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Development of Predusting Mix for Coating of Battered and Breaded Squid Rings from (*Loligo duvauceli*)

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ABSTRACT

In present research work, development of pre-dusting mix for coating of battered and breaded squid ring was prepared from marine water Squid (Loligo duvauceli). The development of pre-dusting mix for coating of battered and breaded squid ring for production of value added products has attracted substantial attention. This serves as a good practice of post-harvest management of ready to eat product. Coated product was prepared using three different pre-dusting mix batter formulation viz., Hydroxypropyl Methyl Cellulose (HPMC), Methyl Cellulose (MC), Gaur Gum (G). In the present study, development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentages by batter mix (3%, 6% 9% and 12%) from HPMC, MC and G. Proximate composition of fresh Squid was observed to be moisture 80.27%, crude protein 16.06%, crude fat 1.26% and ash 1.50% respectively. Biochemical composition of fresh Squid was observed to be Peroxide Value (PV) 1.80 meqO2/kg of fat, Free Fatty Acid (FFA) 1.17% of oleic acid, Total Volatile Base Nitrogen (TVB-N) 15.20 mg/100g of meat respectively. Microbiological composition of fresh Squid was observed to be Total Plate Count (TPC) 1.20×102cfu/g, Staphylococcus aureus, Salmonella and Escherichia coli it was completely absent in Squid. The yield of percentage of fresh Squid was observed to be whole dressed squid at 41% respectively. The proximate composition of squid ring from moisture content of HPMC, MC, G at different percentage (3%, 6%, 9% and 12%) was found to be 66.33, 62.72, 64.55 and 67.28; 67.12, 70.43, 64.56 and 62.17; 72.07, 69.96, 73.49 and 72.45% respectively. Protein content was found to be 16.22, 16.92, 17.61 and 19.85; 13.01, 23.32, 18.71 and 18.90; 12.96, 14.99, 16.18 and 14.84% respectively. Fat content was found to be 10.14, 13.15, 12.60 and 9.06; 14.69, 10.51, 11.21 and 14.10; 10.05, 12.57, 10.06 and 9.93% respectively. Ash content was found to be 6.16, 7.20, 5.20 and 4.80; 1.80, 3.41, 1.98 and 4.81; 3.18, 2.47, 2.25 and 2.77% respectively. The yield of percentage was observed for HPMC, MC and G in different percentage (3%, 6%, 9% and 12%) from 67.0, 67.6, 66.6 and 70.3%; 67.6, 68.6, 67.3 and 66.3%; 67.0, 66.6, 70.0 and 66.0% respectively. Organoleptic evaluation score for development of pre-dusting mix for coating of battered and breaded squid ring i.e. based on organoleptic characteristics like colour, odour, taste, texture and appearance was found to be overall acceptability 12% HPMC, 6% MC, 9% G was rated between 8.0-8.6, 6.0-7.3, 7.0-7.6 respectively. Similarly the PV, FFA, TVB-N, Colour, Texture and TPC changed significantly (p<0.05) between fresh squid and frying process. The development of pre-dusting mix for coating of battered and breaded squid ring from HPMC 12%, MC 6% and G 9% were in general greater than those parameters. The application of edible coatings into pre-dusting mix can be easily introduced into the production process and was beneficial to both food industry and consumers.

Key words: *Squid, Predusting-mix, Squid rings, Batter and breaded*

INTRODUCTION

Consumers around the world increased consumption of fish and fishery product in recent years due to recognition of their nutritional value[54]. In dietary guidelines published by USFDA and department of health and human service ask to eat less fat since more fat consumption reduce approximately 30 to 40 % energy intake[50]. There is wide scope to increase the consumption by developing value added products. There is great demand for seafood based product especially value added products; ready to eat 'convenience' from prominent among them is the group of battered and breaded products. India is one of the major fish producing country in the world which holds second and third position in aquaculture and fisheries. Indian sector has high potentials for domestic nutritional security, employment generation, rural development, gender mainstreaming as well as export earnings[4].

Among the squids, the Indian squid (*Loligo duvauceli*) is the dominant species, catching about 97% all over the country per year. Among the squids, the Indian squid is the dominant species, catching about 97% all over the country per year. The squid plays a major role in balancing the marine ecosystem. Generally, the temperature changes, ocean acidification and climatic changes are likely to affect marine ecosystems and their associated fisheries, adding to the challenges of managing fisheries sustainably. The proposed changes responded quickly in the squids and act as ecosystem indicators of environmental change by minimum growth rate and maximum production. Since, the increase in ocean temperatures can cause faster growth and shorter life spans of squid. In addition, briefly reviews the methods of exploitation of squid along with the current squid populations, fishing methods, export, utilization and marketing. India's squid fishing fleet accounted for 3% of the global squid production and makes up approximately 5-7% of U.S. squid imports. The processed squid meat has been exported in global level from the maritime states to US, EU, UAE, Japan, Italy and France through the major ports such as Kochi, Kollam, Tuticorin, Mumbai and Visakhapatnam[4].

Fish and fish products are very important for human nutrition because they are rich of animal protein and other elements for the maintenance of healthy body[3]. The processes of battering and breading provide special functions in food products including improving the appearance of the products, increasing the texture, reducing the oil uptake during the frying process and increasing the shelf life of the coated products[53]. Battered and breaded fish products can undergo undesirable changes during frozen storage time due to microbial contamination from various sources and rapid spoilage as a result of protein denaturation [13] and lipid oxidation, leading to loss of quality. Sensory evaluation was used to assess the degree of freshness based on organoleptic characteristics such as color, odor and texture of the product[23].

A batter can be defined as a liquid mixture composed of water, flour, starch and seasoning in to which food products are dipped prior to cooking. The breading is normally a bread-based crumb, but other coating like small potato chips or puffed grain such as rice also are popular. Battered and breaded foods are usually shallow or deep fried. This produces a unique flavor and texture associated with these types of products. However, the oil content in these products is becoming a consumers concern due to the health implication. Hence, a batter and breading system that could reduce the oil-uptake and at the same time safeguarding all the desirable properties of the product. Replacing the final cooking methods to other than frying for the reduction of the fat content has been recommended[20].

