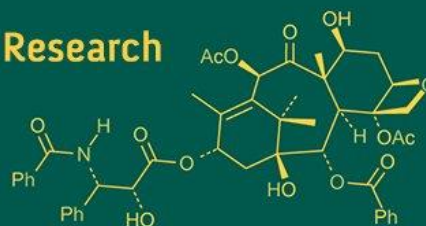
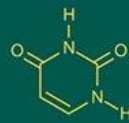


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693

ISSN Online: 2617-4707

NAAS Rating (2026): 5.29

IJABR 2026; 10(9): 05-13

www.biochemjournal.com

Received: 04-06-2026

Accepted: 08-07-2026

BR JukseniyaDepartment of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**VV Vishwasrao**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**DI Pathan**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**JM Koli**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**VG Yewale**Department of Fisheries Engineering,
College of Fisheries, Ratnagiri,
Maharashtra, India**AS Desai**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**SS Sawant**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**EA Goud**Department of Fisheries Engineering,
College of Fisheries, Ratnagiri,
Maharashtra, India**MT Sharangdhar**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**AS Sharangdhar**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**Panchkarla Sedyaw**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**S Dhariniswara**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**DR Murkute**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India**Corresponding Author****BR Juksemiya**Department of Fish Processing
Technology and Microbiology, College of
Fisheries, Ratnagiri, Maharashtra, India

Standardization of Ingredients in Shrimp Cutlet Prepared from Kiddi shrimp *Parapenaeopsis styliifera*, (H.Milne Edwards, 1837) During Chilled Storage

BR Jukseniya, VV Vishwasrao, DI Pathan, JM Koli, VG Yewale, AS Desai, SS Sawant, EA Goud, MT Sharangdhar, AS Sharangdhar, Panchkarla Sedyaw, S Dhariniswara and DR Murkute

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i9a.9799>

Abstract

Marine crustaceans, particularly decapod species such as shrimp, are rich in high-quality protein. The development of value-added shrimp cutlets not only increases the commercial value of shrimp but also enhances consumer acceptability and extends shelf life while maintaining product quality during storage. This study aimed to develop and standardize a value-added shrimp cutlet from *Parapenaeopsis styliifera* and evaluate its proximate composition, sensory evaluation, biochemical changes and microbiological quality during chilled storage. The standardized product was packed in low-density polyethylene (LDPE) bags, sealed using a sealing machine and stored in chilled conditions for 15 days and quality of the product was evaluated at 3-day intervals. At initial day of storage period, moisture, protein, fat, ash, and carbohydrate contents of the product were $57.60 \pm 0.12\%$, $8.94 \pm 0.16\%$, $6.53 \pm 0.12\%$, $3.64 \pm 0.13\%$, and $23.28 \pm 0.52\%$, respectively. At the end of the storage period, these values changed to $60.05 \pm 0.12\%$, $7.64 \pm 0.12\%$, $7.91 \pm 0.17\%$, $3.05 \pm 0.12\%$, and $21.34 \pm 0.53\%$, respectively. Biochemical parameters including pH, total volatile base nitrogen (TVB-N), trimethylamine (TMA), free fatty acids (FFA) and peroxide value (PV), increased progressively throughout the storage period. Total plate count increased gradually throughout the storage, while *Escherichia coli* and *Staphylococcus aureus* were not detected. The product remained acceptable for human consumption up to the 12th day of chilled storage.

Keywords: Shrimp cutlet, *Parapenaeopsis styliifera*, standardization, chilled storage, proximate composition, biochemical indices.

Introduction

Shellfish is rich in nutrients, proteins, bioactive peptides, polyunsaturated fatty acids, carotenoids, vitamins and essential minerals. These components contribute to improve human nutrition and support various physiological functions (Venugopal, 2017) [24]. In 2024, global per capita consumption of aquatic animal foods was estimated at 21.3 kg, while total global fisheries and aquaculture production reached 235 million tonnes. India is the second-largest fish producer in the world and a leading contributor to global aquaculture, with the national fisheries sector producing 197.75 lakh tonnes (FAO, 2026). Total fish production in Maharashtra stands at 3.5 lakh tonnes (0.35 million tonnes), with shrimp landings contributing 81,000 tonnes. In Maharashtra, penaeid shrimp landings during the same year were reported to be 43,000 tonnes, while non-penaeid shrimp landings accounted for 38,000 tonnes (Handbook on Fisheries Statistics, 2025). *P. styliifera*, a small-sized shrimp species of high commercial importance, is widely distributed in Indian waters. It is primarily a coastal species but known to occur up to depths of about 90 m in the western Indian Ocean (Miquel, 1984) [14]. In *P. styliifera*, the mean values of moisture, protein, lipids and total ash were found to be 73.03%, 18.24%, 6.51%, 1.02%, and 1.20%, respectively. Both the flesh and shell contained a total of 18 amino acids, comprising essential amino acids (EAAs), semi-essential amino acids (SEAAAs) and non-essential amino acids (NEAAAs) (Gopan *et al.* 2020) [7]. Shifting modern lifestyles have driven a growing consumer demand for seafood that combines convenience with high quality. Consumers increasingly seek ready-to-cook (RTC)

and ready-to-serve (RTS) products that are hygienically processed and offered in attractive packaging (Praneetha *et al.* 2015) ^[18]. Consequently, the processing of shrimp into value-added commodities has expanded rapidly. Applying coatings such as batter and breading enhances visual appeal, color, texture, and flavor profiles. Furthermore, substantial potential exists to expand seafood consumption in India through diverse value-added offerings, including whole dressed fish, fillets, steaks, and cured, smoked, or marinated products. Additionally, innovative RTC items such as patties, cutlets, burgers, sausages, and seafood pizzas can effectively diversify consumer choices (Pawar *et al.* 2012) ^[16]. Value-added fish products support rural livelihoods and generate employment opportunities, contributing to the economic sustainability of local communities (Kyule *et al.* 2025) ^[12]. The development of value-added products, such as shrimp cutlets, holds significant importance in the modern food industry due to the growing consumer demand for convenient, nutritious, and ready-to-cook food options. The objectives of the present study are to formulate, standardize the recipe for, and prepare value-added shrimp cutlets using Kiddi shrimp (*P. stylifera*), determine its proximate composition, and evaluate its sensory, biochemical, and microbial stability throughout a 15-day chilled storage trial.

