Development of Ready to Eat Snack Product from Rohu Fish (*Labeo Rohita*) and its Physio-Chemical Properties Evaluation During Different Storage Condition

Varun Kumar[1], and Amarjeet Kumar[2*]

[1*]Department of Home Science, RJMC, Saharsa, Bhupendra Narayan Mandal University, Madhepura-852201, India
[2]Department of Home Science, Rohtas Mahila College, Sasaram, Veer Kunwar Singh University, Ara-802301, India

***Corresponding Author*:** Dr. Amarjeet Kumar
***** Assistant Professor of Home Science, Rohtas Mahila college, Sasaram, Veer Kunwar Singh University, Ara, Bihar
Email- amarjeetkumar011@gmail.com

Abstract
The production of value-added ready-to-serve food products from vegetables, fruits, meat, fish, etc. is the subject of several studies being done worldwide. Fish fillets, fish balls, fish cutlets, fortified products, imitation products, curry products, etc. are only a few of the value-added products made from fish. In our study, Rohu fillets were minced, combined with different flours and seasonings, and cooked in different ways. Compared to all other combinations, the product is most agreeable when it contains 15% of mince. It is unacceptable when there is too much fish mince since it has an unpleasant flavour. It was discovered that the novel product containing Rohu mince is high in protein and can be utilised as a fortifying ingredient for human consumption to reduce malnutrition issues. The items were then sealed in nitrogen gas packaging for storage research. Due to the product's deteriorating alterations during storage, the organoleptic score decreased. The test samples, or the product containing mince, clearly show decline. The moisture content, peroxide value (PV), and thiobarbituric acid (TBA) values rise during storage, indicating that the product is rotting. Due to its cookie-like texture and distinctive flavour, this product will be popular with all demographics.

Keywords: Rohu fish, Texture, Moisture content, Peroxide value, Ready- to- eat Snack

1.Introduction

The word "seafood" often refers to a number of ecologically diverse animal species, including crustaceans, molluscs, and fish from freshwater, estuarine, and marine settings as well as shellfish (Venugopal, 2006). The value of fish as a health food has increased recently for a number of reasons, including its abundance in easily digestible proteins, all nine essential amino acids, therapeutically significant polyunsaturated fatty acids, vitamins, minerals including calcium and iodine, and many other nutrients. Fish is unquestionably a nutritious food in every way (Ackman, 2000). The health benefits of seafood have been well investigated and are well documented in the literature. According to numerous studies, eating fish lowers the risk of sudden cardiac mortality. Processing is done to make a product more useable, acceptable, or palatable or to stabilise it so that it may be delivered to the user at its optimal quality (Aitten and Connell, 1979). As a result, processing seafood can add value, increase supply by lowering losses from product quality deterioration, and better utilise the raw material. In fact, extending the useful life of the product is one of processing's main goals. In the second part of the 20th century, there have been notable advancements in the processing of seafood (Kanderan, 2002). This advancement has been aided by the introduction of Individual Quick Freezing (IQF), freeze drying, and contemporary packaging materials (Gopakumar, 2005). Fish mince has tremendous potential for the creation of a wide range of products, including sausages, dried fish flesh flakes, restructured, dried, and formulated goods, and battered and breaded items like fish cutlets, balls, fingers, etc. As a result, the advancement of minced fish technology presents two opportunities for the use of low value fish for human consumption as well as the diversification of fish processing businesses for the worldwide trade in value-added goods (Pokorny, 1981). One of the value-added products made from minced fish meat is this ready-to-eat snack. A ready-to-eat snack product made from Rohu mince was created for this investigation, and its physio-chemical qualities were assessed.

2. Experimental Procedure

2.1. Separation of Fish Flesh from Bones and Skin

Rohu brought some fish from the market, and it had been carefully dressed and washed. Fish was captured, headed and gutted, and the fillets were removed. When it came time to separate the mince from the bones and skin and separate the meat from the bones, the remaining portion was taken and cooked in a container with 3% salt. In order to store the collected mince, it was placed in a polyester polythene bag.

2.2. Standardization of Product Recipe and Processing Method

The different combination of flour mixes prepared. The combination of the recipes is given in the table 1.