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The demand for ready to eat and/or ready to cook products are gradually growing because of their convenience[55]. Battered and breaded or coated systems have the benefits of versatility and familiarity because they enhance the flavor and texture of processed food products[15]. Coatings of meat products with edible materials provide better protection against oxidation and microbiological deterioration. It can also significantly enhance the sensory quality of meat products and could be an effective method of value addition with better consumer acceptability[1]. Considering the demand for ready to eat fish products especially in developing countries like India, there is an instant need to diversify our seafood based products. The main parameters which affect the shelf life of the stored fish products are the production form, features of packing material, storage temperature, packing process and machines that are used[11]. Hence, the aim of present study is to develop ready to eat fish products from squid rings and to determine the rate and the type of deterioration process that occurs during the refrigerated and frozen storage using proximate, biochemical, microbiological and organoleptic assessments.

Consumers develop preferences for particular types of food based upon texture, i.e., the textile experience caused by the food in their mouth in conjunction with the foods distinct physical and chemical characteristics. Fried battered and breaded foods are extremely popular, in good measure because of their crisp texture and their typically golden brown appearance. Indeed, the organoleptic desirability of many fried foods could be significantly improved if enhanced crispiness and golden brown appearance were obtained without overcooking the food or unduly increasing its uptake of oil by frying for extended periods. Additionally, since there is some loss of volatile flavor components during frying, the flavor of fried foods could be further enhanced by minimizing such losses[14]. Battered and breaded or coated systems have the benefits of versatility and familiarity because they enhance the flavor and texture of processed food products[15]. Coatings of meat products with edible materials provide better protection against oxidation and microbiological deterioration. It can also significantly enhance the sensory quality of meat products and could be an effective method of value addition with better consumer acceptability[1].

Considering the demand for ready to eat fish products especially in developing countries like India, there is an instant need to diversify our seafood based products. Deep fat frying foods play an important role in food preparation, especially in convenience foods. Fried foods constitute a primary choice in our diets and have remained ever popular among today's consumers of all ages. Because of changes in life style of consumers in terms of preparation and consumption of food that requires little time, the relative importance of fried foods has escalated into the restaurants, fast food joints and supermarkets as ready-to-eat or easy-to prepare entrées for immediate consumption. In general, fried battered and breaded products are either battered (puff-tempura) or battered and breaded (interface-adhesion) prior to deep fat frying[31].

Batter used for fried foods can be defined as liquid dough, basically consisting of flours, starches, seasoning and water. Batters have become more sophisticated complex systems in which the nature of the ingredients is very wide ranging and their interaction affects the finished product[20]. Frying lends several enticing characteristics including appearance, aroma, flavor and texture (crispiness); however, the quantity of oil in fried food has increased after frying. Since consumers are concerned about the health risks associated with fat consumption and low fat foods, there is a need for reducing oil absorption in fried products. Lowering the overall fat content without adversely altering the crispy outer layer and softer inner texture will enhance the appeal of fried foods[25]. One approach would be to use an edible film ingredient that will improve the coating performance and serve as a shield to control the diffusion of moisture and fat in battered and breading products. The use of seafood breading and batter is widespread, but very limited compositional studies have been reported. Therefore, the aim of present study was to development of pre-dusting mix for coating of battered and breaded battered and breaded squid rings and the effect of HPMC, MC, and Gaur Gum (G) added to pre-dust and batters of Squid (*Loligo duvauceli*) rings on the quality.

MATERIAL AND METHODS

Preparation of samples

Thaw the frozen squid sample and record length and weight for yield estimation. Squid sample will be washed properly with potable water and remove the tentacles, gut contents and prepare squid tube and cut into required size rings for preparation of battered and breaded squid rings.

Frying of battered and breaded squid rings:

For the final battered and breaded squid rings will be fried in refined sunflower oil at 170°C for 3 min.

Preparation of bread crumbs:

The breadcrumbs used for coating from locally available sliced bread after removing the crust portion using a sharp knife. The crust free loaves were dried in stainless steel trays in a hot air oven maintained at 102°C for 45 minutes to a moisture level below 5% and them blended in an electric blender for nearly one minutes. The crumbs were then sieved through a uniform particle size and packed in polyethylene pouches and store in a cool and dry place. **Standardization of batter and breaded mix:**

Standardized batter mix[38]. was used. HPMC, MC, and G were incorporated into the pre-dusting mix by adding 3, 6, 9 and 12 % (w/w) of each coating ingredient to basic pre-dusting mix. The basic pre-dusting mix without adding HPMC, MC, and G were used as control.

Method for preparation of Squid Ring (Flow chart)

Raw material (Fresh Squid)

↓

Washing

↓

Peeling and Evisceration

↓

Cutting into ring

↓

Washing

↓

Marinating (turmeric powder and salt 15-20min.)

↓

Preparing pre-dust material
(Maida, corn flour, Bengal gram flour, table salt, red chilli powder and turmeric powder)

↓

Pre-dusting

↓

Battering

↓

Breading

↓

Frying (170ºC for 2-3 min.)

↓

Ready to eat

Quality analysis:

Proximate composition:

The proximate composition viz., moisture, crude protein, crude fat and ash content of ring were determined following standard methods[5].

Determination of total volatile base nitrogen (TVB-N):

TVB-N content was determined by the procedure given by Beatty and Gibbons[12]. using Conway micro diffusion units and results were expressed in terms of nitrogen mg/100g.

Sensory quality

Sensory quality of battered and breaded squid rings was evaluated directly by 10 trained panellists, using 9 point hedonic scale (1- dislike extremely and 9- like extremely) for product consumer acceptability.