2. Materials and Methods

2.1. Collection and Transportation of Shrimp

Fresh Kiddi shrimp *P. stylifera*, were collected from Mirkarwada jetty Ratnagiri, Maharashtra, India and transported to the Fish Processing Laboratory, College of Fisheries, Ratnagiri, in an insulated ice box using a shrimp-

to-ice ratio of 1:1 to maintain freshness and quality during transportation. The shrimp were thoroughly wash several times with water to eliminate blood and other impurities. Cleaned shrimp were beheaded, peeled, deveined and again washing to remove any residual unwanted material from the shrimp.

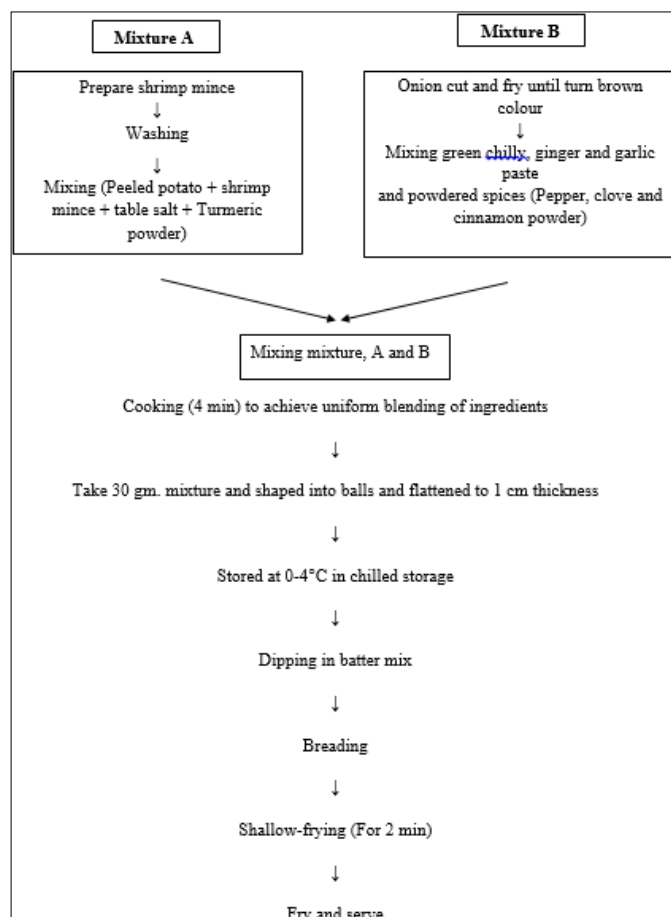
2.2. Preparation of Shrimp Cutlets

The cleaned and prepared shrimp were minced by hand-chopping using a knife. Fresh potatoes were boiled until soft, peeled and mashed. The remaining ingredients like onion, green chilli, coriander leaves, ginger-garlic paste, table salt, pepper powder, clove powder, cinnamon powder, turmeric powder and bread powder were weighed according to the formulation. The fried ingredients and mashed potato were mixed with shrimp mince to obtain a homogeneous mixture. This mixture was cooked for approximately 4 minutes with continuous stirring to ensure uniform blending of all ingredients. After cooking, the mixture was allowed to cool to room temperature for about 20-25 minutes. Portions of 30 g of the prepared dough were shaped into round balls and flattened to an approximate thickness of 1 cm to form cutlets. The prepared cutlets were stored under chilled conditions (0–4°C) prior to coating. For sensory evaluation, each cutlet was dipped in batter, uniformly coated with breadcrumbs, and shallow-fried for approximately 2 minutes on each side.

2.3. Packaging Material

The control and shrimp cutlets were packed in LDPE pouches (30cm × 20cm, 0.05mm thickness) and were storage at 0-4°C in chiller.

Flow chart 1: Shrimp Cutlet Prepared from Kiddi shrimp *Parapenaeopsis stylifera*



2.4. Proximate composition

The proximate composition of cutlet samples was analyzed for moisture, protein, fat, ash and carbohydrate content following standard AOAC (2005) methods. These parameters help determine the proximate composition of the product and provide insight into its overall quality and nutritional value.

2.5. Biochemical Parameters

Biochemical quality changes in the shrimp cutlets during chilled storage were evaluated by determining pH, free fatty acids (FFA), and peroxide value (PV) in accordance with standard AOAC (2005) methods. Total volatile base nitrogen (TVB-N) and trimethylamine nitrogen (TMA-N) were estimated using the Conway micro-diffusion method as described by Beatty and Gibbons (1936).

2.6. Microbiological Analysis

The microbiological quality of shrimp cutlets during chilled storage were assessed by determining the total plate count (TPC) according to the methods described by APHA (1984). The presence of *E. coli* and *S. aureus* were analysed following the procedures recommended by USDA (2022).

2.7. Sensory analysis

Analysed both control and treatment using 1 to 9 point hedonic scale carried out based on 6 sensory attributes like appearance, taste, texture, colour, odour and overall acceptability during sensory evaluation (Hough, 2010)

2.8. Statistical Analysis: The research experiment was performed in triplicates. Data were analysed for degree of variation and significance difference using analysis of variance (ANOVA). The differences among the treatment

means were evaluated by the Tukey test. The significant difference was defined at $p \leq 0.05$ (Snedecor, 1967)^[22]. The data were analysed using IBM SPSS statistics (Version 27) predictive analytics software.

3. Results and Discussions

3.1. Proximate composition of Kiddi shrimp

The study shows that the proximate profile of Kiddi shrimp comprised $72.90 \pm 0.15\%$ moisture $18.27 \pm 0.12\%$ protein, $6.51 \pm 0.10\%$ lipid, $1.20 \pm 0.05\%$ ash. The proximate composition of Kiddi shrimp is shown in (Table 1). Similar trend in moisture content was reported by Mangle *et al.* (2024) and Ramtake *et al.* (2025), 73.03% and 72.80% respectively. In present study protein content was observed to be $18.27 \pm 0.12\%$, and similar values were reported by Mangle *et al.* (2024) and Ramtake *et al.* (2025), 18.22% and 18.24% respectively. In these research fat content was observed to be $6.51 \pm 0.10\%$, similar results were observed by Mangle *et al.* (2024) and Ramtake *et al.* (2025), 6.51% and 6.40% respectively. In present study ash was observed to be 1.20 ± 0.05 , similar trend in ash content was reported by Mangle *et al.* (2024) and Ramtake *et al.* (2025), 0.90% and 1.20% recorded respectively.