Table 1: Combination of recipe and process method for the production of snack product

INGREDIENTS						Incubation	Other treatments	Cooking
Maida	**Corn flour**	**Meat**	**Butter**	**$NaHCO_3$**	**Salt/Sugar**			
70%	20%	10%	Nill	0.20%	salt 1%	30min	Nill	Baking
70%	20%	10%	Nill	Nill	salt 1%	30min	Nill	Baking
70%	20%	10%	Nill	Nill	salt 1%	Nill	Steamed for 10min	Baking
65%	15%	10%	8.30%	0.20%	salt 1.5%	1hr	Nill	Baking
60%	15%	15%	8.30%	0.20%	salt 1.5%	1hr	25ml water	Baking
60%	10%	20%	8.30%	0.20%	salt 1.5%	1hr	25ml water	Baking
60%	15%	15%	8.20%	0.30%	salt 1.5%	2hr	25ml water	Baking
60%	15%	15%	8.20%	0.30%	salt 1.5%	1hr	egg 25ml	Baking
60%	15%	15%	8.20%	0.30%	salt1.5%	1hr	egg 25ml	Baking
50%	13.20%	15%	20%	0.30%	salt 1.5%	1hr	egg 13ml	Baking
30%	10%	15%	20%	0.30%	sugar25%	1hr	Nill	Baking

2.3. Preparation of Snack Product

To allow for thawing, frozen mince is removed, and once thawed, it is evenly mixed with a hand well. Take the standardised components and combine them in a sizable bowl that has been washed and dried. Add the Maida and maize flour to the tray and stir well with your hands. Next, take a larger bowl, add the butter to it, and stir to melt it using just one direction of your hands. Then, add the sugar and sodium bicarbonate, and stir again. Add the melted sugar, butter, and flour mixture to the big tray. Make a dough-like consistency by thoroughly combining all the ingredients. Incubate the dough for the prescribed amount of time, then shape it into a circle with a moulder and bake it in a microwave oven at 200°C for 20 minutes.

2.4. Analysis of Texture of Snack Product

A texture analyzer can be used to analyse the texture. The texture analyzer is a texture analysis device that is controlled by a microprocessor and provides a highly accurate assessment of the texture of the product. The force needed to crush the snack is measured by a very sensitive load cell, which accomplishes this. Give a three-dimensional analysis as a result. Using a general-purpose material testing device made by Lloyd Instruments, U. K., a food texture analyzer, model LRX plus, was used for instrumental texture profile analysis. Nexigen is the programme that runs on the instrument (Love, 1983).

2.5. Determination of Moisture Content

On a Sartorius balance, a 2- to 3-gram sample was weighed into a clean, pre-weighed Petridis container. For six hours, dishes were baked in a hot air oven at 1000C. Dishes were weighed after cooling in desiccators. This was done over and over until the weight remained consistent. A percentage is used to represent moisture (AOAC,1975).

Calculation:

% Moisture Content = Moisture loss/weight of sample x 100

2.6. Determination of Ash Content

A silica crucible that had already been heated, cooled, and weighed received around 1-2g of the sample. Burning the sample at low red heat caused it to become carbonised. After that, the crucible was heated to 550 °C in a muffle furnace for around 4 hours to produce white ash. Once the crucibles were cooled in desiccators, they were weighed. As a percentage, ash content is stated (AOAC,1975).

Calculation:

% Ash content= Loss in weight / weight of sample x 100

2.7. Determination of Crude Protein

A Kjeldahl with a 100ml capacity was used to transfer 0.5–1g of the well-on chilled fish sample. There were also added a few glass beads, a little amount of the digesting solution (8 parts K_2SO_4 and 1part $CuSO_4$), and 15ml of the concentrated H_2SO_4. Over a hob, it was broken down until the solution became colourless. Distilled water was gradually added to the digested and cooled solution while being shaken and cooled until there was no longer a beat. It was then prepared and placed quantitatively into a 100 ml standard flask. A 2ml portion of the prepared solution was added to the micro-kjeldahl distillation device's reaction chamber. 40% NaOH was added along with 2 drops of the phenolphthalein indicator until the indicator became pink. The ammonia that was liberated during the 4-minute distillation process was absorbed into 2% boric acid that also contained a drop of Tashiro's indicator. Titrating with N/50 H_2SO_4 allowed us to determine how much

ammonia was released. The percentage of total nitrogen multiplied by 6.25 is used to calculate crude protein (AOAC,1975).

2.8. Determination of Crude Fat

Petroleum ether (40–60°C boiling point) was used in a Soxhlet device to extract roughly 2-3g of precisely weighed moisture-free material for about 10 hours at a condensation rate of 5–6 droplets per second. After the excess solvent was removed, the fat was dried at 100°C to a consistent weight. Crude fat % was computed and expressed (AOAC,1975).

