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Utilization of Industrial Waste Pineapple Pomace Development and Evaluation of Fiber Rich Cookies

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Abstract:
In the present Era food industries dealing with fruits pulp or juices are producing huge quantity of waste pomace which is increasing environmental burden. The present study was aimed with assessing the effect of supplementing refined wheat flour with pineapple pomace powder on physiochemical and organoleptic properties of cookies. Pineapple pomace was taken from fruit industrial waste pomace then converted into dehydrated powder and used at different levels (0, 10, 20, 30, and 40%) with other ingredients for cookies formulation. The effects of pineapple pomace powder supplementation on physio-chemical and organoleptic parameters were evaluated along with storage study of cookies.Sample having 30% pineapple pomace powder got the most height in terms of more significant value than other samples. It showed good organoleptic properties. The 30% supplementation seems to be suited for refined wheat flour substitution, and made possible to obtain cookies of better quality within the standards for cookies.
Keyword: Cookies, Pomace,Supplementation, sensory, Pineapple

1.1 Introduction:

Pineapple is a common name for one member of the *Bromeliaceae* family, member of tiny shrubs indigenous to the American tropics and subtropics **(*Md sallen et al., 2019)***. After residential sewage, the food processing sector—which includes processing fruits and vegetables—is the second most significant environmental polluter. Nearly 76 percent of the total fruit is consumed in its fresh condition while just 4 percent is processed and 20–22 percent is wasted. ***(Shyamala Bellur Nagarajaiah and Jamuna Prakash 20).*** Pineapple samples were rich in reducing sugars and soluble fiber and contained fewer amounts of ash, fat, and protein *(CW Huang 2021 paper no 18).* Different parts of pineapple fruit contain different bioactive compounds ***(Amit kumar et al., 2021).*** The industries that process fruits and vegetables generate a significant amount of trash, which contains various valuable materials with a high potential for economic gain and high nutritional value. Large volumes of waste materials, such as peels, seeds, stones, and unwanted flesh, are produced throughout the processing chain due to the processing of fruits and vegetables. **(*Abdullah Alkozai at al., 2018*).** Because of their delicious and reviving flavor, pineapples are a very nutritious fruit. The pomace was high in dietary fiber (45.22 %) and low in fat (0.61%), demonstrating its ability to improve the nutritional quality of goods by adding fiber. Sweetness of pineapple low in calories but high in nutrients, which can help immunological and digestive systems of human beings. In the food business, pineapple pomace accounts for up to 76% of products and contains 99.2% insoluble and 0.8percent soluble forms, both of which have high nutritional value. Dietary fiber of pineapple has beneficial fractional qualities and can be used to improve nutritional quality. **(*Manisha Jose et al., 2022*)**. About 25% of wheat in India is

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used to make bakery products. One of the most well-known quick snack items is cookies. They are distinguished by a formula that contains little water and is rich in sugar and shortening. The main ingredients of cookies are sugar, fat, and wheat flour. **(*L. kamla devi et al, 2015*).** In this way, By-products of pineapple pomace could be used as an alternative sources of nutrients in the development of new foods such as bakery products like- cookies, biscuits etc. are considered the best vehicles to increase the nutritional value for being versatile and presenting high popularity and acceptance. **(*Nataly Maria Viva de Toledo et al., 2017*)**. The pineapple (Ananas comosus L.). The pineapple processing is one of the most important economic areas in the tropical fruit industryhowever it produces a huge quantity of waste—up to 30 tons for every 100 tons of processed fruit processed daily. Recently these by-products have been suggested as sources of dietary fiber (DF) and phytonutrients, including carotenoids and polyphenols. ***(Efigenia et, al.2018).*** Currently lack of fiber in the diet is the impetus behind research into dietary fiber as a novel food element. **(*Darshni JR at el, 2021)*** Dietary fiber was one of the main components of the pineapple pomace, with an insoluble fraction containing most of the fiber. The pineapple pomace also had low lipid and protein contents. ***(Miriam Mabel Selani et al.,2014).*** Fruit pomace powder replacement levels throughout the production process for biscuit-type cookies significantly impacted the contents of protein and fiber. ***(Ana Maria Athayde Uchoa 2009*).**

2.0 Material and methods

2.1 Collection of raw material

Procurement of raw material from local market lucknow but collection of pineapple pomace from Allahabad Canning company Allahabad and convert it into powder form at different potential method with using cabinet dryer.