Table 1: Proximate composition of Kiddi shrimp, *Parapenaeopsis stylifera*

Sr. No	Attributes	Composition (%)
1	Moisture	72.90 ± 0.15
2	Protein	18.27 ± 0.12
3	Lipid	6.51 ± 0.10
4	Ash	1.20 ± 0.05

Mean and standard deviation was expressed in terms of three determinations

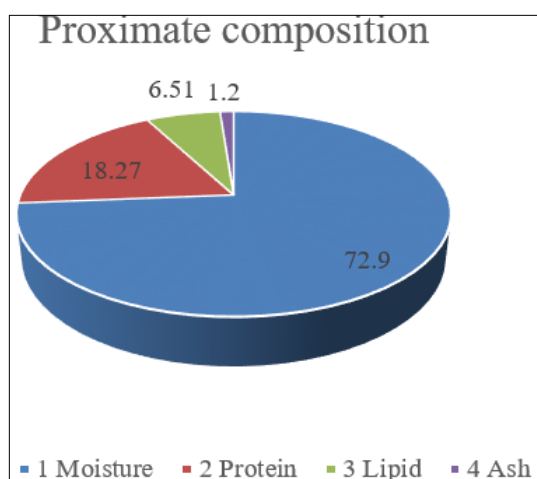


Fig 1: Proximate composition of Kiddi shrimp, *Parapenaeopsis stylifera*

3.2. Quality analysis of kiddi shrimp

3.2.1 Biochemical parameters of kiddi shrimp

In the present investigation, biochemical parameters including TMA-N, TVBN, pH, FFA, and PV were evaluated to determine the quality and freshness of *P. stylifera*, and the observed values were 2.15 ± 0.04 mg/100 g, 5.20 ± 0.10 mg/100 g, 6.51 ± 0.03 , $0.32 \pm 0.02\%$ as oleic acid, 2.15 ± 0.04 meq O_2 /kg respectively and are shown in (Table 2). Prabhakar *et al.* (2020)^[17] reported that TMA-N and TVB-N are important biochemical indicators used to assess freshness and spoilage of shrimp. An increase in TMA-N indicates microbial activity and formation of

trimethylamine, while higher TVB-N reflects the degradation of proteins and nitrogenous compounds. Ramtake *et al.* (2025) reported that biochemical quality parameters, such as TMA-N, TVB-N, pH, FFA and PV, were observed as 1.70 ± 0.05 mg/100 g, 8.42 ± 0.03 mg/100 g, 6.50 ± 0.01 , $0.72 \pm 0.04\%$ oleic acid and 3.30 ± 0.04 meq O_2 /kg, respectively.

3.2.2 Microbial parameter of Kiddi shrimp

The total plate count (TPC) of Kiddi shrimp was 2.12 ± 0.02 log cfu/g. The pathogenic bacteria *Escherichia coli* and *Staphylococcus aureus* were not detected in shrimp

indicating that shrimp remained free from these pathogenic bacteria during the time of research as shown in (Table 2). Mangle *et al.* (2024) observed similar findings, reporting an initial total bacterial count of 2.7×10^2 CFU/g in fresh shrimp and no detection of *E. coli* and *S. aureus*. Apate *et al.* (2026) also observed similar TPC of 2.43 ± 0.02 (log cfu/g) and absence of *E. coli* and *S. aureus*.

Table 2: Quality analysis of Kiddi shrimp

Sr. no	Quality parameters	Observed values
Biochemical quality		
1	pH	6.51 $\pm$ 0.03
2	TMA-N (mg/100g)	2.15 $\pm$ 0.04 mg/100 g
3	TVB -N (mg/100g)	5.20 $\pm$ 0.10 mg/100 g
4	PV (meq of O ₂ /kg)	2.15 $\pm$ 0.04 meq of O ₂ /kg
5	FFA (% as oleic acid)	0.32 $\pm$ 0.02% as oleic acid
Microbial quality		
6	Total plate count (log cfu/g)	2.12 $\pm$ 0.02 (log cfu/g)
7	<i>Escherichia coli</i> (log cfu/g)	Not detected
8	<i>Staphylococcus aureus</i> (log cfu/g)	Not detected

3.2.3 Percentage yield of shrimp mince:

The whole shrimp was weighed initially before processing. After dressing weight of the recovered shrimp meat was recorded. From 100 g of whole shrimp, approximate 35 g of edible mince was obtained after dressing, resulting in a yield of 30%.

Sr. no	Dressing of shrimp	Yield%
1	Raw shrimp	100
2	Shrimp mince	35.46 $\pm$ 0.54

3.4. Standardization of ingredient

3.4.1. Standardization of shrimp mince in shrimp cutlet

In the present study T₄ containing 40g shrimp mince recorded the highest overall acceptability score of 8.4 $\pm$ 0.48 when compared to other treatments with different ratios of shrimp mince such as T₁ (10g), T₂ (20g), T₃ (30g), T₅ (50g) Used in cutlet as shown in (Table 3). Sensory scores recorded at this incorporation level could be associated with

the favourable effects of shrimp muscle constituents, including proteins and flavour-active compounds, along with better moisture retention and juiciness resulting in better overall acceptability at 40g of shrimp meat. Comparable findings have been recorded in value-added fish products, where an optimum level of catla fish meat improved sensory characteristics, whereas excessive incorporation negatively affected product texture and acceptability (Pawar *et al.* 2012) [16]. Similar findings were recorded by various authors Devi *et al.* (2014) and Kumar *et al.* (2022) [5, 11]. When the shrimp mince concentration was between 20% and 40%, the product showed good overall acceptability. However, at higher concentrations of shrimp mince, panellists showed less preference for the product.