Texture property of breaded and battered products:

Texture analysis was analyzed by model -TMS touch make by Food Technology Corporation USA.

Measurement of colour breaded and battered products:

Hunter Lab Scan equipment was used for colour analysing. The colour readings were expressed by machine (L* a* b*) system. L*, a* and b* indicate the whiteness/darkness, redness/greenness and blueness/yellowness, respectively. The maximum value for L* is 100, which would be white. The minimum for L* would be zero, which would be black. The* and b* axes have no specific numerical limits. Positive a* is red and negative of a* is green. Positive of b* is yellow and negative of b* is blue. The colour of the samples was evaluated after 10 min cooling at room temperature and then was measured directly at three different positions on both sides battered and breaded squid rings.

Microbiological analysis:

Samples were analyzed for total plate count (TPC), Staphylococcus, Salmonella, Escherichia coli as per USFDA.

Statistical methods:

Data were analyzed to test significant difference by applying analysis of variances (ANOVA) tool available in MS-Excel 2007. The significant differences were tested by 5% level of significances and are mentioned as p 0.05 for significances difference.

RESULTS AND DISCUSSION

In the present study, ready to eat product of squid ring from squid have been developed. Further, the quality of the products during estimating the proximate, biochemical, microbiological and organoleptic parameters. The results of the analysis are discussed in detail.

Proximate, biochemical and microbiological composition of fresh Squid

In present study was fresh squid the moisture, crude protein, fat and ash contents in 80.27%, 16.06%, 1.26% and 1.50% respectively (Table 1). Similarly, with slight variation was reported by[7]. content in squid meat were 80.72% moisture, 16.16% protein, 1.44% fat, and 1.63% ash respectively. The change in the proximate composition could be attributed due to variation of seasons and maturity of the species[17]. The Peroxide Value (PV), Free Fatty Acid (FFA), Total Volatile Base Nitrogen (TVB-N), Total Plate Count (TPC) of fresh squid meat was found to be 1.80 meqO2/kg of fat, 1.17% of oleic acid, 15.20 ± 0.20 mg/100g of meat and 1.20×102 cfu/g respectively (Table 1). The Staphylococcus aureus, Salmonella and Escherichia coli was completely absent for squid (Table 1). The PV, FFA, TVB-N, TPC levels in fresh squid meat used in the study are below the threshold values.

Table 1. Physico-chemical and microbiological characteristics of fresh squid

Sr. No.	Physico-chemical and microbiological characteristics	Values
1	Protein	16.06 ± 0.9
2	Fat	1.26 ± 0.08
3	Moisture	80.27 ± 0.23
4	Ash	1.50 ± 0.08

5	PV (meqO2/kg of fat)	1.80± 0.28
6	FFA (% of oleic acid	1.17± 0.24
7	TVB-N (mg/100g of meat)	15.20 ± 0.20
8	TPC (cfu/g)	1.20×10^2
9	*Staphylococcus aureus* (cfu/g)	ND
10	*Salmonella* (cfu/g)	ND
11	*Escherichia coli* (cfu/g)	ND

Standardization of batter and breaded mix

The ingredients and their proportion used for the preparation of batter mix as per CIFT recipe. In present study the three different pre-dusting mixes was Methyl Cellulose, Hydroxypropyl Methyl Cellulose and Gaur Gum by adding 3, 6, 9 and 12% (w/w) of each coating ingredient to basic pre-dusting mix.[37] The process of coating with batter and bread crumbs increases the bulk of the product, thereby reducing the content of costly fish and thus reducing the cost product (Table 2). Battered and breaded or coated systems have the benefits of versatility and familiarity because they enhance the flavor and texture of processed food products[15]. Breading is a dry mixture of flour, starch and seasonings, course in nature and is applied to moistened and battered food products prior to cooking. The particle size of the breading is important in terms of appearances, texture and pickup[10].

Selection of recipe for preparation of squid ring

The standardized batter mix[38] was prepared using contents for squid ring. Three different pre-dusting mix was used with squid ring were prepared different recipe by altering the percentage of different batter mix. Based on the sensory analysis for overall acceptability of the product, an ideal recipe for the preparation of squid ring was developed (Table 2). Improvements in shelf life and eating quality have been observed in fried products containing hydrocolloids in both the substrate and coating system[8]. Hydrocolloids viz., Carboxy Methyl Cellulose (CMC), Guar Gum (GG) and Carboxy Methyl Chitosan (CMT) improve the functional properties of food coatings.

Table 2. Composition of various ingredients was prepared by altering the percentage of Hydroxypropyl Methyl cellulose (HPMC), Methyl Cellulose (MC) and Gaur Gum (G) from squid rings

Ingredients	Concentration of Predusting mixture (g)			
	3%	6%	9%	12%
Squid rings	50	50	50	50
Maida (flour)	30	30	30	30
Corn flour	8	8	8	8
Bengal gram flour	5	5	5	5
Turmeric powder	2	2	2	2
Red chilli powder	5	5	5	5
Salt	2	2	2	2
Bread crumb	10	10	10	10
oil	25	25	25	25
HPMC, MC and G	1.5	3	4.5	6

Organoleptic Evaluation

In the present study organoleptic score for squid ring (i.e., based on organoleptic characteristics like colour, odour, taste, texture and appearance) was taken as the main criteria for judging the quality of ready to eat product. However slightly significant difference was found between HPMC 12% and compare to pre-dusting mix for coating of 3%, 6%, and 9%. Based on organoleptic evaluation by

HPMC 12% score 8.45 was observed for 3, 6 and 9% score 6.9, 6.73 and 6.25 which was below the level of acceptability average (Table3). It indicate that HPMC 12% treatment had effect on increasing demand for market.

