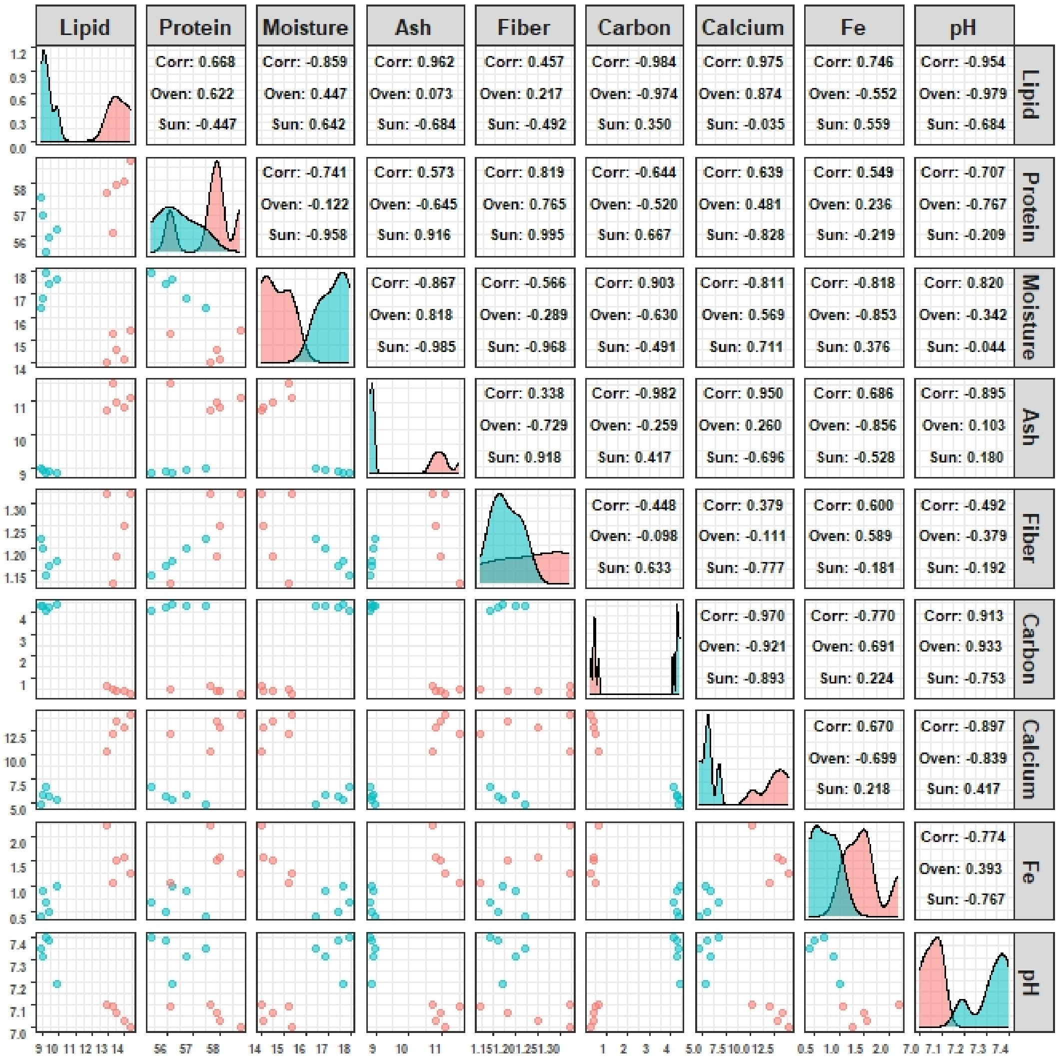

Figure 4. Correlation between multiple variables of the nutrient composition of sun-dried and oven-dried small prawns.

Note: The correlation between the organoleptic properties of sun-dried and oven-dried small prawns. The red colour represents the oven-drying method, while the blue colour signifies the sun-drying method. The overall correlation depicted by single, double, and triple stars reveals significance at the 10%, 5%, and 1% levels.

3.6. Mineral Contents and pH

The mineral content and pH of small prawns were influenced by the drying method (Table 3; Figure 5). Oven-dried samples exhibited higher mean calcium (6.48 ± 1.46) and iron contents (1.51 ± 0.43) compared to sun-dried samples; however, the difference in calcium content was not statistically significant ($p > 0.05$), whereas iron content was significantly higher ($p < 0.05$) in oven-dried prawns (1.51 ± 0.43). The pH of small prawns did not vary significantly ($p > 0.05$) between two different methods.

Table 3. Mineral contents and pH of sun-dried and oven-dried small prawns.

