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Valorization of Watermelon Rind as Dietary Chips Fortified with Composite Flour

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Abstract: The consumption of junk food increases the risk of obesity, cardio-vascular disease, worsens appetite and digestion. The main objective of this project was to estimate the possibility of using watermelon rind, a fruit waste for production of functional foods. Studies show that Rind and seeds are rich source of dietary fiber and bioactive compounds and it could be used in various nutraceuticals. In this project the watermelon rind was ground into fine paste and utilized in chips. The chips were formulated with watermelon rind and composite flour (masoor dal, moong dal, channa dal, soybean dal), salt and pepper. The valorization of watermelon rind fortified with composite flour as a simple baked snack product has a major advantage of being an easy and light food. It is also a protein enriching snack. The final product was tested to have high dietary fiber and low fat content with nil trans-fat. It also had appreciable amount of protein.

Index Terms **– composite flour, dietary chips, sensory analysis, shelf life, watermelon rind.**

I. INTRODUCTION

The utilization of wastes of processed fruits and vegetables acts as a source of functional ingredients (Schieber et al., 2001). Watermelon is an important warm seasonal crop grown in tropical and subtropical regions. Watermelon biomass can be categorized as three main components which are flesh, seed, and rind. The flesh constitutes approximately 68% of the total weight, the rind approximately 2% (Kumar et al., 1985).

Instead of discarding the watermelon rind as waste, we valorize it in many forms and use it as a nutrient source for developing food products. It has plenteous amount of vitamin, mineral, fibre, and citrulline. The watermelon rind also consists of anti-nutrients like saponin, alkaloid, phenol, tannins and flavonoid. (C.Egbuonu*et al.*, 2015) it also has higher moisture, ash content, protein and carbohydrates. The crud fiber content in watermelon rind is 17.28% (M.A. Al-Sayed Hanan *et al.*,2013).

The consumption of junk food increases the risk of obesity, cardiovascular disease, worsens appetite and digestion, and causes uncontrollable cravings. This has demanded a lot of compensation in health and the risk of diseases have increased.

The valorization of watermelon rind fortified with composite flour as a simple baked snack product has a major advantage of being an easy and light food and also a protein enriching snack with low carbohydrate content. It was found that mixing of two materials will help increase the protein content. Baked dietary chips are considered to be a healthier option than the deep-fried chips.

II. MATERIALS AND METHODS

2.1 PREPARATION OF COMPOSITE FLOUR

Composite flour contains two or more varieties of flours weighed by proportion. To prepare the composite flour the following process were done.

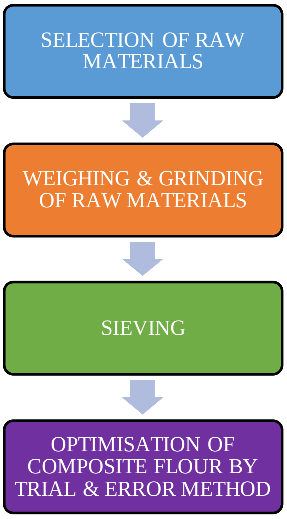


Figure 1: Preparation of Composite Flour

1) Selection &Grinding of Raw Materials

For the preparation of composite flour, pulses were selected and purchased from the local market. The pulses which were selected included Glycine max (soyabean), Vigna radiata (mung bean), Lens culinaris (masoor bean) and Cicer arientinum (chickpea). The pulses were brought &then cleared of visible impurities.

The purchased raw materials were weighed separately for the grinding process. Dry grinding process was done for the preparation of composite flour. They were ground in a pulverizer.

2) Sieving and Optimization of Composite Flour by Trial & Error Method

The ground pulse flour was sieved separately to remove the lumps and partially ground beans from the finely powdered pulse flour. The sieving is done by using 200 mesh size and opening of 0.0063 mm.

Once all the pulse flour is sieved, the composition of the flour was determined. To prepare the composite flour, the grinded pulses were taken in different ratio. Since the entire product is primarily based on Glycine max flour, it had a seemingly increased proportion compared to other flours. The ratio was determined after a few bunches of trials based on how it affected the final product in terms of taste, texture and flavor. The determined ratio was 79:7:7:7 as Glycine max, Vigna radiate, Lens culinaris and Cicer arientinum respectively.

2.2 PREPARATION OF WATERMELON RIND PASTE

Preparation of rind paste is done by the following steps.

Figure 2: Preparation of Rind Paste

1) Purchase of Watermelon, Washing and Peeling

The commonly available variety of Citrullus lanatus was purchased from the market. Fresh and ripened watermelon without any external and internal injury was bought.