The slightly significant difference was found between MC 6% and compare to pre-dusting mix for coating of 3%, 9%, and 12%. Based on organoleptic evaluation by MC 6% score 8.23 was observed for 3, 9 and 12% score 6.37, 7.23 and 6.70 which was below the level of acceptability average (Table 3). It indicate that MC 6% treatment had effect on increasing demand for market. The slightly significant difference was found between Gaur Gum 9% and compare to pre-dusting mix for coating of 3%, 6%, and 12%. Based on organoleptic evaluation by Gaur Gum 9% score 8.45 was observed for 3, 6 and 12% score 6.23, 6.97 and 7.35 which was below the level of acceptability average (Table 3). It indicates that Gaur Gum 9% treatment had effect on increasing demand for market.

Generally, the squid ring is ready to eat product and consumed immediately after preparation. Based on the biochemical, microbiological, organoleptic and physical taste, it can be concluded that the squid ring prepared by using separated squid meat along with the other standardized ingredient in batter mix. Considering the changes in biochemical, microbiological and organoleptic, quality characteristics it can be concluded that squid ring.

A coating should ideally be crispy, i.e., it should exhibit a sufficient resistance to the initial bite and then disappear as a quick melt away in the mouth[30]. Sensory analysis was done as described by Tokur *et. al.*[51], Sensory analyses were assessed according to the flavor, texture, color, odour and general acceptability on a 1-9 point hedonic scale. Garcia *et. al.*[21], reported that edible coatings affected the colour differences between coated and uncoated dough fried samples but did not modify the textural characteristics. Sensory characteristics were evaluated using a 9-point hedonic scale as described by Peryam and Pilgrims[41].

Table 3. Organoleptic evaluation of squid ring with different percentage of HPMC, MC and G used for development of pre-dusting mix

Attributes and pre-dusting mix	3%	6%	9%	12%
Hydroxypropyl Methyl Cellulose (HPMC)				
Appearance	6.0 ± 0.5	6.6 ± 0.3	6.3 ± 0.3	8.6 ± 0.3
Colour	6.6 ± 0.3	6.6 ± 0.3	6.0 ± 0.5	8.6 ± 0.3
Odour	7.3 ± 0.3	7.3 ± 0.3	6.6 ± 0.3	8.6 ± 0.3
Taste	7.3 ± 0.3	6.6 ± 0.3	6.0 ± 0.5	8.3 ± 0.3
Texture	7.6 ± 0.3	6.3 ± 0.3	6.6 ±0 .3	8.0 ± 0.5
Overall acceptability	6.6 ± 0.3	7.0 ± 0.5	6.0 ± 0.5	8.6 ± 0.3
Methyl Cellulose (MC)				
Appearance	5.6 ± 0.3	8.6 ± 0.3	7.6 ± 0.3	6.0 ± 0.5
Colour	6.3 ± 0.3	8.6 ± 0.3	6.6 ± 0.3	7.3 ± 0.3
Odour	7.3 ± 0.3	8.3 ± 0.3	7.6 ± 0.3	7.3 ± 0.3
Taste	7.0 ± 0.5	7.6 ± 0.3	7.6 ± 0.3	6.3 ± 0.3
Texture	6.0 ± 0.5	8.0 ± 0.5	7.0 ± 0.5	7.0 ± 0.5
Overall acceptability	6.0 ± 0.5	8.3 ± 0.3	7.0 ± 0.3	6.3 ± 0.3
Gaur Gum (G)				
Appearance	6.0 ± 0.5	7.3 ± 0.3	8.3 ± 0.3	7.6 ± 0.3
Colour	5.6 ± 0.3	7.3 ± 0.3	8.6 ± 0.3	7.6 ± 0.3
Odour	6.6 ± 0.3	7.6 ± 0.3	8.6 ± 0.3	7.3 ± 0.3
Taste	6.6 ± 0.3	6.0 ± 0.5	8.3 ± 0.3	7.0 ± 0.5
Texture	6.6 ± 0.3	6.6 ± 0.3	8.3 ± 0 .3	7.0 ± 0.5
Overall acceptability	6.0 ± 0.5	7.0 ± 0.5	8.6 ± 0.3	7.6 ± 0.3

Proximate composition of development of pre-dusting mix for coating of battered and breaded squid rings:

Moisture content

In present study, moisture content of development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 66.33, 62.72, 64.55 and 67.28% respectively (Table 4.3.2). The moisture content was significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment (Table 4). In HPMC 12% treatment was given, 60-80% water in squid that reason the moisture content of 12% is higher. The moisture content of development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 67.12, 70.43, 64.56 and 62.17% respectively (Table 4). The moisture content was significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment. In MC 6% treatment was given, 60-80% water in squid that reason the moisture content of 6% is higher. The moisture content of development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 72.07, 69.96, 73.49 and 72.45% respectively (Table 4). The moisture content was significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. In Gaur Gum 9% treatment was given, 60-80% water in squid that reason the moisture content of 9% is higher. The moisture ratio in pre-frying fish finger decreased with pre-frying processing as reported by Cakli *et al.*[16]. Pawar[40] reported moisture content in flash fried cutlet was 65.71% respectively. The mobility of material and exit of moisture during the frying process, caused decrease the moisture content. But pre-frying the fish nuggets at 170°C formed stronger coating and showed higher content moisture in comparison with fish nuggets pre-fried at 150 and 190°C.

Protein content

In present study, protein content of development of pre-dusting mix for coating of battered and breaded squid rings was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 16.22, 16.92, 17.61 and 19.85% respectively (Table 4). The protein content was significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment. In HPMC 12% treatment was given, due to acidified treatment the protein content in squid ring were denatured because of that reason the protein content was highest. In present study, protein content of development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 13.01, 23.32, 18.71 and 18.90% respectively (Table 4). The protein content was significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment. In MC 6% treatment was given, due to acidified treatment the protein content in squid ring were denatured because of that reason the protein content was highest.

In present study, protein content of development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 12.96, 14.99, 16.18 and 14.84% respectively (Table 4). The protein content was significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. In Gaur Gum 9% treatment was given, due to acidified treatment the protein content in squid ring were denatured because of that reason the protein content was highest. Joseph *et al*[28]. reported protein content in flash fried and raw cutlet was 15.41% and 16.51% respectively. The crude protein of Pangasius fish cutlet was found to be 18.43% respectively.