Calculation:

% Fat =Weight of Fat/Weight of sample x 100.

2.9. Determination of peroxide value (PV)

The portion of the fat solution in chloroform that was used directly was around 10 ml. By evaporating and drying another aliquot of the same solution, the fat content in the chloroform solution was calculated. The aliquot in an iodine flask was filled with 15 ml of glacial acetic acid and a little amount of potassium iodide. The KI solution is used to close and seal the flask. It is vigorously shaken and left in the dark for 30 minutes. The flask is then removed. With distilled water, I scrubbed the sides. Starch indicator was added along with a few drops. Immediately titrated against N/100 Na2S2O3. The absence of the blue colour indicates the end (AOAC,1975). The following chemical process is involved in determining PV.

$$2\ ROOH + 2H^{+} + 2\ KI \rightarrow I_2 + 2ROH + H_2O + K_2O$$

$$I_2 + 2\ Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2\ NaI$$

Calculation:

$$PV = \frac{(\text{Titre value} - \text{Blank}) \times (\text{Normality} \times 100)}{\text{Weight of fat.}}$$

2.10. Preparation of Trichloroacetic Acid (TCA) Extract

A mortar and pestle were used to ground approximately 10g of precisely weighed sample before being extracted with 10% trichloroacetic acid. The content was then quantitatively filtered using No. 1 filter paper. TCA was used to thoroughly clean the filter paper, and 100 ml of filtrate was produced. Alpha amino nitrogen (AAN), total volatile bases (TVN), and non-protein nitrogen (NPN) were all measured using the TCA extract (AOAC,1975).

3.Result and Discussion

3.1. Standardized Product Recipe and Processing Method

The prepared product was shown to the sensory panels, and the best one was chosen based on the marks each product received. The sensory panels evaluated every aspect of the product and assigned a score. The table 2 provides the recipe composition and methods for the chosen product.

Table 2: Standardized product recipe and process method

Ingredients and process	Result
Maida	30%
Corn flour	10%
Mince	15%
Butter	20%
Sugar	25%
NaHCO3	0.30%
Incubation time	1 hr
Other treatments	Nil
Cooking	Baking

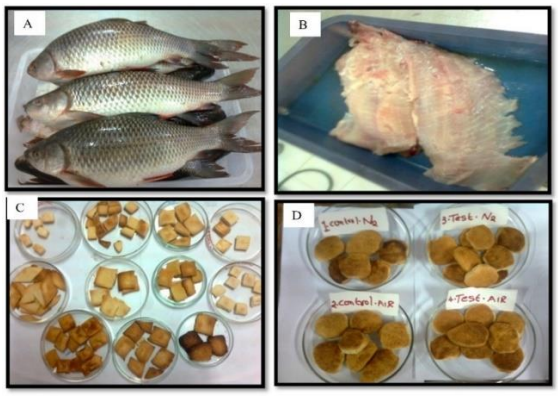

Figure:1 Developed Fish products: (A) Rohu (*Labeo rohita*), (B) Rohu fillet, (C) Standardization of the product, (D) Sampling of the product

3.2. Proximate Composition of the Product

The moisture level of the packed control nitrogen is discovered to be 2.17%, which is slightly lower than average. Due to the addition of fish mince, which has a high moisture content, the test air and test nitrogen have higher moisture contents than the controls. The higher rate of moisture loss from the product during baking is what causes the lower level of moisture. baked goods with a long shelf life and minimal moisture. Due to the addition of fish, which has a high protein level, the test product's protein content is higher than that of the controls. The test air had a protein level of 12.22 whereas the control air had 8.96. With an ash concentration of 0.97, test nitrogen has the highest ash content, followed by test air (0.93), control air (0.85), and control nitrogen (0.83), which has the lowest ash content. If the test nitrogen has a high fat content, the test air, control air, and control nitrogen are then used. Because butter was added to the flour when forming the dough, the product has a high fat content.

Table 3: Proximate composition of the product

Parameter	Control Air (%)	Control Nitrogen (%)	Test Air (%)	Test Nitrogen (%)
Moisture	2.17	2.27	5.22	5.10
Protein	8.96	8.96	12.06	12.16
Fat	16.44	16.43	17.91	18.06
Ash	0.85	0.83	0.93	0.97

3.3. Changes in the Texture of the Product

Hardness is the maximum force that may be applied during the compressive portion of the test. Hardness 1 and hardness 2 are two possible varieties. The results of the texture profile research show that sample control nitrogen is harder than other nitrogen throughout storage days. Due to the addition of soft fish mince to the test samples, they are less hard in comparison to the control samples. The product's textural parameters will alter during the course of storage days as a result of variations in moisture and deteriorative changes to the mince and other components. Analysis of the results reveals that the control samples are noticeably tougher than the test ones. Textural integrity alterations are less pronounced in control nitrogen than in other substances. The texture is lost in air packets, which are the worst due of moisture absorption. Due to the presence of mince and moisture absorption by the product, test nitrogen shows a modest loss, while test air is worse. The following Fig.2 shows the changes in the product's hardness.

