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Development of edible texturised dried fish granules from low-value fish (*Saurida tumbil*)

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Abstract

Large quantities of fish are discarded at sea because it is uneconomic to preserve and bring them ashore .To find the utilization of the presently wasted by catch, an attempt has been made in the study to prepare Texturised dried fish granules, using minced fish meat and low- cost technology. The present research work was carried out on dried fish granules prepared from meat of Lizard fish (*Saurida tumbil*). Lizard fish granules were prepared with Standardized ingredients composition containing 10 g. salt, 2 g. Starch and 0.3 g. turmeric powder in 100 g. of fish meat.

Final developed dried fish Granules had moisture content 5.7 %, 64.7 % Protein, 6.2 % Fat and Ash 1.2 % on the dry basis. Dried fish granules were packed in HDPE pouches and stored at room temperature. During the storage time product was Subject to organoleptic evaluation, assessment of biochemical parameters such as TMA, TVB-N, PV, FFA, Salt, Moisture and microbiological parameters such as TPC. Based on the organoleptic characteristics, Microbiological and Biochemical parameters it was concluded that dried fish granules were acceptable up to 3 month stored at room temperature.

The developed Texturised fish granules from boiled fish minced meat imparted good odour and texture to the fish granules. Boiling reduces the bacterial count considerably and denatures the protein. Use of 10 g salt/100 g of minced fish meat further denatures the protein, release of some moisture. Drying for 12 hours at 43-45^{0}C reduce the moisture. Due to low moisture level and high salt concentration, the product was stable up to 3 months. Well- dried fish granules have shelf life of several months and does not need any expensive facilities compared to frozen fish. If the raw materials used are quite fresh, the quality of the dried fish granules will also be very good. When decay fish are used, the texture of the dried fish granule is quite soft and disintegrates when boiled in water.

Keywords: Texturised dried fish granules, proximate composition of granules, Quality changes in granules, Fish granules

Introduction

Lizard fishes (Family: Synodontidae) constitute an important component of the demersal fish resources of India. The lizardfish production in India was 70,004 tons (CMFRI, 2012).This group is reported

as an important by catch in shrimp trawlers in tropical and subtropical seas. Though considered as a supporting fishery, this group assumes significance by virtue of the high nutritive value and their acceptance as food both in the fresh and dry condition. Nevertheless, information on their fishery, biology and utilization is fractional. Indian EEZ has indicated that the abundance of lizardfish increased from 20-40 m depth up to 150-200 m depth.

India has a coastline of 8118 kms having an Exclusive Economic Zone (EEZ) of 2.02 million sq. kms. Including 0.5 million sq. kms of continental shelf. The estimated sustainable resource potential in the marine sector is 3.9 million tonnes fish per annum. Of this, 58% of the resources is distributed in the in-shore waters, 34.9% in the off-shore areas and the remaining 7% in deep sea. Marine Fisheries are very important to the economy and well-being of coastal communities, providing food security, and job opportunities, and income and livelihoods as well as traditional cultural identity. They produced 80 million tonnes of Fish in 2009 and directly employed 34 million people in fishing operations in 2008 (FAO, 2010).

Most of the fisheries resources have reached their maximum potential for captured-fisheries production, with the majority of stocks being fully or over exploited. Therefore, in order to prevent potential future shortages in the food supply, the maximum utilization of the existing catch will have to be assured (ASEAN-SEAEDEC, 2001).

A significant amount of fish quality is lost during improper distribution, handling and processing (Bhattacharaya et al., 1993). The fish that are not utilized for human consumption include 30 million tons of small pelagic fish used for production of fishmeal and some 20 million tons of discarded by-catch (Chandrapal, 2005).

Product shelf life is affected by composition of the product. The environment to which the product is exposed during production and distribution particularly temperature and humidity and the packaging materials used. (Pegg, 1999).

Fish is an excellent source of good quality animal protein in the diet of Asians. But because of its extreme perish ability and non-availability of technology for its proper utilization; a significant portion of the fishery resource is not utilized as human food (Venugopal 1995). Minced fish, after separation of bones, has been utilized from these sources for production of various value added fishery products (Grantham 1981).

To achieve this goal, portion of the catch that tend to be of low economic value/trash fish may be used for the development of new value - added product by using low cost technology

Materials and Methods

Fish:

Lizard Fish (*Saurida tumbil*), was low-value marine fish ranging from 250-350 mm long were collected in good condition and brought to laboratory under ice.

Washing

The raw materials were washed thoroughly in potable water so as to remove the slime, blood, dirt, etc. and weighed on balance. The fish were dressed by removing head, scales and visceral parts after splitting open the belly. The dressed fish were again washed in water so as to remove blood and then again weighed. Care was taken to avoid damage of the fish flesh. The dressed yield was 75%.