Fat content

In present study, fat content development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 10.14, 13.15, 12.60 and 9.06% respectively (Table 4). The fat content was significantly ($p<0.05$) lower at HPMC 12% treatment as compared to 3%, 6%, 9% treatment. In HPMC 12% treatment was given, due to acidified treatment the fat content in squid ring were denatured because of that reason the fat content was lowest. In present study, fat content development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 14.69, 10.51, 11.21 and 14.10% respectively (Table 4). The fat content was significantly ($p<0.05$) lower at MC 6% treatment as compared to 3%, 9%, 12%. In MC 6% treatment was given, due to acidified treatment the fat content in squid ring were denatured because of that reason the fat content was lowest. In present study, fat content development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 10.05, 12.57, 10.06 and 9.93% respectively (Table 4). The fat content was significantly ($p<0.05$) lower at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. In Gaur Gum 9% treatment was given, due to acidified treatment the fat content in squid ring were denatured because of that reason the fat content was lowest. Joseph *et al*[28]. reported fat content in flash fried and raw cutlet was 5.92% and 3.74% respectively. The crude fat of Pangasius fish cutlet was found to be 4.43% respectively. The increase in fat content of the fried fish fillets is related to oil absorption during the cooking process. Further the increase of fat content can be attributed to the oil penetration on the food after water is partially lost by evaporation[43]. Similar results were reported for sardine and African catfish fried in vegetable oil.

Ash content

In present study, ash content development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 6.16, 7.20, 5.20 and 4.80% respectively (Table 4). The ash content was significantly ($p<0.05$) lower at HPMC 12% treatment as compared to 3%, 6%, 12% treatment. In HPMC 12% treatment was given, due to acidified treatment the ash content in squid ring were denatured because of that reason the ash content was lowest. In present study, ash content development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 1.80, 3.41, 1.98 and 4.81% respectively (Table 4). The ash content was significantly ($p<0.05$) lower at MC 6% treatment as compared to 3%, 9%, 12% treatment (Table 4.4.2). In MC 6% treatment was given, due to acidified treatment the ash content in squid ring were denatured because of that reason the ash content was lowest.

In present study, ash content development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 3.18, 2.47, 2.25 and 2.77% respectively (Table 4). The ash content was significantly ($p<0.05$) lower at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. In Gaur Gum 9% treatment was given, due to acidified treatment the ash content in squid ring were denatured because of that reason the ash content was lowest. Joseph *et al*[28]. reported ash content in flash fried and raw cutlet was 1.88% and 1.99% respectively. The higher ash content in the cooked fish might be due to its higher bony consistency and high scaly nature. Such fish offer minerals in their edible forms more abundantly than large-sized fish do[24].

Table 4. Proximate Composition of squid ring with different percentage of From HPMC, MC and G used for development of predusting mix

Sr. No.	Proximate composition (%)	3%	6%	9%	12%
Hydroxypropyl Methyl Cellulose (HPMC)					
1	Moisture	66.33 ± 0.74	62.72 ± 0.57	64.55 ± 0.08	67.28 ± 0.41
2	Protein	16.22 ± 0.94	16.92 ± 0.60	17.61 ± 0.33	19.85 ± 0.54
3	Fat	10.14 ± 0.19	13.15 ± 0.65	12.60 ± 0.41	9.06 ± 0.87
4	Ash	6.16 ± 0.13	7.20 ± 0.17	5.20 ± 0.08	4.80 ± 0.11
Methyl Cellulose (MC)					
1	Moisture	67.12 ± 2.52	70.43 ± 0.98	64.56 ± 1.79	62.17 ± 0.43
2	Protein	13.01 ± 1.04	23.32 ± 0.25	18.71 ± 0.55	18.90 ± 0.46
3	Fat	14.69 ± 0.10	10.51 ± 0.25	11.21 ± 0.60	14.10 ± 0.39
4	Ash	1.80 ± 0.14	3.41 ± 0.16	1.98 ± 0.56	4.81 ± 0.60
Gaur Gum (G)					
1	Moisture	72.07 ± 0.97	69.96 ± 0.17	73.49 ± 0.29	72.45 ± 0.23
2	Protein	12.96 ± 0.27	14.99 ± 0.50	16.18 ± 0.19	14.84 ± 0.41
3	Fat	10.05 ± 0.09	12.57 ± 0.57	10.06 ± 0.62	9.93 ± 0.06
4	Ash	3.18 ± 0.05	2.47 ± 0.36	2.25 ± 0.58	2.77 ± 0.38

Biochemical changes of development of pre-dusting mix for coating of battered and breaded squid ring:

Peroxide Value (PV)

In present study, peroxide value development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 3.77, 4.02 4.92 and 5.1 meqO_2/kg of fat respectively (Table 5). The peroxide value was significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment. In present study, peroxide value development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 4.35, 5.07, 4.09 and 3.72 meqO_2/kg of fat respectively (Table 5). The peroxide value was significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment.

In present study, peroxide value development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 4.20, 3.82, 5.49 and 4.27 meqO_2/kg of fat respectively (Table 5). The peroxide value was significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. Ferioli *et al*[19]. stated that cooking catalyzed the formation of peroxides and heat proved to be a pro-oxidant factor. AI-Saghir et al.[2], reported that a slight lipid oxidation effect due to the heating procedures applied in salmon fillets. Aro *et al.*[6], reported a decrease in the peroxide value in fried Baltic herring fillets. Fried combined to boiled samples compared to fried samples has high peroxide value; although there is a report of unchanged peroxides after the deep frying of Sardine, F. J. Sanchez-Muniz[45].