Minerals and pH	Drying method	Mean ± SD (mg/100g)	Maximum	Minimum	Skewness	Kurtosis	p-value
Calcium	Sun	5.67 ± 0.72	6.75	4.80	0.32	1.48	0.081
	Oven	6.48 ± 1.46	8.02	5.21	-0.47	1.43	
Iron	Sun	0.69 ± 0.26	1.01	0.40	0.08	0.93	0.005
	Oven	1.51 ± 0.43	2.20	1.14	0.52	1.53	
pH	Sun	7.33 ± 0.06	7.40	7.19	-0.67	1.59	0.999
	Oven	7.06 ± 0.08	7.12	6.90	-0.19	1.03	

Note: Data are presented as mean ± standard deviation within the same row differ significantly at ($p < 0.05$) between two different drying methods.

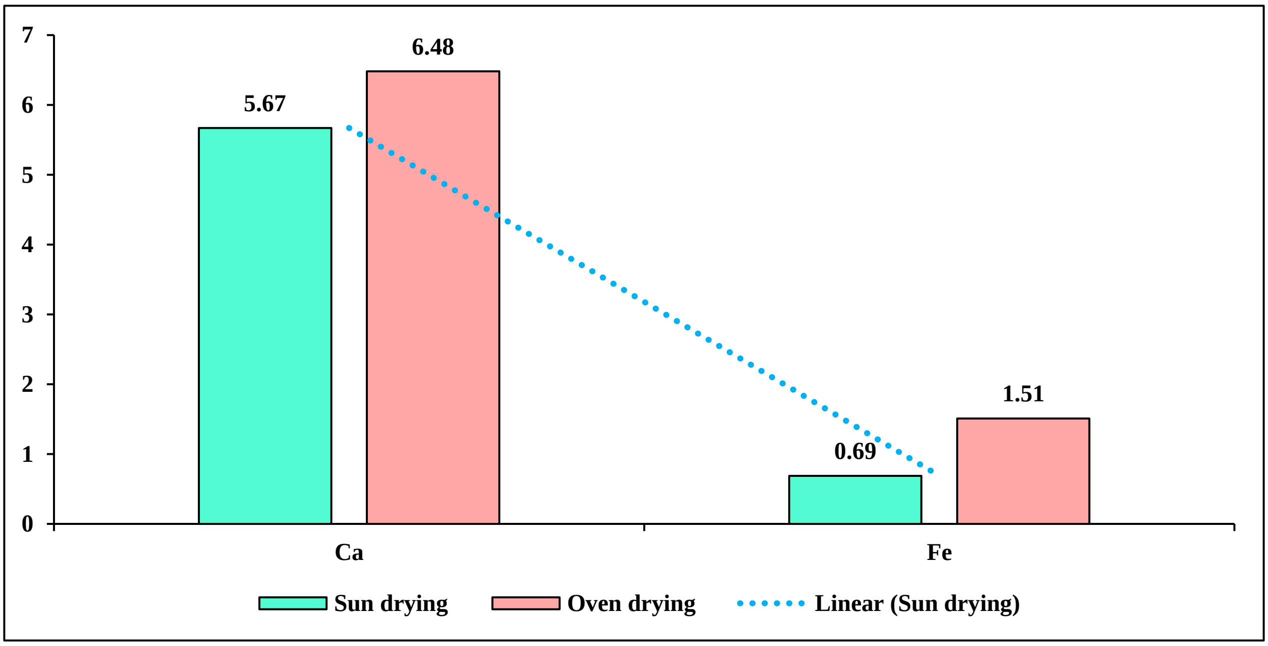

Figure 5. The mineral content of sundried and oven-dried small prawns.

4. DISCUSSION

4.1. Effect of Drying Method on Drying Duration

Sun drying required a longer time to dry small prawns compared to oven drying. Sun-dried small prawns took 36 ± 0.58 hours to dry at a temperature of 40°C. Dey, Alam, and Bhowmik (2024) reported that sun-drying fish typically requires 3-5 days, while smaller fish usually dry faster than larger fish. However, in this study, the drying time was measured in hours instead of days, and it was 1 day and 12 hours. Conversely, oven drying of small prawns took 30 ± 0.015 hours at a temperature of 55°C. Sun drying process requires sun exposure and depends on humidity and air temperature, whereas oven drying conditions can be controlled properly without being nature dependent.