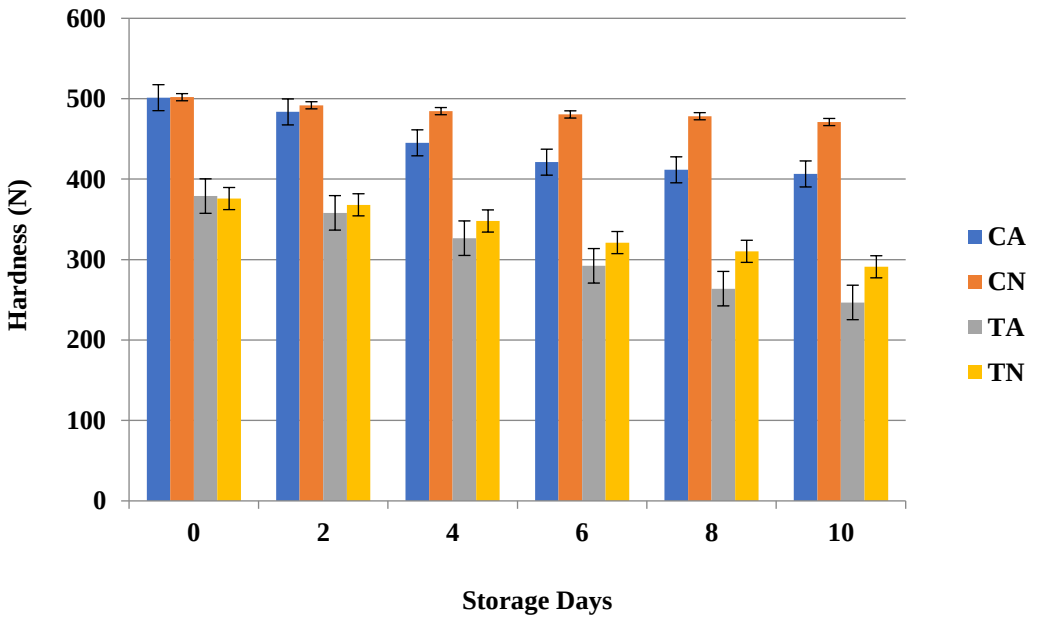

Figure 2: Changes in the hardness of the product. CA=control air pack, CN=control nitrogen pack, TA=test air pack, TN=test nitrogen pack

3.4. Changes in Moisture Content

The table 4 below lists the moisture variations in the products over the course of storage. The shelf life and texture of the all-food products depend on their moisture content. The product's acceptability and quality will be indicated by changes in the moisture content. Due to the addition of mince to the dough, which has a high moisture content, this product's initial moisture content differs from that of the control and test samples (Muraleedharan et al. 1996; Bremner et al 1978). In this

period of declining fish supply, extending the shelf life of fisheries goods is the one essential demand. To satisfy this need, technology development must continue. The initial moisture level of the control air pack was 2.17, and it was increased to 5.80, which represents a significant increase in moisture content of 3.63%. This occurs as a result of the product absorbing moisture from its surroundings inside the bag. We can see that the control sample absorbs more moisture than the test sample when we compare the moisture absorption of the two samples. When compared to air packs, nitrogen packs have less moisture absorption than air packs. This is because there isn't any moisture inside the packs. Because nitrogen packing creates a vacuum and flushes out atmospheric air containing moisture, there will be a shortage of moisture inside the packs and less moisture will be taken in during nitrogen packing.

When analysing the data, it was discovered that the control air pack had the highest increase in moisture level, followed by the control nitrogen, test air, and test nitrogen. The rise in moisture content is in this order: 3.63% of control air, 2.74% of control nitrogen, 1.37% of test air, and 1.22% of test nitrogen. Test nitrogen has the least increase in moisture content, only 1.22.

A baked good's texture and acceptability are directly impacted by changes in moisture content. Therefore, the nitrogen packs play a key function in maintaining the safe moisture level.