The peroxide value of flash fried cutlets was 8.16 to 4.50 meqO_2/kg respectively. The cutlet is highly spiced and anti-oxidant properties of spice because of that further reduced the peroxide formation[56]. Battering and breading of the products can act as oxygen barrier, which will prevent the oxidation. The inclusion of spices which has strong anti-oxidant effect in the mince for the preparation of the cutlet can increase the frozen storage stability of the mince[27].

Peroxide value (PV) is a measure of the degree of oxidation in the fat[22]. The mechanical mincing of fish meat which accelerate oxidation due to the incorporation of oxygen in the tissue or the disruption and intermixing of tissue components. A similar increase in the PV content was observed by Tokur et al[52]. during the frozen storage of fish burger produced from tilapia.

Free Fatty Acid (FFA)

In present study, free fatty acid development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 0.30, 0.41, 0.39 and 0.75% of oleic acid respectively (Table 5). The free fatty acid was significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment. In present study, free fatty acid development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 0.25, 0.41, 0.74 and 0.47% of oleic acid respectively (Table 5). The free fatty acid was significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment. In present study, free fatty acid development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 0.37, 0.48, 0.77 and 0.64% of oleic acid respectively (Table 4.5.4). The free fatty acid was significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. FFA of Pangasius fish cutlet stored in refrigerated display unit (-15 to -18°C) showed an increasing trend from 1.26 to 4.83% of oleic acid. The FFA content in the lipid of a fish is an indication of lipid hydrolysis. As the freshness quality of fish gets reduced, the FFA content in the lipids of fish increases due to the action of lipases Reddy *et al*[42].

Total Volatile Base- Nitrogen (TVB-N)

In present study, TVB-N development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were found to be 2.92, 2.68, 3.82 and 4.48 mg/100g respectively (Table 5). The TVB-N was significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment. In present study, TVB-N development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from MC were found to be 2.54, 2.76, 4.67 and 3.62 mg/100g respectively (Table 5). The TVB-N was significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment. In present study, TVB-N development of pre-dusting mix for coating of battered and breaded squid ring was used in four different percentage by batter mix (3%, 6% 9% and 12%) from Gaur Gum were found to be 3.11, 3.49, 4.72 and 3.26 mg/100g respectively (Table 5). The TVB-N was significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. TVB-N is a commonly used chemical method to determine spoilage of fish. The TVB-N in freshwater fish and their products comes from ammonia[52]. Ninan *et al.*[33], observed a significant increase in TVB-N during the frozen storage of fish cutlet prepared from tilapia fish. Leaching out phenomena of volatile bases could be a cause for the decrease of TVB-N values when samples are packed in improperly sealed bags[36]. Pandey and Kulkarni[39] observed a significant increase in the TVB-N value of grass carp fish cutlet and fish finger during the frozen storage for 6 months. Ninan *et al.*[35], reported the TVB-N value was in the range of 12.4 to 20.2 mg/100g in tilapia fish cutlet.

Table 5. Biochemical changes in squid ring prepared with different percentages from HPMC, MC and G

Sr. No.	Biochemical changes	3%	6%	9%	12%
Hydroxypropyl Methyl Cellulose (HPMC)					
1	Peroxide value (meqO_2/kg)	3.77 ± 0.29	4.02 ± 0.07	4.92 ± 0.07	5.16 ± 0.0
2	Free Fatty Acid (% of oleic acid)	0.30 ± 0.01	0.41 ± 0.02	0.39 ± 0.04	0.75 ± 0.05
3	TVBN (mg/100g)	2.92 ± 0.39	2.68 ± 0.16	3.82 ± 0.07	4.48 ± 0.11
Methyl Cellulose (MC)					
1	Peroxide value (meqO_2/kg)	4.35 ± 0.22	5.07 ± 0.08	4.09 ± 0.11	3.72 ± 0.2
2	Free Fatty Acid (% of oleic acid)	0.25 ± 0.03	0.41 ± 0.04	0.74 ± 0.03	0.47 ± 0.01
3	TVBN (mg/100g)	2.54 ± 0.23	2.76 ± 0.28	4.67 ± 0.15	3.62 ± 0.09
Gaur Gum(G)					
1	Peroxide value (meqO_2/kg)	4.20 ± 0.15	3.82 ± 0.07	5.49 ± 0.30	4.27 ± 0.32
2	Free Fatty Acid (% of oleic acid)	0.37 ± 0.01	0.48 ± 0.04	0.77 ± 0.03	0.64 ± 0.03
3	TVBN (mg/100g)	3.11 ± 0.09	3.49 ± 0.09	4.72 ± 0.12	3.26 ± 0.07

Colour in development of pre-dusting mix for coating of battered and breaded squid rings

Colour is an important indicator of food quality. The consumer associates food color with good processing and safety. However, colour cannot be studied without considering the parameter normally not used by many consumers in their buying decision, it is very important when seafood is consumed. In present study, colour development of pre-dusting mix for coating of battered and breaded squid rings was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were expressed in terms of L*, a* and b*, found to be an L* was 56.11, 53.92, 26.68 and 44.15; a* was 11.50, 16.51, 25.95 and 16.10; b* was 4.50, 10.50, 26.52 and 18.98 respectively (Table 6). Squid ring with different percentage from HPMC used for development of pre-dusting mix at 12% showed the greatest lightness value (L*). Similar values were found for redness (a*) and there is significance difference with respect to yellowness (b*).

The MC were expressed in terms of L*, a* and b*, found to be an L* was 50.77, 38.02, 19.45 and 31.37; a* was 19.45, 24.46, 14.95 and 21.54; b* was 40.99, 35.39, 45.95 and 47.37 respectively (Table 6). Squid ring with different percentage from Methyl cellulose (MC) used for development of pre-dusting mix at 6% showed the greatest lightness value (L*). Similar values were found for redness (a*) and there is significance difference with respect to yellowness (b*).