4.2. Organoleptic evaluation

The organoleptic properties of small prawns differed between drying methods, with oven-dried samples receiving higher scores for colour (7.8 ± 0.78), odour (7.5 ± 0.5), texture (7.66 ± 0.48), and overall appearance (7.73 ± 0.79) than sun-dried samples. Lin et al. (2025) reported that variations in fish quality during drying are a significant focus of research in aquatic food processing. Research has shown that the color, texture, and sensory characteristics of shrimp change during the drying process. Similar trends have been reported previously by Jahan and Akhtar (2019), who observed higher appearance (7.75 ± 1.29), colour (7.25 ± 1.63), texture (7.51 ± 1.30), and overall acceptability (7.50 ± 1.30) scores in oven-dried *Puntus sophore* than sun-dried ones. Kumar et al. (2017) reported higher sensory scores in oven-dried *Pangasius hypophthalmus* compared to sun-dried counterparts. These results indicate that oven drying generally enhances the sensory qualities of dried fish and prawns. It seems that this has been done to process it under hygienic conditions in an oven.

4.3. Proximate Composition

4.3.1. Lipid Content

In the current study, the lipid content of small prawns ranged from 11.25 ± 0.39% in sun-dried samples to 13.65 ± 0.59% in oven-dried samples. These values are in agreement with previous studies on dried fish products. For instance, Sultana, Parween, and Hossain (2011) reported lipid contents ranging from 12.2% to 22.7% in dried SIS fish, while Paul, Reza, Islam, and Kamal (2018) observed lipid levels between 2.74% and 15.44% in dried marine fishes from Cox's Bazar. Similarly, Rana, Chakraborty, and Saeid (2020) documented lipid contents of 4.20–13.03% in indigenous dried fish, which closely correspond to the present findings. However, the fat content observed in the present study was higher than the 5.74 ± 0.11% reported for solar-dried shrimp by Akonor, Ofori, Dziedzoave, and Kortei (2016) and substantially exceeded the 1.2–1.3% range reported by Sriket, Benjakul, Visessanguan, and Kijroongrojana (2007) for whole shrimp. This is lower than the present study. Chukwu and Shaba (2009) reported an inverse relationship between fat and moisture content in shrimp, where lower fat levels correspond to higher moisture content. In the current study, the moisture content is comparatively lower. So, the lipid content may be higher than that reported in the study. The observed variations may also be attributed to interspecific differences, habitat conditions, and processing methods.

4.3.2. Protein Content

In this investigation, the protein content of dried small prawns was 56.36 ± 0.79% for sun-dried samples and 57.69 ± 0.98% for oven-dried samples. Das, Salman, Islam, Suraiya, and Haq (2021) reported that the protein content of *Palaemon karnafuliensis* was 57.46 ± 5.88%, which is similar to the present study. Paul et al. (2018) reported crude protein contents ranging from 33.56 to 58.22% in dried marine fish and *Penaeus* species, with shrimp showing the highest values, closely aligning with the present results. Ajifolokun, Basson, Osunsanmi, and Zharare (2018) found that sun-dried shrimp contained 58.4 ± 0.51% protein and noted that protein content increased with decreasing drying temperature. Al Banna et al. (2022) found protein contents between 52.06% and 64.33% in dried fish, which are largely consistent with this study.

Azmi et al. (2024) stated that the protein content of oven-dried shrimp (*Parapenaeopsis* sp.) was 47.62 ± 0.67%, which is comparatively lower than the findings of the present study. In the present study, in a hot air oven, the temperature was well maintained, so the protein content was intact, and the amount of protein in sun-dried and oven-dried products was more or less the same.

4.3.3. Moisture Content

Maintaining low moisture levels is essential, as it increases protein content in fish through the coagulation of proteins. In the study, the highest moisture content (17.27 ± 0.64%) was found in sun-dried, and the lowest content

(14.66 ± 0.63%) in oven-dried small prawn. The findings of this study are consistent with those of Akuamoa, Odamtten, and Kortei (2018), who reported that shrimp moisture content is significantly affected by radiation treatment and shrimp source, with values ranging from 11.9% to 17.76%. Likewise, Ajifolokun et al. (2018) found a moisture content of 13.70% in sun-dried shrimp powder, which is similar to the present study. Rosemary, Omokaro, Wemedo, and Ogbonna (2020) also reported a moisture content of 15.92% ± 0.23% in market-dried shrimp. Here, all the above-discussed references are more or less similar to the present study.

4.3.4. Ash Content

In the present study, the ash content of small prawns ranged from 8.89 ± 0.05% (sun-dried) to 11.01 ± 0.32% (oven-dried). These obtained values fall within the range of previously reported findings, exemplified by Ullah, Hazarika, and Handique (2016), who documented ash contents of 11.18–29.19% in sun-dried fish, and Mansur et al. (2013), who observed 11.11% and 18.89% in *C. striatus* and *W. attu*, respectively. c reported that the ash content of sun-dried shrimp was 6.77 ± 0.05%, attributing the higher value to substantial moisture loss, as ash content is influenced by both moisture level and temperature. Das et al. (2021) reported that the lower the moisture content, the higher the ash content. That might be the reason for the high amount of ash content.