Table 3: Sensory Score for Standardization of Shrimp Mince in Shrimp Cutlet

Characteristics	Control	T1 (10g)	T2 (20g)	T3 (30g)	T4 (40g)	T5 (50g)
Appearance	7.4 $\pm$ 0.84 _a	6.9 $\pm$ 0.8 _{7a}	7.6 $\pm$ 0.6 _{9ab}	7.9 $\pm$ 1.10 _{ab}	8.6 $\pm$ 0.6 _{9b}	7.8 $\pm$ 0.91 _{ab}
Taste	7.2 $\pm$ 1.31 _{abc}	6.5 $\pm$ 0.9 _{7a}	7.0 $\pm$ 0.8 _{1ab}	7.6 $\pm$ 0.96 _{abc}	8.3 $\pm$ 0.8 _{2c}	7.9 $\pm$ 0.87 _{bc}
Texture	7.1 $\pm$ 0.87 _a	7.5 $\pm$ 0.5 _{2a}	7.8 $\pm$ 0.9 _{1ab}	6.9 $\pm$ 1.10 _a	8.6 $\pm$ 0.5 _{1b}	7.4 $\pm$ 0.69 _a
Colour	6.6 $\pm$ 0.96 _a	7.3 $\pm$ 1.0 _{1ab}	7.6 $\pm$ 0.8 _{4ab}	7.2 $\pm$ 1.54 _{ab}	8.2 $\pm$ 0.7 _{8b}	6.8 $\pm$ 0.78 _a
Odour	6.8 $\pm$ 1.22 _a	6.4 $\pm$ 0.9 _{6a}	7.1 $\pm$ 1.1 _{0ab}	7.6 $\pm$ 0.84 _{ab}	8.3 $\pm$ 0.8 _{2b}	7.3 $\pm$ 0.94 _{ab}
OA	7.2 $\pm$ 1.22 _{ab}	7.0 $\pm$ 1.0 _{3a}	7.5 $\pm$ 0.5 _{2ab}	7.6 $\pm$ 0.91 _{bc}	8.4 $\pm$ 0.4 _{8c}	7.4 $\pm$ 0.78 _{abc}

Data are expressed as mean $\pm$ standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory attributes were evaluated using a 1 to 9-point hedonic scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

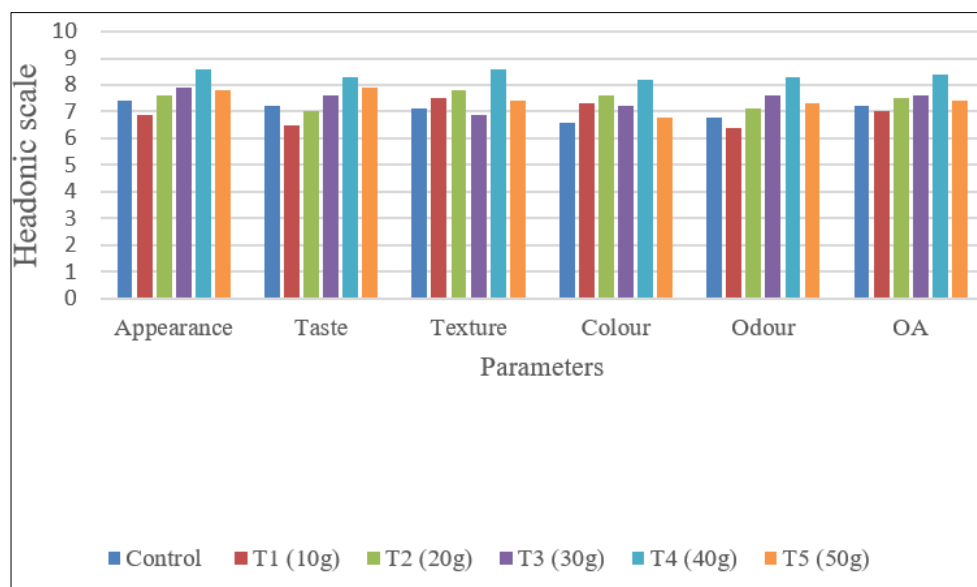


Fig 2: Mean results of sensory characteristics for standardizing the percentage of Shrimp mince in shrimp cutlet.

3.4.2. Standardization of salt in shrimp cutlet

In the present study T₁ (2 g salt) showed the highest overall acceptability score of 8.2 $\pm$ 0.51 with comparison to other

sample with different ratios of salt such as T₂ (3g), T₃ (4g) used in cutlet. Salt is an important ingredient that enhances flavour in overall acceptability of shrimp product. The

higher sensory score recorded for the 3% salt formulation was observed by Sharangdhar *et al.* (2026) [21]. Lower salt content resulted in a less flavoured product, whereas excessive salt addition negatively affected the taste. Therefore, maintaining an optimum level of salt is important

for achieving better overall acceptability. Similar results were observed by Chandra *et al.* (2020). Ninan *et al.* (2008) [15] used 3g of salt in cutlet prepared from tilapia (*Oreocromis mossambicus*).

Table 4: Sensory Score for Standardization of Salt in Shrimp Cutlet

Characteristics	Control	T1 (2g)	T2 (3)	T3 (4g)
Appearance	6.9±1.19 ^a	8.5±0.84 ^b	7.4±1.07 ^{ab}	7.7±1.05 ^{ab}
Taste	7.0±0.94 ^{ab}	8.4±0.69 ^c	7.9±1.10 ^{bc}	6.3±1.05 ^a
Texture	6.5±0.84 ^a	8.1±1.10 ^b	7.2±1.13 ^{ab}	7.8±1.13 ^b
Colour	7.4±0.69 ^{ab}	8.0±0.66 ^b	6.8±1.39 ^a	7.6±0.96 ^{ab}
Odour	7.0±1.15 ^{ab}	8.1±0.87 ^b	7.6±0.69 ^b	6.3±1.13 ^a
OA	7.0±0.73 ^{ab}	8.2±0.51 ^c	7.4±0.94 ^{ab}	6.7±1.26 ^a

Data are expressed as mean ± standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

