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Processing of Innovative Ready to Fry Crackers from *Penaeus japonicus*

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Abstract: Innovative value added product of prawn meat sago and rice crackers were developed and their nutritive and organoleptic qualities were analysed. The nutrients such as protein and lipid were higher in crackers. The spoilage indicators such as FFA TMA-N and TVB-N were slightly increased during the storage period and the increase was not exceeded the permissible limit. Microbial and organoleptic characters were good and crackers are safe and delicious for human consumption.

Key words: Prawns · Sago and rice crackers · Qualities

INTRODUCTION

Sea foods comprise of fin fishes, Crustaceans and mollusks are being used as a main protein source from time immemorial. Seafood is preferred throughout the world and its consumption helps in maintaining a balanced nutrient Intake compatible with low fat diet. The dietary guidelines published by USFDA and department of health and human service asks to eat less fat since more fat consumption reduce approximately 30-40 % energy intake [1]. Seafood is an excellent source of protein, minerals and some vitamins but low fat, cholesterol and sodium.

The demand for seafood is being increased due to the increase in consumption rate by the increasing world population and awareness on the nutritional qualities of fishery resources [2]. Food eating habit of the people is changing very fast particularly in recent times due to their Socio-economic improvement, availability of new resources as food application of enriched, prepared foods for the convenience of the customers. Development of new products from new sources becomes imperative to catch the taste of different people with different food habits. Crispy food items are very common snack all around the world. In south India, crispy food like chips made out of potato, banana and tapioca are very popular. Value addition and diversification of processed seafood is an important need in fish processing. Value addition means "any additional activity that changes the nature and presentation of the product thus adding value to it for sale". Present market trends are indicative of extensive growth in demand for ready-to-cook or ready-to-serve convenience products processed out of a Varity of fin and shell fishes. The technology for ready to eat food products preparation is now rapidly advancing in India. Large number of value added and diversified products used for export and internal market based on fish, shrimp, squid, cuttle fish, bivalves and minced meat from low priced as well as farmed fishes [3]. Many ready to eat or ready to serve products such as pickle [4], soup powder [5], wafers [6], flakes [7], cutlet, meat balls [8,9],chutney powder [10], Sauce and fish sausage are prepared from seafood's. Value can be added to fish and fishery products according to the requirement of various markets and products range from ready-to-serve heat and eat type products.

Shrimps are one of the favorite seafood's promoted by super markets. In India seafood processing units are presently involved in processing different species of Shrimps for export. Nila seafood Pvt. Ltd of Tuticorin processing eight species of prawns for the export market [11]. Production of value added products are labor intensive and do not require costly machinery and equipment. Thus most of the products can be produced at a reasonable price in the country [12]. The objective of the study is the development of innovative value added product such as crackers using prawn meat to increase the delicacy and nutritive value of the product based on consumers benefit.

MATERIALS AND METHODS

Prawn, *Penaeus japonicus* (Fig. 1) was selected and were bought from fish landing center of Tuticorin, India and brought to the laboratory in clean polythene bags.

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Table 1: Ingredients and their quantity used for the preparation of seafood rice and sago crackers

S.No.	Ingredients	Quantity	Ingredients	Quantity
	---------- Seafood rice a crackers ----------		----------Seafood sago crackers ----------	
1	Seafood powder	15g	Seafood powder	15g
2	Rice flour	10g	Sago	100g
3	Tapioca flour	5 g	Rice flour	10g
4	Slightly grounded green chilly	2 Nos.	Slightly grounded green chilly	2 Nos.
5	Broken cumin seeds	0.35 g	Broken cumin seeds	0.35 g
6	Pepper powder	0.65	Pepper powder	0.65
7	Sesame seeds	2.5 g	Sesame seeds	2.5 g
8	Food colour	0.5 g	Food colour	0.5 g
9	Asafoetida powder	0.180	Asafoetida powder	0.180
10	Salt to taste	Salt to taste		

Fig. 1: *Penaeus japonicus*

The prawns were washed, deheaded and body shells were removed and the edible meat were separated and washed in potable water to remove dirt. The edible portions were dried in hot air oven at 80° C and powdered. The powders were packed in polythene bags used for biochemical and microbiological analysis and preparation of crackers.

Preparation of Crackers: Two types of Crackers such as seafood rice cracker and Seafood sago crackers were prepared using the prawn meat adding with some agro products. The ingredients used for the preparation of the both crackers and their quantity are listed in Table 1.