The Gaur Gum were expressed in terms of L*, a* and b*, found to be an L* was 55.74, 64.78, 24.58 and 63.03; a* was 11.92, 8.96, 26.20 and 11.37; b* was 2.70, 3.23, 10.22 and 2.14 respectively (Table 6). Squid ring with different percentage from Gaur Gum used for development of pre-dusting mix at 9% showed the greatest lightness value (L*). Similar values were found for redness (a*) and there is significance difference with respect to yellowness (b*). Significantly higher ($p<0.05$) L* value for pre-fried and deep fried products was observed in sample, and then the lighter colour indicates that the product absorbed less oil[30]. Baker *et al.*[9], reported that cooking method is a factor that can affect the colour of the product. The results are in agreement with Moradi *et al*[32]. Sirkorski *et al.*, stated that denaturation and oxidation of protein, as well as the formation of coloured compounds with involvement of H_2S released from amino acids and in Maillard type reactions could be the reasons of colour changes in cooked samples. The ideal colour of fried food stuff is a light golden brown[48]. Similar L*, a*, b* values were obtained by Bochi et al., for fish burgers containing catfish filleting residues.

Table 6 Colour of Squid rings with different percentage from HPMC, MC and G used for development of predusting mix

Sr. No.	Parameters	3%	6%	9%	12%
Hydroxypropyl Methyl Cellulose (HPMC)					
1	Lightness (L*)	56.11 ± 2.27	53.92 ± 1.47	26.89 ± 13.0	44.15 ± 1.38
2	Redness (a*)	11.50 ± 0.63	16.51 ± 0.83	25.95 ± 14.8	16.10 ± 0.94
3	Yellowness (b*)	4.50 ± 1.80	10.50 ± 2.17	26.52 ± 13.7	18.98 ± 1.72
Methyl Cellulose (MC)					
1	Lightness (L*)	50.77 ± 0.28	38.02 ± 5.14	19.45 ± 0.68	31.37 ± 2.18
2	Redness (a*)	19.45 ± 0.68	24.46 ± 1.77	14.95 ± 3.64	21.54 ± 3.02
3	Yellowness (b*)	0.99 ± 3.50	35.39 ± 6.26	45.95 ± 3.01	47.37 ± 2.87
Gaur Gum(G)					
1	Lightness (L*)	55.74 ± 1.43	64.78 ± 2.24	24.58 ± 9.98	63.03 ± 1.11
2	Redness (a*)	11.92 ± 0.90	8.96 ± 0.53	26.20 ± 11.3	11.37 ± 0.17
3	Yellowness (b*)	2.70 ± 1.63	3.23 ± 1.37	10.22 ± 1.39	2.14 ± 0.57

Texture profile analysis of development of pre-dusting mix for coating of battered and breaded squid rings:

TPA is one of the methods that stimulate the condition to which the food is exposed in the mouth. In present study TPA of development of pre-dusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were expressed in termed Hardness was 1641.6, 1451.6, 1471.6 and 1677.3; fracturability was 1405.0, 1435.6, 1442.3 and 1470.0; adhesiveness was -76.0, -78.0, -82.0 and -85.0; springiness was 0.71, 0.70, 0.70 and 0.77; chewiness was 354.6, 342.0, 245.6 and 391.0; cohesiveness was 0.21, 0.23, 0.23 and 0.25 and resilience was 0.03, 0.03, 0.03 and 0.06 respectively (Table 7). The TPA was significantly or not significantly ($p<0.05$) higher at HPMC 12% treatment as compared to 3%, 6%, 9% treatment.

In MC were expressed in termed Hardness was 1582.6, 1611.0, 1555.0 and 1508.3; fracturability was 1555, 1570, 1552.0 and 1538; adhesiveness was -87.60, -95.0, -88.0 and -83.0; springiness was 0.70, 0.80, 0.71 and 0.74; chewiness was 471.0, 491.0, 426.6 and 422.6; cohesiveness was 0.25, 0.33, 0.24 and 0.19 and resilience was 0.04, 0.05, 0.04 and 0.03 respectively (Table 7). The TPA was significantly or not significantly ($p<0.05$) higher at MC 6% treatment as compared to 3%, 9%, 12% treatment.

In Gaur Gum were expressed in termed Hardness was 1351.6, 1365.0, 1411.0 and 1356.0; fracturability was 1294.6, 1324.3, 1336.6 and 1324.6; adhesiveness was -80.60, -79.30, -74.60 and -80.30; springiness was 0.60, 0.60, 0.67 and 0.56; chewiness was 281.0, 279.3, 291.0and 273.0; cohesiveness was 0.50, 0.58, 0.15 and 0.30 and resilience was 0.02, 0.04, 0.07 and 0.06 respectively (Table 4.5.6). The TPA was significantly or not significantly ($p<0.05$) higher at Gaur Gum 9% treatment as compared to 3%, 6%, 12% treatment. Sanz *et al.*[47], found that the peak force values (hardness) of battered squid ring obtained immediately after frying were greater for 2% MC batters than the control. Laly *et al.*[29], reported that TPA in mackerel steaks deep fried in sunflower oil hardness, adhesiveness, cohesiveness, resilience, springiness, chewiness i.e., 501.87, 0.30, 0.47, 0.38, 0.99, 232.60 respectively. Cohesiveness is the parameter of texture profile analysis (TPA), which describes the ability of fillets to recover from deformation Jon, O. V. and Ole, J. T.[26]. Texture is an important factor for the consumer acceptance. Dyson[18]. reported that the characteristics of extruded crumbs will behave in the order of firm to hard when it is coated with the products.