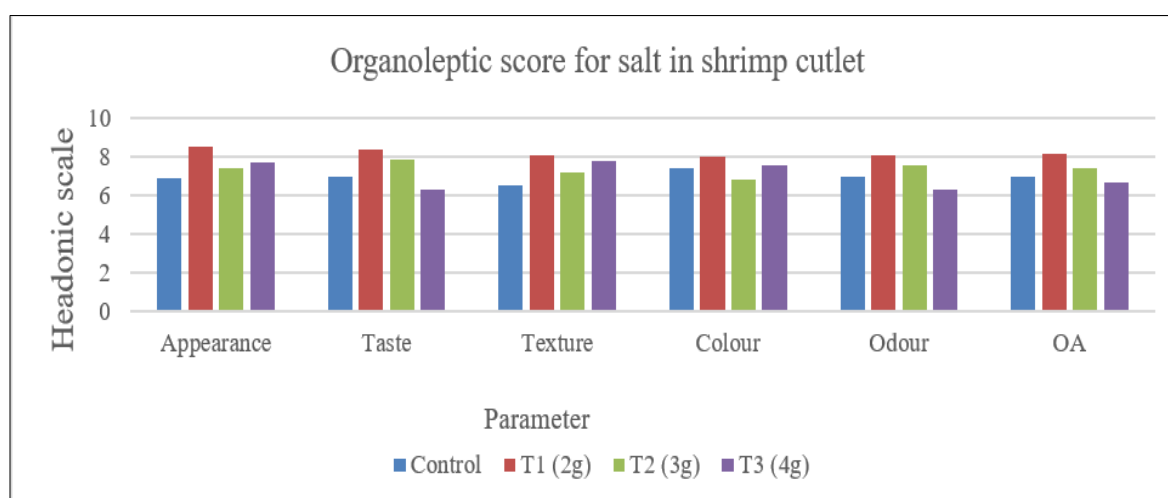


Fig 3: Mean results of sensory characteristics for standardizing the percentage of salt in shrimp cutlet.

3.4.3. Standardization of different level of green chilly in shrimp cutlet

In the present study, T₂ (5 g) showed the highest overall acceptability score of 8.5 ± 0.52 in comparison to other sample different ratios of green chilly such as T₁ (2.5g), T₃ (7.5g) used in cutlet. Species variation has also been shown

to influence the proportion of green chilli required relative to mince weight. A ratio of 5g of green chilli, ginger and garlic to meat was selected to achieve better taste and overall acceptability (Pawar *et al.* 2012) [16]. In the present study, panellists observed that a higher proportion of green chilly resulted in an excessively spicy flavour of the cutlet.

Table 5: Sensory Score for Standardization of Green Chilly in Shrimp Cutlet

Characteristics	Control	T1 (2.5g)	T2 (5g)	T3 (7.5g)
Appearance	7.8±0.63 ^a	7.2±0.63 ^a	8.7±0.48 ^b	7.1±0.87 ^a
Taste	7.7±1.05 ^{ab}	6.9±0.56 ^a	8.6±0.66 ^b	7.1±0.87 ^a
Texture	7.8±0.78 ^{ab}	7.2±0.63 ^a	8.2±0.78 ^b	7.4±0.96 ^{ab}
Colour	7.5±0.70 ^{ab}	7.2±0.63 ^a	8.2±0.42 ^b	7.5±0.70 ^{ab}
Odour	7.5±0.52 ^{ab}	7.3±0.67 ^a	8.1±0.31 ^b	7.8±0.63 ^{ab}
OA	7.5±0.82 ^{ab}	7.1±0.56 ^a	8.5±0.52 ^b	7.6±0.84 ^a

Data are expressed as mean ± standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

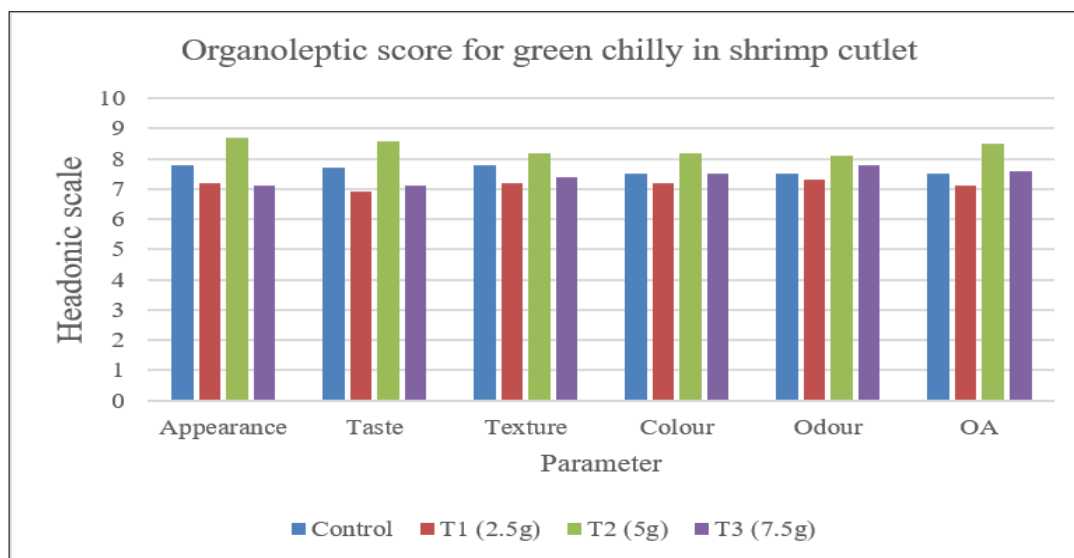


Fig 4: Mean results of sensory characteristics for standardizing the percentage of green chilly in shrimp cutlet.

3.4.4. Standardization of ginger garlic in shrimp cutlet

Among the treatments, T₂ (10 g) showed the highest overall acceptability score of 8.5 ± 0.52 . The other different ratios of ginger garlic paste such as T₂ (5g), T₃ (15g) were used in cutlet. Studies reported that optimum levels of ginger and

garlic improved the flavour, sensory quality of fish-based products, while the appropriate concentration varied with the product and formulation. These findings were supported by the standardization of ginger-garlic paste levels in shrimp cutlet by Kolekar *et al.* (2012) and Kadam *et al.* (2024)^[8, 9].