Preparation of minced Meat:

The dressed fish were cooked at 73-75°C (Gautam, 1996). After cooking, the fish were taken out and allowed to cool at room temperature. The skin was removed by hand. The muscle proteins along with small bones were then separated from back bone by hand. This separated meat was then passed through small hand meat Mincer to free it

from the small bones. The minced meat can be used for the preparation of fish sausage, cake, cutlets, patties, ball pastes, Texturised product, etc. (Morehead, 1974). This minced meat was used for preparation of Texturised granules.

Preparation of Granules:
The ingredients were mixed thoroughly and left for 15 minutes. The salt denatures the protein and loosens the water. The loose water was squeezed out by hand pressing it in a cheese cloth. The Texturised fish granules were prepared by using minced meat. Fish minced meat was mixed with different concentration of salt with 7%, 10 %, 12 %, 15 %. After mixing with salt different concentration of starch with 1%, 2%, 3 %, 4 % were used then pinch of turmeric powder was added in mixture. After preparation of Granules with different concentration of salt they were cooked at 5, 7, 10, and 12 minutes. The granules were prepared in triplicates. (Chavan et al., 2008).

Drying of granules:
The granules were dried in a mechanical drier at 43-45°C for 12 hours. The moisture content of dried granules lay between 6 and 7% (Bhattacharya et al., 1993).

Integrity test:
The dry, Texturised granules were boiled in tap water for 10 minutes and the number of pieces from single test sample which had disintegrated was noted. After boiling, the samples were also chewed to determine the texture and examined visually for cloudiness. Three replicated samples were used.

Organoleptic evaluation:
Sensory attributes of dried fish granules, taste, texture, odor, appearance, and overall acceptability were evaluated. The evaluation was conducted using 7- point hedonic scale (1= dislike extremely, 7 = like extremely) by ten semi trained panelists who were selected from students and staff. (Larmond, 1977).

Proximate Composition:
Proximate composition of the fresh fish muscle and final dried fish granules were analyzed. The moisture content was determined by drying the samples at 105°C to constant weight; the crude protein content was determined with the Kjeldahl's technique, using conversion factor of 6.25; the crude fat content was determined with the Soxhlet technique, with petroleum ether as a solvent (Folch et al., 1957); the total ash content was determined by combusting the samples at 550°C and the crude fiber was also determined by using the fibertec system (Tecator, 2000).

Biochemical Analysis:
Free fatty acid (FFA) and peroxide value (PV) were analyzed by using Standard method (Egan et al., 1981) and changes in biogenic amines such as TMA and TVBN were analysis by Standard method (Capillas and Horner, 1999). Salt percentage (%) was analyzed by method of (AOAC, 2005).

Microbiological analysis
Microbial analysis of dried fish granules, total plate count was quantified by using spread plate technique (Mehlman, 1984).

Statistical analysis
The score of overall acceptability in the organoleptic evaluation were subjected to statistical analysis. One way analysis of variance (Snedecor and corchran, 1968) was done for the standardization of product as well as during storage study. SNK
(Student Newman Keuls test) was used for further analysis.

Results and Discussion
Proximate Composition of Lizard Fish (*Saurida tumbil*)

The proximate compositions of Lizard fish were moisture 76.93 %, Crude Protein 17.95 %, Crude Fat 2.30 % and Ash 1.60 % respectively.

Standardization of different ingredients used for preparation of dried fish granules from Lizard Fish(Saurida tumbil)

1. Standardization of Concentration of Salt for the preparation of dried fish granules from Lizard fish.

Sr. No.	Different Concentration of the salt (%)
1	7
2	10
3	12
4	15

The dried fish granules prepared with salts 7 %, 10 %, 12 % and 15 % of fish meat were made into granules and were subjected to organoleptic evaluations by Panelists. Salt concentration with 7 % and 12% were given very tough texture to dried fish granules. Salt concentration with 10 % was given soft texture to dried fish granules. According to panelists 10 % salt was ideal for preparation of dried fish granules.

Salt concentration with 15 % was very soft texture to the dried fish granules. Dried fish granules with salt concentration 15 % were given very soft texture so that it was difficult to prepare granules. Granules were broken at 15 % salt concentration.

Over all acceptability score for the 7 %, 12 % and 15 % salt were 7.2, 5.7 and 4.3.in dried fish granules respectively. The Overall acceptability score for 10 % salt was 8.4 in dried fish granules.

