Development Of Extruded Snacks Using Pumpkin Flour

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Abstract: The post-harvest sector involves the processes from harvest to consumption. Losses of fruits and vegetables are a major problem in the post-harvest chain. Post-harvest loss is the degradation of both the quality and quantity of agricultural produce. Sri Lanka is an ideal county for agriculture because it is a tropical country. Climate is well suited for agriculture. Because of that, the yield of the agricultural commodity is getting high. But levels of post-harvest losses continue to persist in fresh produce value chains in Sri Lanka because of a large variety of factors varying from growing condition to handling at keep level. Fruits and vegetables are the most perishable produce. When considering Sri Lanka, pumpkin holds a priority in post-harvest losses. Not only are losses a waste of food but they also show a similar waste of human effort, agriculture inputs livelihoods, investment and scarce sources such as water. This is one of the major issues in Sri Lanka that we identified. The objectives of this article were both the utilization of pumpkin which produces in excess amount, for product development and partially replacing wheat flour with pumpkin flour. The manufacturing of extruded snacks with pumpkin flour is the healthy food alternative regarding the utilization of pumpkin to reduce the post-harvest loss.

Index Terms: Pumpkin, Snacks, Post harvest, Preservation, Extrude

1. INTRODUCTION

Pumpkins are extensive growth in tropical and sub-tropical countries. In Sri Lanka, there is a huge post-harvest loss in peak seasons. Post-harvest losses of pumpkin in Sri Lanka have been authoritatively estimated to be in the range of 50%-60% or more of the harvest. Because of their high moisture content, fresh pumpkins are very susceptible to attack by pathogenic fungi, bacteria during the period between harvest and consumption. The economic losses because of post-harvest diseases are proportionally greater than the losses in the field because the cost of harvesting, transport, and storage must be added to those of production. Because of the structural changes in the economy of pumpkin generate high prices and difficulties of the local farmers to sell their products. Value-added products are the solution to this problem. Over reason decades consumer requirements for food products have changed significantly. Extruded products take one of the major places among them [1]. Extrusion is a technology for getting products by forcing raw materials through the die of the extruder. Extrusion cooking is a high-temperature quick process. After feeding material to the barrel screw knead the material into a semi-solid material. Inside the barrel, frictional heat and additional heat are used to cook the material. For that pressure and shear are increased and material is forced through the die because of the food emerge under the pressure from the die, it expanded to the final shape and cool rapidly with the moisture removal [2]. This technology is used in food production to produce a vast variety of products including pasta, snacks, cereal and meat products. Most of the time wheat flour is the main ingredient used in these products. But because of the low nutritional properties of wheat flour, consumers try to reduce the consumption of wheat flour based products. Baking without wheat flour can be challenging because it contains gluten protein that gives proper texture for the products. So in this product nutritional quality is improved by reducing wheat flour content wheat flour amount by using pumpkin flour. Pumpkin is rich in different nutrients. Pumpkin seed is also high in oil, protein and total unsaturated fatty acids and provides an important source of nutrition [3][4].

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TABLE 1

PUMPKIN, FRESH, NUTRITIVE VALUE PER 100G. (SOURCE: USDA NATIONAL NUTRIENT DATA BASE)

Principle	Nutrient value	Percentage
Energy	26Kcal	1%
Carbohydrates	6.50g	5%
Protein	1.0g	2%
Total Fat	0.1g	0.5%
Cholesterol	0mg	0%
Dietary Fiber	0.5g	2%
Vitamins		
Folates	16 micro g	4%
Niacin	0.60mg	4%
Panthothenic acid	0.298mg	6%
Pyridoxine	0.061mg	5%
Reboflavine	0.110mg	8.5%
Thiamin	0.050mg	4%
Vitamin A	7384IU	246%
Vitamin C	9.0mg	15%
Vitamin E	1.06mg	7%
Vitamin K	1.1mcg	1%
Minerals		
Calcium	21mg	2%
Copper	0.127mg	14%
Iron	0.80mg	10%
Magnesium	12mg	3%
Manganese	0.125mg	0.5%
Phosphorus	44mg	5%
Selenium	0.3mcg	<0.5%
Zinc	0.32mg	3%
Phyto-nutrients		

Alpha-Carotene	515mcg	-
Beta-Carotene	3100mcg	-
Crypto-Xanthin-Beta	2145mcg	-
Lutein-zeaxanthin	1500mcg	-

Extruded snacks are produced by extrusion cooking, and these products are very popular among children. However, these products are perceived as unhealthy food stuff to many consumers. So by adding pumpkin flour nutritional value can be increased than normal snacks.

2 PROCESS DESCRIPTION

Raw pumpkin is used for pumpkin flour production. It should have more flesh and more seeds with fresh quality. All the parts of the pumpkin fruit are used in flour production without peels. The wheat flour, vegetable oil, salt, spices (pepper and garlic) and dried onion powder are used in snack production (Fig.1) with pumpkin flour. Spices and flavors can be added as consumer preferences.