2.2 Preparation of pineapple pomace powder

Collected pineapple pomace from the industry was dried at 54ºC for 8-9 hr using a cabinet dryer. These dried samples were ground using a domestic mixer grinder power requirement of 750 W rotating at 15,000 rpm and ground for 1 min. Pineapple pomace powder was sieved from 40 mesh sizes. The pineapple pomace powder was sealed in zip lock polyethylene and stored at room temperature.

2.3 Physiochemical properties of raw ingredients

All physiochemical properties like protein, fat, ash, moisture, and fiber content of pineapple pomace powder were analysed with using the AOAC method ***(Jose, M et al., 2022).***

2.4 Preparation of blends

Mixing of different ingredients and prepared four samples with control sample C, C1, C2, C3 and C4 (C= Control sample, C1= 10% PPP, C2 =20% PPP, C3= 30% PPP, C4= 40% PPP).each sample having particular amount of different ingredient that's required for sample preparation. Ingredients like refined wheat powder, pineapple pomace powder, butter, sugar baking powder and baking soda were taken as the recipe given below.

Ingredients ⇨		**RWF/100 g**	**PPP/100 g**	**Butter/100 g**	**Sugar/100 g**	**Baking powder/100 g**	**Baking soda/100 g**
Prepared samples	**C**	100 g	0 g	40 g	50 g	1g	0.05g
	C1	90 g	10 g	40 g	50 g	1g	0.05g
	C2	80 g	20 g	40 g	50 g	1g	0.05g

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	C3	70 g	30 g	40 g	50 g	1g	0.05g
	C4	60 g	40 g	40 g	50 g	1g	0.05g

*RWF= Refine wheat flour, PPP= pineapple pomace powder, g= gram,C= Control sample, C1= 10% PPP, C2 =20% PPP, C3= 30% PPP, C4= 40% PPP

2.5 Development of cookies

Collected raw material (RWF and PPP) was homogeneously mixed and sieving with 40 mm mesh size sieve. Butter and sugar were mixed properly as per given recipe then sieved materials were added with particular amount and mixed then kept for five minutes(holding time) then dough balls were preparedthen cut the rolled dough with biscuit cutter in desired shape and size followed by transferred in pre heated oven at 180^0C for 15-20 minutes after that they were cooled down upto room temperature then packaging of cookies in zip lock polyethylene(food grade) pack was done.

Raw material
⇩
Sieving
⇩
Weighing
⇩
Mixing of butter and sugar
⇩
Mixing (5 minutes)
⇩
Addition of RWF and baking Powder
⇩
Mixing (5 minutes)
⇩
Addition of PPP
⇩
Preheating of oven (180^0C for 10 minutes)
⇩
Preparation of dough ball
⇩
Cut the rolled dough with biscuit cutter
⇩
Baking (180^0C for 15-20 minutes)
⇩
Cooling up to room temperature
⇩
Packaging

2.6 Physiochemical properties of cookies

All physiochemical properties of cookies as protein, fat, ash, moisture and fiber content of pineapple pomace powder were analysed with AOAC method.

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2.7 Physical parameter of cookies

2.7.1 Length and diameter

Moreover the physical characteristics as thickness,diameter,spread ratio etc.of the final product were determined with using digital Verniere calipers.

2.8 Sensory analysis

The overall acceptability parameter was judged by10 semi trained sensory panelist member fallowed by 9 point hedonic scale.

2.9 Storage study of the product

The samples were kept for the period of 3 month in the air tight zip lock polyethylene at room temperature and their storage studies was carriedout as per given intervals.

2.10 Statistical analysis

All finding were calculated with SPSS 18.0 version software, and analyzed mean, SD and ANOVA etc.