4.3.5. Crude Fibre Content

Dietary fibre is crucial for our digestive health, even though it is needed in small amounts. It can help prevent diseases such as heart disease, bowel cancer, and diabetes (Anderson et al., 2009). The present study determined crude fibre contents of 1.18 ± 0.03% in sun-dried and 1.24 ± 0.09% in oven-dried small prawns. As there is no existing literature on fibre content in dried small prawns, these findings provide reference data for subsequent studies.

4.3.6. Carbohydrate Content

The carbohydrate content of small prawns in this study, measured at 1.28 ± 0.11% (sun-dried) and 0.43 ± 0.14% (oven-dried), aligns with previously reported ranges for fish powders, such as 3.14–6.01% (Mahmud et al., 2019), indicating that the present findings fall within expected levels for dried aquatic products. Sun-dried shrimp exhibited the lowest carbohydrate content (18.40% ± 0.23%), whereas oven-dried samples showed higher values of 20.64 ± 0.20%, 20.79 ± 0.25%, and 25.17 ± 0.03% at 50°C, 60°C, and 70°C, respectively (Ajifolokun et al., 2018). This indicates an inverse relationship between lipid and carbohydrate contents in shrimp powder. In the present study, the lipid content is higher, which might explain the lower carbohydrate content.

4.4. Mineral Content

4.4.1. Calcium

Calcium, an essential mineral, contributes to growth, blood coagulation, bone formation, milk production, and vitamin D metabolism (Institute of Medicine, 2011). The study revealed that the calcium content in the small prawn was 5.67 ± 0.72 and 6.48 ± 1.46 mg/100g for oven-dried and sun-dried, respectively. These values differ from those reported in previous studies, such as a broader range of 33.70–3590 mg/100 g in dried fish (Al Banna et al., 2022). Earlier studies have also reported higher calcium levels, including 121.84–289.70 mg/100 g in ten small freshwater species (Hossain, Afroz, Haque, & Begum, 2015) and 1930–5800 mg/100 g in dried marine small fish (Mamun et al., 2024). These differences may arise from differences in analytical techniques, dissimilarities in fish samples (such as species, size, age, and season), and their geographical origins (Akonor et al., 2016; Rasul et al., 2021).

4.4.2. Iron

Iron content varied between oven- and sun-dried small prawns, with values of 1.51 ± 0.43 mg/100 g and 0.69 ± 0.26 mg/100 g, respectively. These levels fall within ranges reported for small indigenous species (0.28–12.0 mg/100 g, Roos, Islam, and Thilsted (2003)). Higher iron concentrations have been documented in certain SIS, such as *Amblypharyngodon mola* (44.90 mg/100 g) and *Oxygaster bacaila* (16.85 mg/100 g, Sultana et al. (2011)), as well as in dried marine small fish (11.7–63.0 mg/100 g, Mamun et al. (2024)). These variations likely result from differences in species, size, drying methods, and geographical origin.

4.5. pH Value

The pH of small prawns was measured at 7.06 ± 0.08 in oven-dried samples and 7.33 ± 0.06 in sun-dried samples, with no significant differences detected between drying methods. The pH shows almost the same value for the two drying methods. According to Binici and Kaya (2018), fresh fish pH is almost neutral; it declines due to lactic acid produced during the death of fish. It could also be brought on by a rise in acid concentration as salt-containing acids diffuse into the prawn muscle and water migrates outside the muscle (Nirmal & Benjakul, 2011). The present findings are comparable to those reported by Jahan and Akhtar (2019), who found pH levels ranging from 6.3 ± 0.31 (oven-dried) to 6.75 ± 0.70 (sun-dried). Considering that the acceptable post-mortem pH for fish typically ranges from 6.8 to 7.0 (Metin, Erkan, Varlik, & Aran, 2001), the dried prawns in the recent study fall within a suitable range for consumption.

5. CONCLUSION

Sun drying remains the most extensively practiced method for fish preservation due to its ease and low cost; however, the present study demonstrates that oven drying produces prawns with superior sensory attributes and improved nutritional quality. The higher protein, mineral content, and overall acceptability of oven-dried samples indicate greater efficiency and reliability of this method. These findings suggest that oven drying represents a viable alternative for achieving consistent product quality and is a very simple drying system compared to sun drying, and can be performed in any season throughout the year. Also, oven drying is beneficial to minimize expenses and losses of raw fish and support the development of a large-scale, standardized dried fish industry, and unemployment can also be reduced. Limitations of this study include variability in raw materials, and future research should use larger samples, explore additional drying methods, assess sensory quality and shelf life, and emphasize the application of this drying method at an industrial level.

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