Table 7. Texture profile of squid rings with different percentage from Hydroxypropyl Methyl Cellulose (HPMC), Methyl Cellulose and Gaur Gum (G)

Parameters	**3%**	**6%**	**9%**	**12%**
Hydroxypropyl Methyl Cellulose (HPMC)				
Hardness	1641.6 ± 167.8	1451.6 ± 27.50	1471.6 ± 15.32	1677.3 ± 106.89
Fracturability	1405.0 ± 107.50	1435.6 ± 105.50	1442.3 ± 119.40	1470.0 ± 116.70
Adhesiveness	-76.0 ± 5.03	-78.0 ± 1.52	-82.0 ± 4.80	-85.0 ± 5.56
Springiness	0.71 ± 0.07	0.70 ± 0.05	0.70 ± 0.05	0.77 ± 0.06
Chewiness	354.6 ± 43.60	342.0 ± 42.30	345.6 ± 45.10	391.0 ± 32.80
Cohesiveness	0.21 ± 0.01	0.23 ± 0.01	0.23 ± 0.03	0.25 ± 0.02
Resilience	0.03 ± 0.01	0.03 ± 0.01	0.03 ± 0.01	0.06 ± 0.01
Methyl Cellulose (MC)				
Hardness	1582.6 ± 23.6	1611.0 ± 23.02	1555.0 ± 22.91	1508.3 ± 47.2
Fracturability	1555 ± 107.7	1570 ± 116.7	1552 ± 117.2	1538 ± 117.2
Adhesiveness	-87.60 ± 6.22	-95.0 ± 5.56	-88.0 ± 1.52	-83.0 ± 6.11
Springiness	0.70 ± 0.05	0.80 ± 0.008	0.71 ± 0.04	0.74 ± 0.02
Chewiness	471.0 ± 38.7	491.0 ± 32.8	426.6 ± 6.0	422.6 ± 8.19
Cohesiveness	0.25 ± 0.02	0.33 ± 0.005	0.24 ± 0.026	0.19 ± 0.02
Resilience	0.04 ± 0.01	0.05 ± 0.01	0.04 ± 0.02	0.03 ± 0.05
Guar Gum (G)				
Hardness	1351.6 ± 22.4	1365.0 ± 21.79	1411.0 ± 23.02	1356.0 ± 31.21
Fracturability	1294.6 ± 100.1	1324.3 ± 127.9	1336.6 ± 128.7	1324.6 ± 120.6
Adhesiveness	-80.60 ± 4.25	-79.30 ± 4.91	-74.60 ± 5.69	-80.30 ± 3.75
Springiness	0.60 ± 0.04	0.60 ± 0.03	0.67 ± 0.06	0.56 ± 0.03
Chewiness	281.0 ± 34.5	279.3 ± 37.5	291.0 ± 32.8	273.0 ± 39.8
Cohesiveness	0.50 ± 0.20	0.58 ± 0.22	0.15 ± 0.02	0.30 ± 0.14
Resilience	0.02 ± 0.008	0.04 ± 0.01	0.07 ± 0.04	0.06 ± 0.02

Microbiology characteristics (Total Plate Count) of development of pre-dusting mix for coating of battered and breaded squid rings:

In present study, the microbiological characteristics (TPC) development of predusting mix for coating of battered and breaded squid ring (Loligo duvauceli) was used in four different percentage by batter mix (3%, 6% 9% and 12%) from HPMC were expressed in termed found to be 1.75×10^2, 1.70×10^2 , 1.82×10^2 and 1.54×10^2 (cfu/g) (Table 8). The MC was expressed in termed found to be 1.53×10^2, 1.50×10^2, 1.65×10^2 and 1.72×10^2 (cfu/g) (Table 8). The G was expressed in termed found to be 1.78×10^2, 1.86×10^2, 1.62×10^2 and 2.08×10^2 (cfu/g) (Table 8). The Staphylococcus aureus, Salmonella and Escherichia coli has lost its viability in the product of squid ring respectively. It was completely absent for squid ring product. AI-bulushi and Ninan *et al.*[33] during the frozen storage of fish burger from Arabian Sea meagre at -20°C for 3 months and frozen storage of value added products from tilapia, respectively.

Table 8. Microbiological analysis of squid rings with different percentage from Hydroxypropyl Methyl Cellulose (HPMC), Methyl Cellulose and Gaur Gum (G)

Sr. No.	Microbiological characteristics	3%	6%	9%	12%
Hydroxypropyl Methyl Cellulose (HPMC)					
1	TPC (cfu/g)	1.75×10^2	1.70×10^2	1.82×10^2	1.54×10^2
2	*Staphylococcus aureus* (cfu/g)	ND	ND	ND	ND
3	*Salmonella* (cfu/g)	ND	ND	ND	ND
4	*Escherichia coli* (cfu/g)	ND	ND	ND	ND
Methyl Cellulose (MC)					
1	TPC (cfu/g)	1.53×10^2	1.50×10^2	1.65×10^2	1.72×10^2
2	*Staphylococcus aureus* (cfu/g)	ND	ND	ND	ND
3	*Salmonella* (cfu/g)	ND	ND	ND	ND
4	*Escherichia coli* (cfu/g)	ND	ND	ND	ND
Gaur Gum (G)					
1	TPC (cfu/g)	1.78×10^2	1.86×10^2	1.62×10^2	2.08×10^2
2	*Staphylococcus aureus* (cfu/g)	ND	ND	ND	ND
3	*Salmonella* (cfu/g)	ND	ND	ND	ND
4	*Escherichia coli* (cfu/g)	ND	ND	ND	ND

CONCLUSION

The aforesaid studies outline the scope for the development of pre-dusting mix for coating of battered and breaded squid rings. The fish has only limited scope foe consumption in the fresh form; development of pre-dusting mix for coating product is a better option for the utilization of this species. Squid is expected to become an important food product with squid ring processing technology. The development of pre-dusting mix for coating of battered and breaded squid ring from HPMC, MC and Gaur Gum at different percentage of 3%, 6%, 9% and 12% was batter and breaded product of squid ring based on evaluation of proximate composition of fresh squid and product, yield of fresh squid and final product, biochemical composition showed a rising trend (PV, FFA and TVB-N), texture, colour and score for sensory analysis of appearance, color, odour, texture, taste, overall acceptability was studied.

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