Table 6: Sensory Score for Standardization of Ginger Garlic in Shrimp Cutlet

Characteristics	Control	T1 (5g)	T2 (10g)	T3 (15g)
Appearance	7.4±0.51 ^a	7.4±1.00 ^a	8.5±0.70 ^b	6.6±0.51 ^a
Taste	7.7±1.15 ^{bc}	7.1±1.19 ^{ab}	8.5±0.52 ^c	6.4±0.51 ^a
Texture	7.3±0.67 ^b	7.2±0.91 ^{ab}	8.4±0.51 ^c	6.4±0.51 ^a
Colour	7.0±0.94 ^{ab}	7.0±1.05 ^{ab}	7.9±0.87 ^b	6.2±0.63 ^a
Odour	7.0±0.94 ^a	7.1±0.73 ^a	8.3±0.67 ^b	6.6±0.69 ^a
OA	7.1±0.99 ^a	7.1±1.10 ^a	8.5±0.52 ^b	6.5±0.52 ^a

Data are expressed as mean $\pm$ standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

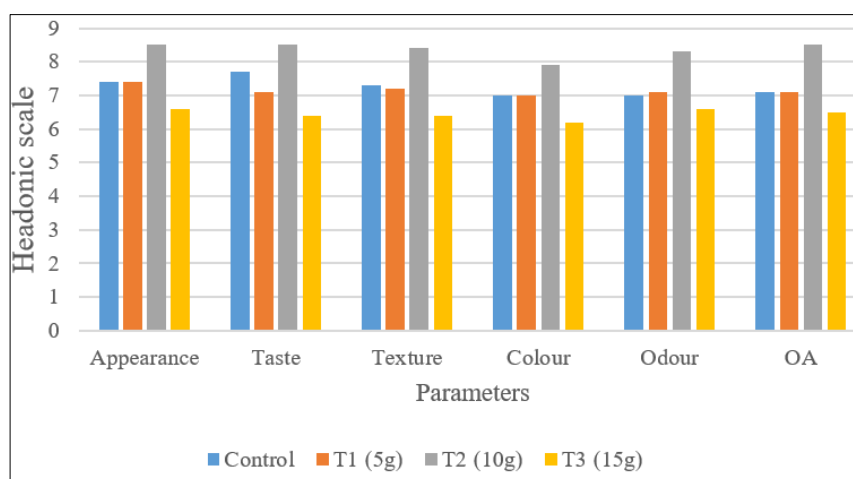


Fig 5: Mean results of sensory characteristics for standardizing the percentage of ginger garlic in shrimp cutlet

3.4.5. Standardization of turmeric powder in shrimp cutlet

Among the treatments, T₁ (0.1 g) showed the highest overall acceptability score of 8.7 ± 0.48 . Different ratios of turmeric powder such as T₂ (0.2g), T₃ (0.3g) were used in cutlet. Turmeric improved the colour, taste and odour of the

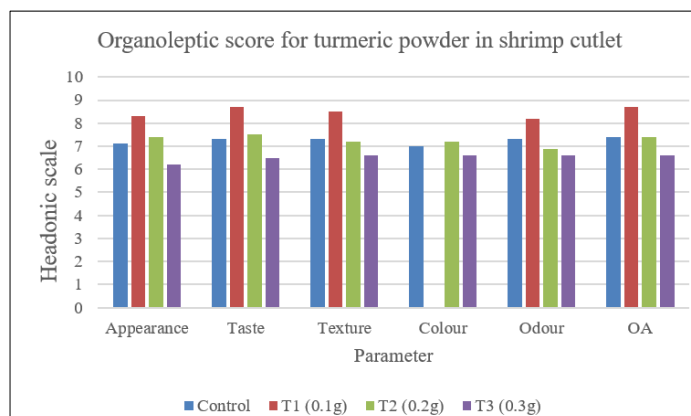
product, while excessive addition may result in a strong colour and flavour, reducing acceptability. Similar use of turmeric in fish cutlets was reported by Pawar *et al.* (2012) and Rathod *et al.* (2012)^[16, 20].

Table 7: Sensory score for standardization of turmeric powder in shrimp cutlet

Characteristics	Control	T1 (0.1g)	T2 (0.2g)	T3 (0.3g)
Appearance	7.1±0.73 ^b	8.3±0.67 ^c	7.4±0.69 ^b	6.2±0.78 ^a
Taste	7.3±0.94 ^{ab}	8.7±0.67 ^c	7.5±0.84 ^b	6.5±0.70 ^a
Texture	7.3±0.67 ^a	8.5±0.70 ^b	7.2±0.78 ^a	6.6±0.84 ^a
Colour	7.0±0.47 ^a	8.4±0.69 ^b	7.2±1.03 ^a	6.6±0.69 ^a
Odour	7.3±0.67 ^a	8.2±0.78 ^b	6.9±0.73 ^a	6.6±0.69 ^a
OA	7.4±0.51 ^a	8.7±0.48 ^b	7.4±0.96 ^a	6.6±0.69 ^a

Data are expressed as mean ± standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

**Fig 6:** Mean results of sensory characteristics for standardizing the percentage of turmeric powder in shrimp cutlet.

3.4.6. Standardization of onion in shrimp cutlet

In the present study T₁ (20 g) showed the highest overall acceptability score of 8.1 ± 0.48. Different ratios of onion such as T₂ (25g), T₃ (30g) were used in cutlet. Findings reported that the 20g onion-to-shrimp mince ratio was

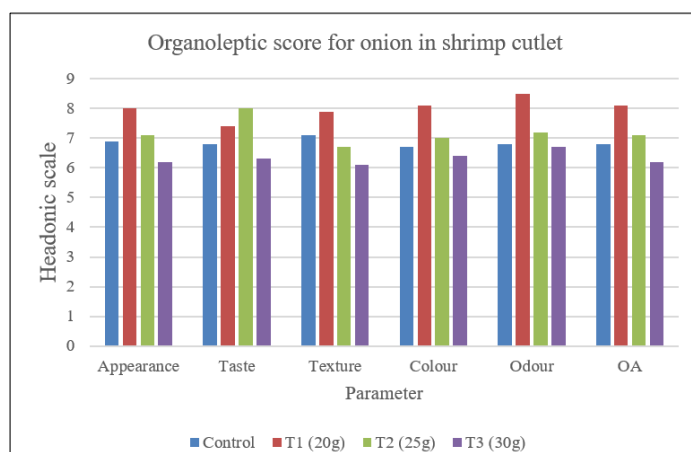
superior to the other levels tested, providing better taste (Kudale *et al.* 2018) [10]. Whereas excessive onion may impart a strong flavour and adversely affect sensory quality. Similar findings were reported by Rathod *et al.* (2012) [20].

