ORIGINAL ARTICLE

Development of Cookies Prepared from Red Rice Flour (*Oryza sativa*), Papaya Fruit, Brown Sugar and Proximate Analysis

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ABSTRACT

Background: The effect of incorporation of 40 % of Papaya fruit pulp in 100 % of Red rice flour along with Brown Sugar in cookies was investigated along with the other required raw materials and was compared with 100% Brown rice flour cookies, 100 % Foxtail Millets cookies and 100 % of Refined Wheat Flour Cookies. The 100% Red rice flour cookies were produced with incorporation of Papaya Fruit ,brown sugar and shortenings. The 100% Brown rice flour cookies,100% Foxtail Cookies and 100% Refined wheat Flour were prepared with Brown sugar and Shortening. Materials and Methods: The proximate composition, Vitamin C analysis, Iron content evaluation and sensory evaluation of cookies were done using standard methods. **Results and Discussion:** The proximate analysis showed that the Energy value was 417.72 % in Red rice Flour Papaya cookies, whereas Brown rice Flour cookies scored 529.38 %. The Fat value was 7.19 % in Red Rice flour Cookies and was 28.2 % in Brown rice cookies. The protein content value of Red rice flour cookies is 9.57% which is nearer value to Foxtail Cookies of 10.1%. The moisture content value of Red Rice Cookies is 4.18 % which is higher than other 3 cookies. The Red rice flour Papaya cookies, Brown rice flour cookies and Foxtail flour cookies were gluten free and Refined wheat flour cookies have 1.57%.The vitamin C content in Red rice flour Cookies were 27.77% and Iron Content value is 0.19%.Sensory evaluation shows that the Red rice Flour Papaya cookies has colour value 3.6,Texture 3.8.Flavour 3,4 and sweetness was 3.8 and was preferred more with overall acceptability. **Conclusion:** The study shows that Red rice Flour Papaya cookies have less fat, energy, gluten free , its nutritional quality was noted and organoleptic characteristics were accepted by panellist. Red rice Flour Papaya cookies has reduced the usage of shortening and less fat was noted in Red Rice papaya incorporated cookies. Hence inclusion of papaya fruit pulp in Red rice flour cookies should be cheered.

Keywords: Red rice flour, Papaya fruit pulp, Sugar, Proximate analysis, Vitamin C, Iron content

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INTRODUCTION

Cookies are ready- to-eat, convenient and inexpensive food snacks produced from unpalatable dough that is transformed into a light porous, readily digestible and appetizing product through the application of heat. The principal ingredients in cookies are wheat flour, fat, sugar and water, while other optional ingredients include milk, salt, flavouring agent, aerating agent and other food additives [1] The per capita consumption of cookies in India is reported to be 8 kg per annum as against 15 kg per annum in developed countries.[2] A strict gluten-free (GF) diet is followed by many people who do not suffer from celiac disease nowadays. The exclusion of gluten is considered, by many, to be a healthy habit or a way to prevent the onset of celiac disease [3].

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Rice is nutritious as it contains protein, carbohydrates, crude fibre fats, ash mineral viz.. Ca ,

p, Fe, Na ,K and Vitamin such as thiamine, Riboflavin, niacin, Tocopherols. Red rice is those which has red layer on the bran. The colour is due to the anthocyanin in different layers of seed coat, pericarp and aleuronic .[4] .The eating quality of red rice makes it difficult and challenging for consumers to eat red rice every day as they eat white rice. For people who are used to eat red rice may assume the eating quality is not an issue when compared to the nutritional content. But for those who are not used to eat it then the improvement of red rice eating quality is needed [5] . Cookies made from milled rice or wheat flour had substantially lower AcA levels than those from whole grains [6].

Papaya can be used for many purposes. Ripe papaya is eaten fresh, incorporated into desserts, made into juice and processed as jelly, marmalade, candies and crystallized fruits. The various products such as jam, jelly, candy, nectar, puree, concentrate slab, toffee, tootti-fruity, freeze dried chunk, dried rolls, dried slices and pickles can prepared from papaya processing.[7]

Green and unripe papaya can be served as a vegetable stew, in salad or pickled.[8]. The post harvest losses of papaya in India are estimated at 5-30 percent of total production. The processing of papaya fruit not only minimizes these losses to some extent but also gives better return to farmer during the glut season and there is great scope for processing of papaya fruits to curtail the post harvest losses. [9]

MATERIALS AND METHODS

Preparation of Flour

Red rice was purchased from an organic farmer belongs to Puducherry region. The Red rice was washed thoroughly, removed foreign particles and soaked for three hours. Then it was allowed to solar dry for 10 hours till all the moisture content is removed. Later it was milled into flour using the Pulverizer.

Brown rice and Foxtail millets were purchased from organic farmer belongs to Puducherry region. They were washed, removed foreign particles and soaked for 2 hours separately. Then dried for 10 hours and milled separately using Pulverizer. The refined wheat flour was purchased from local market of good quality using FSSAI standards.

Preparation of Papaya Extract

Papaya (C. papaya L.) ripe fruit, skin in orange colour, with no longer latex dark orange-coloured pulp ,without any physical damage and firmness appropriate for consumption was purchased in the uzhavar sandai(Farmers market) of Puducherry region. Papaya was washed, peeled, pulp was ground and kept ready for making biscuits.

Preparation of Other Raw Materials

The Shortening ,baking powder and Brown sugar were purchased from local market .Brown sugar was systematically spread in flat trays and checked with any sand particles present. Biscuit tray ,dough kneading machine ,spoons, moulds, weight machine and bowls were washed and sterilised.

Biscuit Preparation

The Red rice flour was sieved with the baking powder for homogenisation and mixed with 40% of papaya fruit pulp ,20% of brown sugar and 24% of shortening .