Method of Preparation of Sea Food Rice Cracker: The rice is soaked in water for 4 hours in the previous day evening and then grinded and fermented for over night. Fermented rice flour was mixed with little amount of water and cooked in low fire with continuous stirring. Then tapioca flour and dried prawn powders were mixed with little water and added along with fermented rice flour and cooked with continues stirring. To this, slightly grounded green chilly, pepper powder, broken cumin seeds, Asafoetida, sesame seeds, salt and food colour were added and cooked with continuous stirring to prevent lump formation. If water is necessary, required amount of boiled water was added and cooked until it became a semi solid material. The cooked semi solid matter was poured with a table spoon on a wetted white cotton cloth in small rounds and sun dried. The dried crackers were removed from the cloth by sprinkling water on the other side of cloth. The removed crackers were sun dried properly by placing on stainless steel plates. The well dried crackers were stored in air tight polythene bags until fried for consumption. The unfried and fried seafood rice crackers are shown in Fig. 2.

Method of Preparation of Sea Food Sago Crackers: Required amount of sago was soaked in water for 6 hours. The rice was soaked in water for 4 hours in the previous day evening and then grinded and fermented for over night. The soaked sago was cooked in little fire with continuous stirring. Fermented rice flour was added with sago and mixed well and cooked with continuous stirring. The dried prawn powders was mixed with little water and added with the mixture of rice and sago and cooked with stirring. Then half grounded chilies, cumin seeds, pepper powder and asafoetida powder, salt and food color were added and cooked with well by continuous stirring to prevent lumps until semisolid sago mixture formed. Then it was poured on a wetted white cotton cloth in small rounds and sun dried. After proper sun drying, it was removed from the cloth by sprinkling water on the other side of cloth. The removed crackers were well sun dried and stored in polythene bags. The dried sago crackers were stored in air tight polythene bags until fried for consumption. The un fried and fried seafood rice crackers are presented in Fig. 3.

Fig. 2: Un fried and fried seafood rice crackers

Fig. 3: Un fried and fried seafood sago crackers

Biochemical Characteristics: The crackers were powdered and protein content was estimated by following Lowry's method [13] and the lipid content by using gravimetric method [14]. The spoilage indicators such as Moisture, Free Fatty Acid (FFA), Tri Methyl Amine Nitrogen (TMA-N) and Total Volatile Base Nitrogen (TVB-N) were analyzed during the storage period. The moisture content of both the crackers was calculated by drying the samples in a hot air oven for two days. FFA content was measured by using titrimetric method [15]. The estimation of TMA-N and TVB-N content in the sample were carried out using Conway's micro diffusion method [16].

The microbiological characteristics such as Total Plate Count (TPC) were enumerated by the APHA method [17] using Plate Count Agar and Total Fungal Count (TFC) were done by the APHA method using Potato Dextrose Agar [17]. Pathogenic bacteria like *Escherichia coli*, *Salmonella* and *Vibrio* were enumerated by following the method of USFDA [18].

Organoleptic Characteristics: The organoleptic characteristics of both the crackers were found out by frying the crackers in edible oil and serving to a taste panel of 6 to 8 members and the overall acceptability was determined by using hedonic scale [19]. The organoletic score of both fried crackers were rated as 9 for excellent. Products scores 6 were considered as good and below 5 as poor or unacceptable.

RESULTS

The prawns and their value added products such as seafood rice and sago crackers biochemical parameters such as protein and lipid contents were assessed and the results are presented in figures 4 and 5.

Protein value of raw meat was 27.65% and the protein content of sago cracker increased slightly to 32% while seafood rice cracker showed much higher protein content, 43.75% (Fig. 4). Higher percentage of protein in seafood rice cracker may be due to the additional ingredient tapioca flour. The lipid content of the prawn meat was 4.37% while that of seafood rice and sago crackers, it was 4 and 3.9% respectively. There is no detectable increase in lipid value in both types of crackers.