Table 8: Sensory score for standardization of onion in shrimp cutlet

Characteristics	Control	T1 (20g)	T2 (25g)	T3 (30g)
Appearance	6.9±1.19 ^{ab}	8.0±1.24 ^b	7.1±1.19 ^{ab}	6.2±1.13 ^a
Taste	6.8±1.31 ^{ab}	7.4±1.57 ^{ab}	8.0±1.24 ^b	6.3±1.15 ^a
Texture	7.1±1.44 ^{ab}	7.9±0.99 ^b	6.7±1.25 ^{ab}	6.1±1.19 ^a
Colour	6.7±0.82 ^a	8.1±0.73 ^b	7.0±1.24 ^{ab}	6.4±1.42 ^a
Odour	6.8±0.91 ^a	8.5±0.52 ^b	7.2±1.22 ^a	6.7±1.41 ^a

Data are expressed as mean ± standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point hedonic scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

**Fig 7:** Mean results of sensory characteristics for standardizing the percentage of onion in shrimp cutlet.

3.4.7. Standardization of bread crumb in shrimp cutlet

Among the treatments, T₂ (20 g) showed the highest overall acceptability score of 8.4 ± 0.42 . Different ratios of bread crumb such as T₁ (10g), T₃ (30g) were used in cutlet. Bread crumb improved the appearance, crispness, texture and overall acceptability of the product, when we use excessive

bread crumb may adversely affect product quality. Various authors observed that different breading materials influenced coating, adhesion and bread crumb improved the appearance, crispness (Nanda *et al.* (2020) and Balange *et al.* (2020) [4].

Table 9: Sensory score for standardization of bread crumb in shrimp cutlet

Characteristics	Control	T1 (10g)	T2 (20g)	T3 (30g)
Appearance	6.9±1.59 ^a	6.4±1.34 ^a	8.7±0.48 ^b	7.3±1.38 ^a
Taste	7.4±1.07 ^a	7.0±1.33 ^a	8.6±0.51 ^b	7.7±0.82 ^{ab}
Texture	7.4±0.96 ^{ab}	7.1±0.73 ^a	8.4±0.69 ^b	6.6±1.07 ^a
Colour	6.3±1.05 ^a	7.0±0.81 ^{ab}	8.0±0.81 ^b	7.3±0.82 ^{ab}
Odour	6.8±1.03 ^a	7.1±0.99 ^a	8.7±0.48 ^b	7.3±0.67 ^a
OA	7.1±1.19 ^a	6.9±0.84 ^a	8.4±0.42 ^b	7.6±0.84 ^a

Data are expressed as mean $\pm$ standard deviation (n = 10). Mean values bearing different superscript letters within the same row differ significantly ($p < 0.05$), whereas values with identical superscripts are not significantly different. Sensory

attributes were evaluated using a 1 to 9-point hedonic scale, where a score of 9 represented “like extremely” and a score of 1 represented “dislike extremely”.

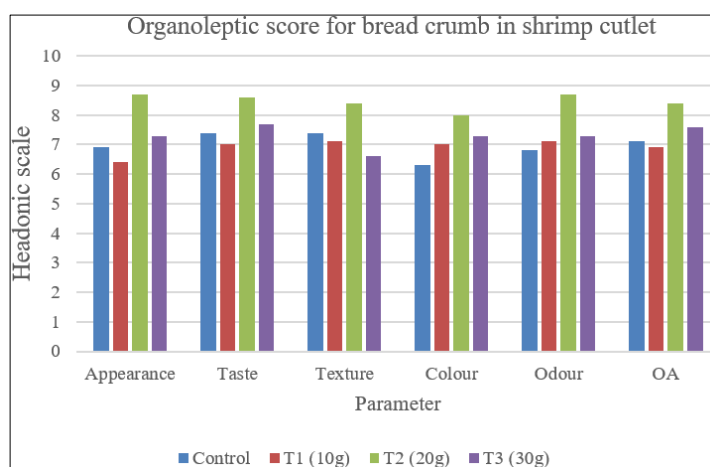


Fig 8: Mean results of sensory characteristics for standardizing the percentage of bread crumb in shrimp cutlet

Table 10: Final standardized recipe for shrimp cutlet

Sr. No	Ingredients	Quantity (g)	Quantity (%)
1	Shrimp mince	40	24.55
2	Potato	60	36.83
3	Table salt	2	1.23
4	Green chilly	5	3.07
5	Coriander leaves	5	3.07
6	Ginger Garlic paste	10	6.14
7	Onion	20	12.28
8	Pepper powder	0.3	0.18
9	Clove powder	0.3	0.18
10	Cinnamon powder	0.2	0.12
11	Turmeric powder	0.1	0.06
12	Bread powder	20	12.28

Table 11: Preparation of Batter mix for shrimp cutlet

Sr. No	Ingredients	Quantity (g)	Quantity (%)
1	Maida flour	77.50	77.50
2	Corn flour	9.70	9.70
3	Bengal gram flour	9.70	9.70
4	Table salt	1.20	1.20
5	Sodium Tri Polyphosphate	0.47	0.47
6	Carboxyl Methyl Cellulose	0.47	0.47
7	Turmeric powder	0.96	0.96

4. Conclusion: These study successfully developed and standardized a value-added shrimp cutlet using Kiddi

shrimp (*Parapenaeopsis styliфера*). Among the different formulations evaluated, the formulation containing 40 g

shrimp mince showed the highest overall sensory acceptability, while the levels of salt, green chilli, ginger-garlic paste, turmeric, onion and bread crumbs were also successfully standardized based on sensory evaluation. Kiddi shrimp is rich in nutritional composition, with protein, lipid and minerals. During chilled storage, the biochemical indices (pH, TVB-N, TMA-N, FFA, and PV) increased progressively with storage time of 15 days but remained within acceptable limits up to the 12th day. Microbiological analysis confirmed that the product remained safe during storage, with not detection of *E. coli* and *S. aureus* throughout the storage period. Sensory evaluation revealed a gradual decrease in overall acceptability with increasing storage period.