2. Standardization of Concentration of Corn flour Starch for the preparation of dried fish granules from Lizard fish.

Sr. No.	Different Concentration of the Corn flour starch (%)
1	1
2	2
3	3
4	4

The dried fish granules prepared with starch 1 %, 2 %, 3 % and 4 % of fish meat were made into granules and were subjected to organoleptic evaluation by Panelists. Starch with 1 % concentration was given tough texture to the dried fish granules. Over all acceptability score of starch with 1 % concentration was 7. Starch with 2 % starch was given soft texture to dried fish granules. According to panelists the 2 % starch concentration was ideal for preparation of granules. Over all acceptability score of the 2 % starch was 8.5. Starch concentration with 3 and 4 % were given poor texture to the granules. Overall acceptability score for the 3 and 4 % were respectively 5.9 and 2.8.

3. Standardization of boiling time for the preparation of dried Fish granules from Lizard fish.

Sr. No.	Different boiling time of the dried fish granules in minutes
1	5
2	7
3	10
4	12

The dried fish granules prepared with different boiling time like 5 min, 7 min, 10 min and 12 min were subjected to organoleptic evaluations by Panelists. Granules prepared with boiling time 5 min was given tough texture. The Overall acceptability score for the granule prepared with 5 min boiling time was 7.4. Granules prepared with boiling time 5 min was given soft texture. The Overall acceptability score

for the granule prepared with 10 min boiling time was 8.6. Granules prepared with boiling time 7 min and 12 min were given tough texture. The Overall acceptability score for the granule prepared with 7 min and 12 min were 6.3 and 4.

4. Standardization of mixing time for the preparation of dried fish granules from Lizard fish.

Sr. No.	Different mixing time of the dried fish granules in minutes
1	2
2	4
3	6
4	8

The dried fish granules prepared with different mixing time like 2 min, 4 min, 6 min and 8 min were subjected to organoleptic evaluation by panelists. Dried fish granules with 2 minutes mix time were given tough texture. Overall acceptability score for the 2 min mixing time was 6.9. Dried fish granules with 4 minutes mixing time were given tough texture to the granules. Overall acceptability score for the 4 min mixing time was 5.7. Dried fish granule with 6 min mixing time was given soft texture. Overall acceptability score of granule prepared in 6 min mixing time was 8.3. Dried fish granules with 8 minutes mixing time were given very tough texture to the granules. Overall acceptability score for the 8 min mixing time was 2.8.

Storage characteristics of dried fish granule

Table 1: Standardization ingredients for the preparation dried fish granules from Lizard fish (*Saurida tumbil*)

Sr. no.	Ingredients	Quantity(g)
1	Fish meat	100 g
2	Salt	10 g
3	Turmeric powder	0.3 g
4	Starch	2 g

Table 2: Proximate composition of dried fish granules prepared by adopting standardized method of dried fish granules preparation.

Sr. no.	Proximate Composition	Percentage in Compositions %)
1	Moisture	5.7
2	Protein	64.76
3	Fat	6.2
4	Ash	1.28

Storage studies of dried fish granules prepared from Lizard Fish (*Saurida tumbil)*

Storage studies included changes in biochemical characteristics, microbiological characteristics and organoleptic characteristics etc.

Table 3: Biochemical characteristics, microbiological characteristics and organoleptic characteristics.

Storage in (Days)	Moisture (%)	TMA Mg (%)	TVBN Mg (%)	PV Millieuivalent /1000 g	FFA % 0f Oleic acid	Salt (%)	TPC Cfu/g
0	6.56	9.5	27.2	1.8	2.6	10	1.2×10^2
15	7.43	11.3	30.6	3	3.1	12.8	1.6×10^2
30	8.1	12.5	31.3	3.3	3.5	15.1	2.1×10^2
45	8.6	12.8	33.3	4.5	4.2	17.7	2.7×10^2
60	8.9	13.2	35.9	5.3	5.5	19.8	3.4×10^2
75	9.2	13.7	37.1	7.1	7.6	24.3	3.9×10^2
90	9.7	14.4	41.5	8.5	9.4	29.7	4.8×10^2

Table 4: Changes in Organoleptic Characteristics of dried Fish granules during storage at room temperature.

Storage (in days)	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
0	8.7	8.4	8.2	8.6	8.5	8.5
15	8.5	8.1	7.8	8	8.1	8.1
30	8.1	7.6	7.5	7.7	7.8	7.7
45	7.2	7.1	7	6.9	7.2	7.2
60	6.5	6.2	6.6	6.3	6.2	6.2
75	6.1	5.7	6	5.8	5.6	5.8
90	5.4	5.3	5.2	5.3	5.2	5.3

Changes in Moisture content in dried fish granules:

Moisture content of dried fish granules was found to increase during 3 month of storage period. Initially moisture content was 6.5 %. After one month moisture was 8.6 % and finally it was reached to 9.7 %. (Table 3)

Changes in moisture content might be due to penetration of salt in fish muscle and expulsion of moisture (Voskresensky, 1965). Due to the tendency to approach equilibrium, salt travels in the fish muscle and water is extracted. This change in moisture content may cause slight change in proximate composition of dried fish granules at the end of storage study.