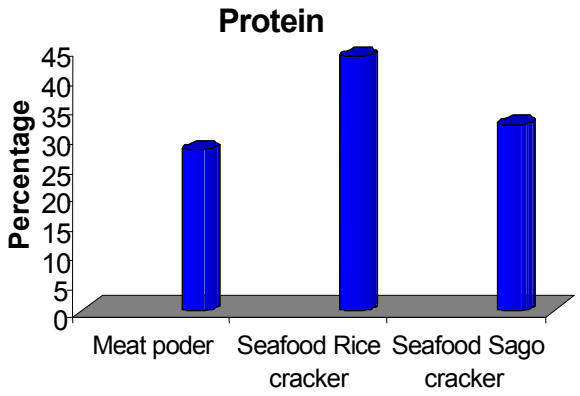

Fig. 4: Protein content of raw meat, sea food rice and sago crackers

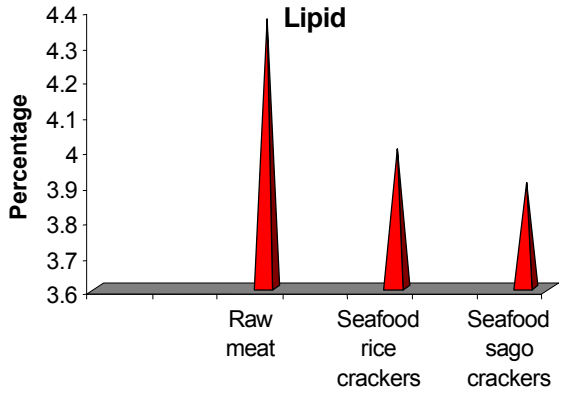

Fig. 5: lipid content of raw meat, sea food rice and sago crackers

Table 2: Qualities of seafood rice and sago crackers

		Seafood rice cracker		Seafood sago cracker	
S.No.	Parameters	Initial	After 30 days	Initial	After 30 days
1	Moisture	0.1	0.2	0.2	0.4
2	FFA (%of oleic acid)	0.02	0.38	0.10	0.62
3	TMA-N (mg%/100g)	ND	4.05	ND	5.02
4	TVB-N (mg%/100g)	2.20	6.74	3.20	6.79

Table 3: Organoleptic analysis of seafood rice and sago crackers (Initial)

Organoleptic parameters	Seafood rice crackers								Seafood sago crackers							
Appearance	9	8.5	7.5	8	7	9	9	9	7	9	8	7.5	8.5	9	9	9
Colour	8	7	8	9	7.5	8	8	7	7	9	8	8.5	9	8	8	9
Odour	8	8	8	9	8	9	8	8	7	8	8	8.5	9	8	8	8
Taste	9	9	9	9	8	7	9	8	8	9	8	7	9	9	9	9
Texture	9	9	9	7	9	8	9	9	7	9	8	8	9	9	9	9
Flavour	8	8	7.5	9	8	6	8	9	7	9	8	8	9	8	8	9
Overall Acceptability	9	8	9	9	8	8	9	9	7	9	8	8.5	9	9	9	9

Table 4: Organoleptic analysis of seafood rice and sago crackers after 30 days of storage

Organoleptic parameters	Fresh seafood rice crackers								30 days stored Seafood sago crackers							
Appearance	9	8.5	7	8	7	9	9	9	7	9	8	7.5	8.5	9	9	9
Colour	8	7.5	8	8	7	9	9	7	7	9	8	8.5	9	8	8	9
Odour	8	8	8	8.5	8.5	9	9	9	8	8	7	8.5	9	8	8.5	9
Taste	9	9	9	9	8	7	9	8	8	7.5	9	7	8	9	9	9
Texture	7	8.5	9	7.5	9	6	9	9	7	8.5	9	8	8.5	9	9	9
Flavour	8	8	7.5	9	8	6	9	9	7	9	8	8	9	8	8.5	9
Overall Acceptability	9	8.5	9	9	8	9	9	9	7	9	9	8.5	9	9	9	9

Microbiological analysis was done for prawn meat powder, seafood rice and sago crackers. The Total Plate Count (TPC) was noticed only in prawn meat powder and it was 35 CFU/g. The TPC in both the crackers were very low and it was expressed as TLTC (Too Low to Count). The Fungus was totally absent in raw prawn meat, sea food sago and rice crackers. Presence of pathogens such as Salmonella, *Vibrio* and *E.coli* were analyzed. *E.coli* was detected in the prawn meat powder only whereas in the seafood rice and sago crackers it was absent. The qualities of seafood rice and sago crackers were analyzed initially and after one month storage in air tight plastic covers and the results are presented in Tables 2.

The initial moisture content of rice cracker was 0.1% and after 30 days it slightly increased to 0.2%. In the case of sago cracker, the initial moisture was 0.2% and after 30 days of storage it increased to 0.4%.

The Free Fatty Acid (FFA-% of oleic acid) in seafood rice cracker was 0.02% and after 30 days storage it increased to 0.38%. In the case of seafood sago crackers, FFA was 0.1% and it increased to 0.62% after 30 days of storage.

Tri Methyl Amine-Nitrogen (TMA-N) and Total Volatile Base Nitrogen (TVB-N) were analyzed to know the extent of spoilage. Initially there was nil TMA-N in seafood rice cracker and after 30 days of storage, it was 4.05 (mg/100g). In the case of sago cracker it was initially 2.20 and it increased to 6.74 (mg/100g). In both type of crackers, the spoilage indicator (TVB-N) was within the acceptable limit through out the storage period. In the case of TVB-N also slight increase in both the crackers during storage, but it was within the acceptable limit.

Results of organoleptic characteristics in the initial stage and after 30 days storage of the sea food rice and sago crackers were given in tables 3 and 4. There were no remarkable organoleptic characteristic changes in both the seafood crackers. All the organoleptic characteristics of both type of crackers remained within acceptable limits initially and after 30 days of storage period.