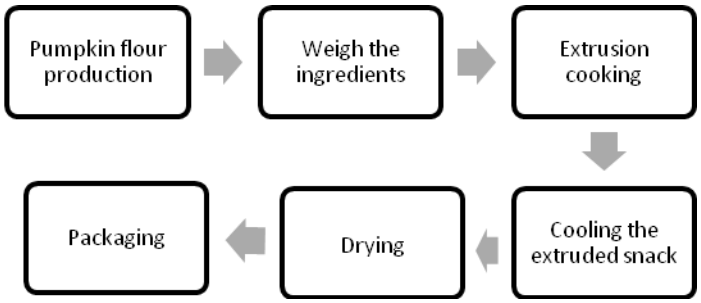

***Fig.1**. Preparation of pumpkin snack*

Preparation of pumpkin flour

Start with good looking pumpkins that have more flesh and more seeds. Then the pumpkins were washed and peeled. After peeling, the stem was removed and cut into two halves. Then the seeds and stringy bits were taken out. Then the pumpkins were cut into small shreds. Next, the cut shreds were blanched for two minutes. After that shreds, stringy bits and seeds were placed on the trays and dehydrated at 65^{o}C for four hours. After dehydration, all were ground and sieved. Finally, pumpkin flour was obtained (Fig. 2).

***Fig. 2**. Preparation of pumpkin flour*

Preparation of pumpkin snacks

Initially, the required ingredients were collected and weighed into suitable proportions. Then weighed two types of flour that were mixed and sieved. After that, the extruder(twin-screw extruder) was set to following parameter ranges.

- Temperature: 130—180 ^{O}C
- Pressure:120–250 bar
- Screw speed: 150rpm
- Nozzle diameter: 4mm

Then all the dry ingredients were added into the extruder hopper. After the dry ingredients have been uniformly blended, it is possible to apply liquid ingredients such as shortening, flavors, and water as sprays by injection into the extruder. After the product is extruded the product was cooled and dried until 4–5% moisture. Then the extrude snacks were packaged according to modified atmosphere packaging using aluminum-coated PET (Polyethylene Terephthalate) [5]. Customers willingness to eat snack food is increasing due to their satisfaction, value attractive, appearance, taste and texture. Cereal based extruded snacks are very common among consumers. Extrusion Technology can merge the varied ingredients used to develop unique snack foods. The quality of the end product depends on the conditions used in extruders and these conditions are the composition of the raw materials, feed moisture, screw speed, screw configuration barrel heat, and also, ingredients and formulation is an important aspect in developing the texture of the extruded product to the consumer. Therefore, processing should be precisely controlled to optimize the survival of function components [6]. Most of the Snacks contain, wheat, corn, rice, in a high proportion the major ingredient. The Vegetable powder is not commonly used in RTE Snacks. Pumpkin is a vegetable that can be used in RTE extruded Snacks. Pumpkin is a great source of carotenes important for the yellow colour of a pumpkin. So, the colour of the Snack can mainly get through the natural pigments in pumpkin. There is no necessity of adding artificial colorings. To that, pumpkin flour naturally enhances the flavor of the snack. The main snack texture property is crunchiness and porous. The texture of the snack is greatly influenced by the extrudate composition. The moisture content of raw material and the processing temperature, the pressure of the extrusion process were important factors affecting the expansion ratio of the extruded snacks. However, too much temperature can deteriorate the nutritional properties of the final product flavor. When increasing the moisture content of the raw materials, the expansion also increases. Inside the extruder, there is high pressure for atmospheric pressure. As the food emerges under pressure from the die, it expands to the final shape and cools rapidly as moisture is flashed off as steam [7]. But final they remained in the range of 4-4%.When considering the overall appearance of the product, it is a puffy, porous, but the bit hard outer surface than the wheat flour-based snacks. And, due to the addition of salt, dried onion powder, garlic, and spices enhance the spicy. Moisture content influences the crunchy texture. The shape is an important property for the extruded food product. The die part at the exit of the extruder gives the required shape and size for the final product. Steam blanching is a cooking process before dry fruit and vegetables. It helps to preserve the colour of fruits and vegetables during drying. Blanching inactivates the enzymes

that involve in the browning process. Steam blanching is done for about 2-4 minutes, so the nutrition loss is very low. That's why the final flour got the fresh yellow colour of the pumpkin. The mixing proportion of wheat flour and pumpkin flour is the most important factor in the extrusion process because it will directly affect the final snack product quality parameters such as texture, shape, and taste. When using the packaging material, it should be considered on barrier properties for moisture and odor because the extruded products are highly hygroscopic. So, aluminum-coated PET (polyethylene terephthalate).

4 CONCLUSION

This product shows that it is possible to produce extruded snacks using wheat flour and pumpkin flour. It is a good solution for the post-harvest loss of pumpkin. This pumpkin snack was harder than typical snacks, and nutritional qualities were higher than wheat flour snacks. Pumpkin flour enhances iron, calcium, beta-carotene and protein content of the products. The color of the product was yellow because pumpkin is a good source of carotenes. It gives a pleasant appearance to the product. Formulating extrudes snacks with pumpkin flour together with wheat flour can be recommended to boost human nutrient intake.

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