5. Acknowledgements

I express my sincere gratitude to my major advisor, Shri. V. V. Vishwasrao for his valuable guidance, encouragement, and continuous support throughout this research. I extend my heartfelt thanks to my Advisory Committee members, Dr. D. I. Pathan, Professor (CAS), Dr. J. M. Koli, Professor (CAS) and Dr. V. G. Yewale, for their valuable suggestions and guidance. Sincerely thank the Dean, College of Fisheries, Ratnagiri, the Head of the Department of Fish Processing Technology and Microbiology and all the teaching and non-teaching staff for providing the facilities and support necessary to complete this work.

References

1. Association of Official Analytical Chemists International. Official methods of analysis of the Association of Official Analytical Chemists International. 18th ed. Horwitz W, editor. Washington (DC): AOAC International; 2005. p. 35, 2-36.
2. American Public Health Association. Compendium of methods for the microbiological examination of foods. 2nd ed. Washington (DC): APHA; 1984. p. 45.
3. Apte RS, Desai AS, Koli JM, Sawant SS, Chaudhari KJ, Pathan DI, *et al.* Standardization of various food ingredients to develop protein enriched kiddi (*Parapeneopsis stylifera*) shrimp paratha. Int J Agric Biol Res. 2026;10(7):165-174.
4. Balange AK, Nayak BB, Xavier KAM. Evaluation of different conventional breeding materials on functional quality attributes of battered and breaded fish cutlets. J Aquat Food Prod Technol. 2020;29(7):641-649.
5. Devi PB, Vijayabharathi R, Sathyabama S, Malleshi NG, Priyadarisini VB. Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fibre: a review. J Food Sci Technol. 2014;51(6):1021-1040.
6. Food and Agriculture Organization of the United Nations. The state of world fisheries and aquaculture 2024: blue transformation in action. Rome: FAO; 2024.
7. Gopan AS, Anandan R, Maiti MK, Varghese T. Nutritional profiling of Kiddi shrimp, *Parapeneopsis stylifera* (H. Milne Edwards, 1837), collected from southwest coast of India. Int J Fish Aquat Stud. 2020;8(3):1944-1950.
8. Kadam SD, Sawant SS, Sharangdher ST, Vishwasrao VV, Yadav BM, Desai AS, *et al.* Standardization of recipe for the development of masala coated tilapia (*Oreochromis niloticus*) steaks. J Exp Zool India. 2024;27(1):799-803.
9. Kolekar AD, Pagarkar AU, Kedar JC, Baug TE, Bhatkar VR. Standardisation of recipe for fish ball in curry from *Catla catla*. Biosci Biotechnol Res Asia. 2012;9(2):831-835.
10. Kudale AS, Pagarkar AU, Gaikwad BV, Ranveer RC, Pujari KH, Rathod NB, *et al.* Standardisation of recipe for batter and breaded product Acetes cutlet from Jawala, *Acetes indicus*. Biosci Biotechnol Res Commun. 2018;11(4):563-570.
11. Kumar A, Tomer V, Kaur A, Kumar V, Gupta K. Millets: a solution to agrarian and nutritional challenges. Agric Food Secur. 2021;10(1):1-15.
12. Kyule D, Munguti J, Muthoka M, Opiyo M, Abwao J, Maundu A. A review of fish value-added products in Kenya: current status, challenges and areas for improvement. Sustain Aquat Res. 2025;4(1):116-142.
13. Mangale SM, Sharangdher ST, Koli JM, Vishwasrao VV, *et al.* Standardization of battered and breaded shrimp fingers from Kiddi shrimp (*Parapeneopsis stylifera*). J Exp Zool India. 2024;27(1):805-809.
14. Miquel JC. Shrimps and prawns. In: Fischer W, Bianchi G, editors. FAO species identification sheets for fishery purposes: Western Indian Ocean (Fishing Area 51). Rome: FAO; 1984. p. 851-865.
15. Ninan G, Bindu J, Joseph J. Frozen storage studies of minced-based products developed from tilapia (*Oreochromis mossambicus*, Peter 1852) fish. Fish Technol. 2008;45(1):35-42.
16. Pawar PP, Pagarkar AU, Rathod NB, Baug TE, Rather MA. Standardisation of recipe for fish cutlet product from freshwater fish Catla (*Labeo catla*). Eur J Exp Biol. 2012;2(6):2043-2048.
17. Prabhakar PK, Vatsa S, Srivastav PP, Pathak SS. A comprehensive review on freshness of fish and assessment: analytical methods and recent innovations. Food Res Int. 2020;133:109157.
18. Praneetha SS, Dhanapal K, Reddy GVS, Balasubramanian A, Kumar GP. Studies on the quality of fish cutlet prepared from Rohu (*Labeo rohita*) during refrigerated storage. Int J Curr Microbiol Appl Sci. 2017;6(12):3262-3271.
19. Ramteke SU, Koli JM, Desai AS, *et al.* Development and quality enhancement of dried Kiddi shrimp (*Parapeneopsis stylifera*) using hurdle technology. Int J Adv Biochem Res. 2025;9(8):120-126. doi:10.33545/26174693.2025.v9.i8b.5108.
20. Rathod NB, Pagarkar AU, Pujari KH, Shingare PE. Chemical, microbial and sensory quality changes of fish cutlets during refrigerated storage. Ecol Environ Conserv. 2014;20(1):435-440.
21. Sharangdhar AS, Koli JM, Desai AS, Sawant SS, Sharangdhar MT, Pathan DI, *et al.* Development and standardization of functional bakery puffs incorporated with Kiddi shrimp (*Parapeneopsis stylifera*) and finger millet (*Eleusine coracana*) flour. Int J Agric Biol Res. 2026;10(6):286-295.
22. Snedecor GW, Cochran WG. Statistical methods. 6th ed. Ames (IA): Iowa State University Press; 1967. p. 304-308.
23. U.S. Food and Drug Administration. Fish and fishery products hazards and controls guidance. June 2022 ed. Silver Spring (MD): U.S. Department of Health and Human Services; 2022. Available from: <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-fish-and-fishery-products-hazards-and-controls>
24. Venugopal V, Gopakumar K. Shellfish: nutritive value, health benefits, and consumer safety. Compr Rev Food Sci Food Saf. 2017;16(6):1219-1242.