DISCUSSION

The development of sea food in the form of meals, snacks, side dishes, dessert and so forth flew to new heights in the beginning of late 1980s. In urban areas, due to the changes in the life style of people “ready-to-serve” and “ready-to-cook” convenience fishery products are in great demand. Sea food crackers is a popular prawn based processed product of china.

The lipid content of sea food rice and sago crackers was slightly less than that of prawn meat powder because no other lipid source was added as ingredient while preparing crackers. The slight decrease in lipid content observed may also due to lipid oxidation and dehydration. This result is agreed with the earlier work in dehydrated ribbon fish which reveals there was an increase in lipid oxidation during storage [20].

Protein content of the prawn meat was 27.65% where as it increased in seafood rice cracker (43.75 %) and in seafood sago cracker (32 %) and this increase was due to ingredients such as tapioca flour, rice flour and sago. The protein value of the gastropod *Pleuroploca trapezium* was 10.28 % but the meat balls prepared using same gastropod meat with corn flour and potato had 16.044 % of protein and it was mainly due to the ingredients used for the preparation of the meat balls[21]. In the case of octopus meat balls prepared adding Bengal gram flour and smashed potato had slightly higher protein, lipid content due to the ingredients [22].

The Free Fatty Acid content of seafood rice and sago crackers increased during storage. High level of free fatty acid is an indication of microbial spoilage activity. The acceptable limit of Free Fatty Acid in seafood is about 0.5-1.5% [23, 24]. In the present study, the FFA (%-of oleic acid) slightly increased during storage and also increase was reported in fish fillets during storage [25] and these increase may be due to oxidation of the product during storage [26].

TMA-N is often used as an index to asses the quality and shelf life of sea food products [27]. In the present study, the TMA-N was not detected in both types of crackers in the initial stage but it slightly increased after 30 days stage. The TMA-N production was dependent on the bacterial activity [28]. TVB-N comprises of TMA, DMA and ammonia and is produced by both bacterial and endogenous enzymes [29]. TVB-N is one of the most ammonia indices of quality universally. In the present work, TVB-N values was found to increase after 30 days of storage but was well below the acceptable limit. The acceptable limit of TMA-N for fishery products is 10-15 mg/100g [30] and TVB-N in fishes is 35-40 mg / 100 g [31].

Moisture level of products also plays an important role in spoilage. Very less moisture content was observed in both crackers which probably resulted in very low bacterial load of the crackers. Microbial count of prawn meat powder was 3.5 x 103 CFU/G, which was below the microbiological quality parameter of 5, 00,000 TPC/g [32], whereas the TPC of rice and sago crackers did not exceed

the statistically acceptable limit of 25-2 50 [33] and thus expressed as TLTC (Too low to count). Fungal colony was not observed in the entire sample. The presence of different types of fungi in fish and fishery products was reported [34] and the moisture content supports the fungal growth[35]. But the low moisture content of both the seafood crackers was very low which adequately prevented the fungal growth. In prawn meat powder, 2/g *E. coli* colonies was observed which is below the quality parameter of 20/g [32] and pathogens Salmonella and *Vibrio* were absent in all the three samples. The absence of pathogens Salmonella and *Vibrio* in squid *Sepioteuthis lessoniana* soup powder was reported earlier [5]. Seafood safety [36] does not approve presence of pathogens in sea food.

Acceptability of fishery product is normally based on the consumer's perception of the overall appearance, color, odor, taste and texture of the product. Sensory evaluation is defined as the scientific discipline used to evoke measure analyzed and interpret reaction characteristics of food as perceived through the senses of sight, smell, taste, touch and hearing [37]. All characters showed increase in organoleptic score with duration of storage. In the case of seafood rice and sago crackers, the appearance of odor, taste and texture and flavor had good sensory score and remained within the acceptable condition. The prepared flakes using *Chicoreous ramosus* and *Pleuroploca trapezium* stored for a period of 120 days remained without any spoilage [38]. In the present study, both seafood crackers were found to remain in good condition for a month.

The sensory judgment of the products prepared from seafood was carried out by serving both products to the people and the overall acceptability was determined using hedonic scale of 1 to 9 [19]. Products with scores below 4 were considered unacceptable. The delicacy, appealing appearance and long self life under the storage of the cracker are found to be good and thus it can be used as a new variety of ready-to-fry product to consumers. The sensory score for the horse conch, *Pleuroploca trapezium* meat ball decreased gradually during the storage period, but even after 10 months of frozen storage the score were well above the acceptability limit of 5 [39].

CONCLUSION

Innovative ready to fry product such as crackers were prepared using *Penaeus japonicus* meat powder, rice, sago and other agro products. The nutritional quality of the prawn crackers were higher than the prawn meat. The spoilage indicators such as FFA, TMA-N and TVB-N were slightly increased during 30 days of storage period but the increase was not exceeded the permissible limit. The microbial and organoleptic characters were good and crackers are safe for human consumption

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