3.0 Results and Discussion

3.1 Physicochemical properties of raw ingredients

Two basic ingredients for pineapple pomace cookies was RWF and PPP, that is chemical composition are given below:

Ingredients	Carbohydrate (g)	Protein (g)	Fat (g)	Ash (g)	Moisture (g)	Fiber (g)
Refine Wheat Flour (RWF)	62	11	1.2	1.5	11.5	1.90
Pine apple Pomace Powder (PPP) (db)	42.9	4.57	0.73	1.4	3.57	1.93

*****Composition of pineapple pomace in 100 gm, db= dry basis

3.2 Physicochemical and microbiological properties of cookies

Sample	Carbohydrate (per 100g)	Protein (per 100g)	Fat(per100g)	Ash (per100g)	Moisture (per 100g)	Fiber (per 100g)	Yeast and mould count (per 100g)
C	63.42±0.05	7.60±0.11	22.60±0.10	1.17±0.01	4.16±0.41	1.05±0.11	2.5×10^3
C1	63.95±0.03	6.90±0.08	20.11±0.14	1.31±0.07	5.31±0.24	2.43±0.15	2.6×10^3
C2	59.70±0.06	7.70±0.22	21.23±0.09	2.65±0.12	6.63±0.10	3.10±0.12	3.0×10^3
C3	58.25±0.01	8.14±0.06	18.09±0.04	3.93±0.24	6.96±0.47	5.63±0.10	2.7×10^3
C4	57.86±0.02	8.09±0.08	19.08±0.12	3.68±0.25	7.31±0.51	4.98±0.20	3.1×10^3

*All value are represented as mean± SD and those with significantly different ($p<0.05$)

3.3 Physical parameter of cookies

Sample	Thickness (cm)	Diameter (cm)	Spread ratio	Weight (g)
C	0.86±0.02	4.80±0.04	8.22±0.07	4.96±0.04
C1	0.56±0.01	4.42±0.02	8.01±0.10	5.03±0.06
C2	0.48±0.04	4.24±0.08	7.98±0.15	5.06±0.09
C3	0.48±0.04	4.10±0.10	7.88±0.17	5.10±0.05
C4	0.42±0.08	4.08±0.07	7.46±0.21	5.12±0.04

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*All value are represented as mean± SD and those with significantely different ($p<0.05$

3.4 Sensory analysis

Parameters	C	C1	C2	C3	C4
Color	7.6±0.42	6.9±0.66	7.0±0.63	7.5±0.32	7.4±0.12
Flavor	7.0 ±0.67	6.4±0.82	7.2±0.43	7.2±0.22	7.0±0.23
Texture	7.8±0.26	6.0±0.53	5.8±0.34	7.0±0.43	6.8±0.20
Taste	7.5±0.64	5.8±0.78	6.1±0.89	7.0±0.12	6.8±0.16
Overall acceptability	7.7±0.82	6.27±0.88	6.52±0.67	7.17±0.46	7.00±0.20

3.5 Storage study of the product

Samples and parameters	C (OAA)	C1 (OAA)	C2 (OAA)	C3 (OAA)	C4 (OAA)
0 days	7.7±0.82	6.27±0.82	6.52±0.67	7.17±0.46	7.00±0.20
15 days	7.6±0.53	6.22±0.23	6.48±0.58	7.14±0.51	6.90±0.34
30 days	7.4±0.45	6.10±0.46	6.26±0.89	6.90±0.37	6.71±0.42
45 days	7.0±0.27	6.00±0.67	6.20±0.22	6.88±0.43	6.32±0.21
60 days	6.9±0.47	6.20±0.90	6.00±0.58	6.63±0.67	5.89±0.46
75 days	6.7±0.33	6.00±0.34	6.00±0.90	6.58±0.90	5.68±0.54
90 days	6.1±0.83	6.00±0.24	5.60±0.66	5.9±0.56	5.22±0.45
Mean	7.05±0.90	6.11±0.44	6.15±0.49	6.74±0.78	6.24±0.26

*All samples were analyze after 15 days on the basis of 9 point hedonic scale (sensory parameter)

Conclusion

When we concluded a comprehensive study, we found the main ingredients RWF and PPP containing sample C3 (30% PPP cookies) was finally scored the highest on the basis of sensory and storage study, etc. C3 sample contains 70 g RWF and 30 g PPP with the mixing of other ingredients, its best result to all physical, physiochemical, and storage studies, etc. Therefore all findings of this study prove that we use industrial waste in different forms and may reduce it by using this way. In this study, we use pineapple pomace powder (PPP) to develop value-added PPP cookies. Recently industrial waste is approximately 20-22%, so this study is beneficial for using industrial waste, reducing waste, and developing value-added products (cookies). Sample C3 showed the best result compared to others without a control sample. C3 sample contains more fiber and showed the best sensory score (overall acceptability), storage study , nutritional and physical parameters. We developed high fiber-rich cookies that are very useful to complete the nutrition as well as to promote health for all, and it was liked by all age groups.

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