Changes in TMA content in dried fish granules:

TMA content of dried fish granules was found to increase during 3 month of storage period. Initially TMA content was 9.5 mg %. After one month TMA was 12.8 mg % and finally it was reached to 14.4 mg % (Table 3). The recommended acceptable limit of TMA is varying from 10 to 15 mg % (Mukundan and Balasubramaniam, 2011). Result was indicated that TMA value was in acceptable limit during 3 month of storage time.

Changes in TVBN content in dried Fish granules:

TVBN value showed in increase trend during 90 days of storage. Total volatile base-Nitrogen (TVBN) value is the indices of spoilage. The spoilage accompanied by release of several compounds like Trim ethyl amine, ammonia etc. The recommended acceptable limits vary from 30 to 45 mg % (Mukundan and Balasubramaniam, 2011)

TVBN content of dried fish granules was found to increase during 3 month of storage period. Initially TVBN content was 27.2 mg %. After one month TVBN was 33.3 mg % and finally it was reached to 41.5 mg % (Table 3). TVBN value of the dried fish granules were in acceptable limit during 3 month of storage.

Changes in PV Content in dried fish granules:

PV is measure of degree of oxidation of fat hence termed as index of spoilage due to oxidative rancidity. The upper acceptable limit for peroxide value lies within 10-20 milimoles of oxygen per kg of fat (Balachandran, 2001).

PV content of dried fish granules was found to increase during 3 month of storage period. Initially PV content was 1.88 Millieuivalent/1000g after one month PV was 4.53 millieuivalent/1000 g and finally it was reached to 8.5 millieuivalent/1000 g (Table 3). PV value of dried fish granules were in acceptable limit during 3 month of storage.

Peroxide value increased slowly with storage period, this is due to the fish muscle

containts low levels of antioxidants such as ascorbic acid and Tocopherol; however, their concentrations decline as storage time increases(Richard et al., 1998).

Changes in FFA content in dried fish granules:

FFA content of dried fish granules was found to increase during 3 month of storage period. Initially FFA content was 2.6 after one month FFA was 4.2 and finally it was reached to 9.4 (Table 3).

FFA content increased slowly with storage period, this is due to the fish muscle containts low levels of antioxidants such as ascorbic acid and Tocopherol; however, their concentrations decline as storage time increases(Richard et al., 1998).

Changes in Concentration of Salt in dried fish granules:

Salt content of dried fish granules was found to increase during 3 month of storage period. Initially salt content was 10 % after one month salt content was 17.7 % and finally it was reached to 29.7 % (Table 3).

The increase in the salt concentration observed might be due to penetration of salt in to the fish flesh in the dried fish granules. The penetration of salt slows down as the concentration of salt of the fish tissue becomes equal to the concentration of salt in the surrounding (Voskresensky, 1965).

Changes in Microbiological Characteristics:

Changes in Total plate count

TPC content of dried fish granules was found to increase during 3 month of storage period. Initially TPC content was 1.2 x 10^2 Cfu/g. after one month TPC was 2.7 x 10^2 Cfu/g. finally it was reached to 4.8 x 10^2 (Table 4). Accepted limit of TPC is 5 x10^5 Cfu/g in fresh/chilled/frozen fishery products and for cooked/boiled fishery products 1 x 10^5 Cfu/g. (EIA, 1995).The reason for the increase in TPC in dried fish granules were due to increase in moisture content in granules during storage time. Present study indicated that TPC content in dried fish granules was under acceptable limit during 3 month of storage.

Changes in organoleptic quality characteristics:

The organoleptic analysis during the storage of dried fish granules at room temperature indicated that there was decline in overall quality characteristics namely appearance, colour, flavour, taste, texture and overall acceptability etc. during storage. Initial overall acceptability score was 8.5 and after 3 month it was 5.3 as shown in table 3.

Conclusion

From the organoleptic, biochemical as well as microbiological evaluation of dried fish granules prepared from Lizard fish (*Saurida tumbil*), it was concluded that, dried fish granules packed in HDPE pouches and stored at room temperature were acceptable up to 3 month. Due to low moisture level and high salt concentration the product was stable to three months by preventing the normal bacterial spoilage.

Further study will be required to find out the shelf life of granules prepared from lizard fish. It may be utilized for produce dried fish granules. If the raw material used is quite fresh, water release after addition of salt is quite small and the quality of the final product would be very good. When stale fish is used, more water is released after addition of salt and the loose water should be squeezed out by hand pressing in a cheese cloth otherwise the texture of the final product will be soft and the fish granules will disintegrate when boiled in water. The dual advantages of the developed texturised dried fish granules are: finding ways for maximum utilization of low value fish species and providing protein-rich convenience foods, as has been pointed out. However, the key to success of this approach depends largely on the market strategies utilized.

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