The whole watermelons were washed in water to remove the dust particle from the surface. The fleshy red part of the watermelon was removed completely. The rind part of watermelon is then washed again. The green epidermis of the fruit was removed from the rind using a peeler as it is sturdy and changes the color of the final product.

2) Grinding of Watermelon Rinds and Pasteurization of Watermelon Rind Paste

The rinds are cut into small cubes of 2x2 cm. The rind cubes are sheared into fiber rich watermelon rind paste by grinding them in a commercial home mixer. The obtained paste was fine and smooth in texture.

The possibility for the presence of microorganism in freshly ground watermelon rind paste is high. So the rind paste was heated to a temperature70°C for 30 minutes based on various studies. The consistency of the paste was slightly thick after pasteurization due to evaporation of excess water.

2.3 FORMULATION OF THE PRODUCT

Figure 3: Formulation of the Product

1) Dough Formulation

For the formulation of the dough, the composite flour, rind paste, salt and pepper powder were measured and taken at different ratios.

No. of Trials	Ratio(Rind: Flour)	Outcome
TRIAL 1	80:20	Dough was not thick and couldn’t be formulated.
TRIAL 2	73:27	Dough couldn’t be formulated yet.
TRIAL 3	50:50	Dough could be rolled but the product was hard and thin.
TRIAL 4	45:55	The dough could be formulated but product was hard.
TRIAL 5	40:60	The product was crispy but shape was not defined.
TRIAL 6	32:68	Product was crispy and the shape was defined.

Table 1: trials conducted to formulate the dough and the product

2) Sheeting, Cutting and Convection Baking

The dough is rolled on the flat surface and made into sheets evenly. With the help of cutter, the sheets were cut into desired shape.

The convection baking oven is preheated for 15 minutes to obtain the optimum temperature. The cut dough pieces were placed on the baking plates either enough spacing between each other. The plates are placed into the oven and baked for 5 minutes at 270°C. The final product is obtained.

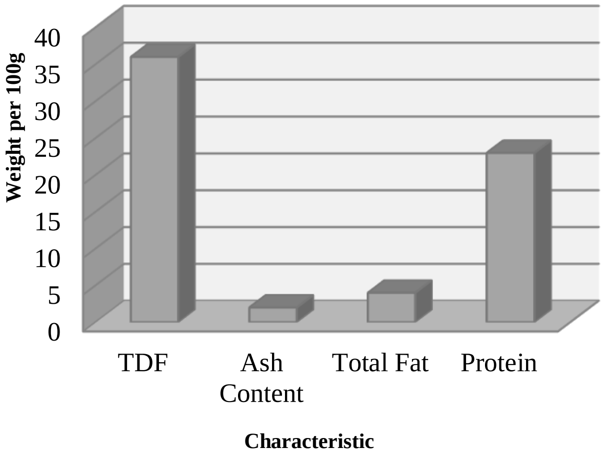
2.4 PACKAGING AND STORAGE

The watermelon rind chips were stored in airtight container and shelf live was analyzed for one month.

III. RESULT AND DISCUSSION

3.1 PROXIMATE ANALYSIS OF THE PRODUCT

Proximate analysis of the product was analyzed for protein content, fat content, Total Dietary Fibre, Carbohydrate and Ash content.



Proximate Analysis of Watermelon Rind Dietary Chips

Characteristics	Weight per 100g
Total Dietary Fiber(TDF)	39g
Ash content	2g
Protein	18g
Total Fat	4g
➢ Trans Fat	0g
➢ Saturated Fat	0g

Based on the various trials conducted, it was noted that the best results were obtained for the ratio which had flour in higher composition compared to rind paste. The ratio was found to be 32:68 respectively. The watermelon rind dietary chips are rich in total dietary fiber is 39g. The ash content of dietary chips is 2.0g which is due to the addition of composite flours. The composite flours are rich in ash content and proteins. The protein content of the chips is 18g, because the addition of composite flours like soybean which are rich in proteins. The total fat is found to be 4.0g which is less amount of fat comparing to other chips.

3.2 ORGANOLEPTIC OR SENSORY ANALYSIS OF PRODUCT

The sensory evaluation was also done with 5 different people for a scale of 5. The various sensory attributes were taste, texture, smell, auditory and flavor. The scale along with parameters was noted as the one given below. The results obtained are as follows:

1- Average
2- Acceptable
3- Good
4- Satisfactory
5- Exceptionally good

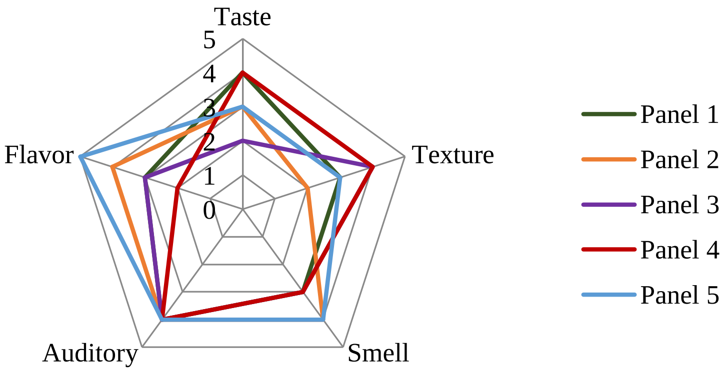


Figure 4: Organoleptic Analysis Web Graph of the Product

3.3 OVERALL ACCEPTABILITY

The overall acceptability is based on the sensory analysis the product had good response for its crunchiness. It had a satisfactory smell and flavor. The taste and texture were concluded as acceptable.

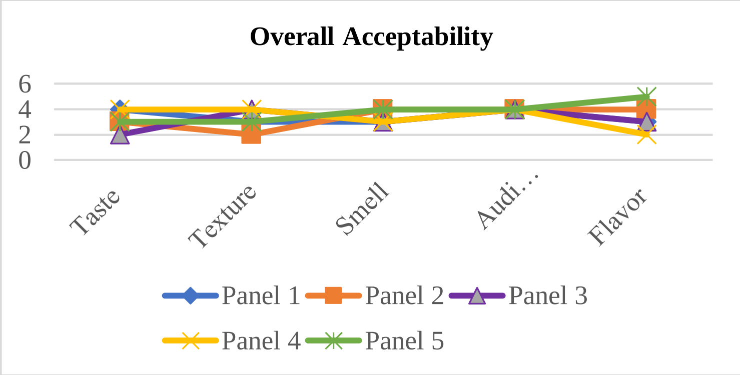


Figure 5: Sensory Attributes of Watermelon Rind Dietary Chips (Overall Acceptability)

3.4 SHELF – LIFE STUDY

The product crispiness was analyzed on a scale of 10 by a panel member. The product was stored in an air tight container. It was observed that the products crispiness was consistent for one week.

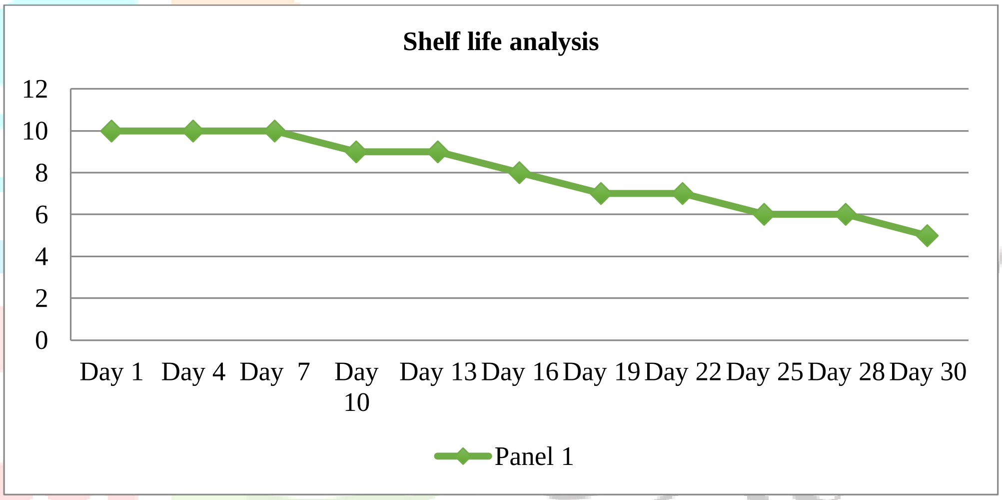


Figure 6: shelf-life analysis

IV. SUMMARY AND CONCLUSION

A successful and novel formulation of chips production with watermelon rinds and composite flours was developed. Watermelon rinds and composite flours are good sources of phenolic compounds and dietary fibers. Composite flour is rich in protein and essential amino acids. Chips dough was formulated with partial substitution of flour or fat with watermelon rind had bio active components as compared to chips prepared with 100% potatoes. Watermelon rind and composite flour were good in antioxidant activity. There is no product in the market made from watermelon rind. Overall, it could be recommended that the technology of using watermelon rind and composite flours should be encouraged among food industries to make economic use of local raw materials to incorporate into chips and provide chips with more functional components and more effective antioxidant activity.

This project can be further developed by conducting packaging studies and more proximate test. The shelf life can be analyzed for microbial load. The same product can be developed for different palatable flavors.

V. ACKNOWLEDGMENT

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