Table 4: Changes in moisture content of the product

Storage periods (Days)	Control Air	Control Nitrogen	Test Air	Test Nitrogen
0	2.17	2.27	5.22	5.10
2	3.48	3.79	5.29	5.31
4	3.49	4.29	5.47	5.60
6	5.08	4.51	6.39	5.76
8	5.28	4.71	6.58	6.13
10	5.80	5.01	6.59	6.32

3.5. Changes in Thiobarbituric Acid (TBA)

Table 5 lists changes in TBA values during the course of the product's storage term. The fatty acid oxidation is indicated by the TBA readings. Melton 1983 asserts that although while malonaldehyde is a byproduct of lipid oxidation, this does not always imply that the TBA value keeps rising over time. Malonaldehyde reactions with proteins are likely to be the cause of these low TBA readings (Ke and Woyewoda, 1979).

The product is either unacceptable or on the verge of spoiling if the TBA value increases. This result demonstrates that the initial TBA value of the test samples was slightly higher than expected due to the inclusion of fish mince. But as time goes on, the nitrogen packs' TBA value increasing trend is only marginal. Therefore, the nitrogen pack is more effective than regular air packs at controlling lipid oxidation. The Test air pack has the highest increase in TBA value, which is partly caused by oxygen in the air packs and fish having fat. Followed to test air, control air, test nitrogen and least increase in TBA is in control nitrogen pack this is due to the absence of both free oxygen in the pack and absence of fish mince in the sample. During the days of storage, the control air pack's TBA value rises from 0.134 to 0.361. In a similar manner, test air increased from 0.156 to the high value of 0.436, test nitrogen pack increased in the TBA value from 0.226 to 0.413, and control nitrogen increased from 0.350 to 0.350. The test air pack makes a strong audible increase in the TBA value. It shows that the test air pack has the most deterioration.

Table 5: Changes in TBA values of the product

Storage Periods (Days)	Control Air	Control Nitrogen	Test Air	Test Nitrogen
0	0.134	0.296	0.156	0.226
2	0.210	0.300	0.218	0.241
4	0.261	0.319	0.358	0.351
6	0.316	0.327	0.390	0.390
8	0.331	0.343	0.402	0.405
10	0.361	0.350	0.436	0.413

3.6. Changes in P V

Table 6 lists changes in PV values over the course of the product's storage duration. Lipid oxidation reduces fish's ability to last for a long time. Peroxide readings are highly sensitive indicators of oxidative rancidity in its early stages. Oxygen attack on fat is clearly what causes rancidity, which results in the production of oxidised products and related foul odours. Aldehydes, ketones, and alcohols are the end products of oxidation. Foods containing lipids can be expressed as having an elevated peroxide value. It counts the main lipid oxidation byproduct. The distinctive increase in the PV value or fat oxidation that occurs during product storage occurs in the test air pack because of air and fish. Test nitrogen, control nitrogen, and control air come next. Test air starts off with a PV of 1.16 and rises to 5.72 over the course of seven days. The effects of FFA and PV on nitrogen are not particularly significant. Rancidity has a lower probability. They keep oxidation at away.

Table 6: Changes in PV values of the product

Storage periods (days)	Control air	Control nitrogen	Test air	Test nitrogen
0	1.28	1.16	1.16	1.87
2	1.84	1.49	2.24	2.02
4	1.92	1.84	2.32	2.10
6	2.15	2.66	3.40	3.80
8	2.36	3.41	4.50	4.34
10	3.10	3.91	5.72	4.80

4.Summary and Conclusion

The secret to being successful in the fish market is value addition through processing. Although people lack the knowledge and confidence to prepare seafood, it is an important component of a balanced diet (Sikorski et al,.1995) The word "value addition" is crucial in the modern food industry. It has traditionally been understood as a processing phrase that involves enhancing the value of fundamental foods through coating, component combination, processing, and practical preservation. The functional and psychological advantages of quality and nutrition are among the most fundamental advantages of value addition (Stansby, 1962). Due to the significance of value-added food, there is interest in creating a baked good using fresh water Rohu mince and researching the preservation properties of nitrogen and air packs.

The amount of fish produced from cultural sources has greatly increased recently. As a result, there is a huge need to develop appropriate strategies for making the best use of the increasing production. In order to develop a ready-to-eat snack product from the Rohu mine and determine its acceptance, the current study was carried out. It discovered that the most acceptable level of mince integration is 15%.

Conflict of interest statement

There are no conflicts of interest to be declared by the authors.

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