The brown rice cookies, Foxtail millet cookies and Maida cookies were prepared as per the ingredient shown in Table 1.

Dough Preparation

The dough were prepared in such a way that there will be no cracks and checked with all the ingredients were evenly mixed. The dough mixture were seperately rolled as a sheet using rolling pins with 5 mm of height .

Moulding and Baking

Then the Red rice cookies and other cookies were cut into shapes .The cookies were baked in an Electrical Bakery Oven in separate trays for 15 minutes in 120 degree Celsius following the pre-heating to 180 degree Celsius for 50 mins.. Red rice Flour Papaya cookies and other cookies were prepared using the Department of Foods and Nutrition, Post Graduate & Research Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad 500 030, India TNAU technology with slight modifications . Development and evaluation of biscuits from foxtail millet and papaya fruit (National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets, Madurai symposium, Thamukkam Grounds,Madurai,13th September 2013).

Proximate Analysis

The proximate analysis of Brown Rice Flour Cookies , Foxtail Millet Cookies , Refined Wheat Flour Cookies samples was done using the method of AOAC.[10] and Red rice Flour Papaya cookies were determined using IS 12711:1989 RA 2014. The determination of proximate composition of the cookie samples, namely, moisture content, ash, protein, fat were determined following the procedure outlined by AOAC. Gluten was determined using -IS:1155:1968(RA 2010) Appendix D.

Table 1: Formulation of Cookies

S. No.	Name of Cookies	Ingredients Utilized (in gms)								
		Red Rice flour	Brown Rice flour	Foxtail Millet Flour	Refined Wheat Flour	Shorte-ning	Brown Sugar	Papaya fruit Pulp	Baking Powder	Ella chi powder
1.	Red rice Flour Papaya cookies	1000	-	-	-	240	200	400	10	10
2.	Brown Rice FlourCookies	-	1000	-	-	640	500	-	10	10
3.	Foxtail Millet Flour Cookies	-	-	1000	-	640	500	-	10	10
4.	Refined Wheat Flour Cookies	-	-	-	1000	640	500	-	10	10

Iron and Vitamin C Analysis

The IRON and Vitamin C content of Red rice Flour Papaya cookies were determined using AOAC 20th edition 939.03 and AOAC Official Method 967.21, 18th Edition respectively. The iron content and vitamin c content were tested only in Red rice papaya cookies.

Sensory analysis

Sensory evaluation of the composite cookie samples was carried out by twenty five panellists of Women Food Entrepreneur, organic rice Women farmer and to the Papaya Fruit Cultivator. The sensory attribute included colour, sweetness, flavour, texture, and overall acceptability was evaluated using a 4point hedonic rating scale ranging from 4 (extremely like) to 1 (extremely dislike) and as described by Ihekoronye and Ngoddy [11]

Inclusion Criteria- Women and Healthy

Exclusion Criteria - Has colour-blindness • Has gluten-related disorder (eg: Celiac disease).

STATISTICAL ANALYSIS

All data obtained were subjected to statistical analysis of variance using SPSS software version statistical pages. Means were separated using Duncan multiple range tests.

RESULTS AND DISCUSSION

Proximate Composition

Table 2 shows the result of the proximate composition of variety of cookies. Cookies produced with Red rice Flour Papaya cookies are gluten free and less in fat content. Foxtail cookies seem to be high in protein value, and less carbohydrates comparatively. Brown rice cookies have very less moisture value. Compared to other cookies .Refined wheat flour have less total ash and presence of gluten.

Energy

The study shows that the energy value of Red rice Flour Papaya cookies seems to have lower value of 417.72% whereas the plain brown rice flour cookies have high energy value of 529%.

Table 2: Proximate analysis of Cookies

	Energy (kcal)	Carbohydrates (g)	Fat (g)	Protein(g)	Moisture	Total ash	Gluten
Foxtail Millet Flour Cookies	516.17	58.49	26.8	10.1	2.01	2.6	0
Brown Rice FlourCookies	529.38	62.22	28.2	6.57	1.82	1.19	0
Refined Wheat Flour Cookies	501.75	67.22	21.6	9.14	1.44	0.6	1.31
Red rice Flour Papaya cookies	417.72	77.49	7.19	9.57	4.18	1.57	0

calories restriction (CR) is a dietary intervention with lot of benefits for the health and life span extension [12]. Leanne M. Redman.

Carbohydrate

The research reveals that, the carbohydrate value of foxtail cookies is having a less value of 58.49% whereas the Red rice Flour Papaya cookies have highest value of 77.49%.(The high carbohydrate (HC) diets are recommended for lowering the risk of coronary heart disease because of the decrease plasma low – density lipoprotein (LD2) Cholesterol concentrations [13]

Fat

The analysis denotes that Red rice Flour Papaya cookies in cooperated red rice cookies has a less fat of 7.19 %. And Brown rice cookies have high fat value of 28.2. Feeding rats with low- fat cookies diets prepared with oil at 250 gm. /kg fat replacement levels resulted in a significant decrease in total serum cholesterol and triglycerides [14]. Production of low – fat cookies and their nutritional and metabolic effects in rats.

Protein

This result shows that Red rice Flour Papaya cookies and Foxtail cookies have a high protein value of 9.57 % and 10.1% respectively. The cookies are a good source of protein compared to the healthy diet of adult 0.75 g protein/ Kg/ b.wt /day) and it improves the rapid growth and muscle development and 100gm of cookies can provide the child about the 30-40% of daily protein allowance [15].

Moisture

Red rice Flour Papaya cookies had higher moisture content of 4.18% and . Refined wheat flour cookies had lowest moisture content of 1.44 %.The moisture content of 7.20 to 7.69g ensures the storage stability and to obtain desirable shelf life of the products [16]. Total ash

The total ash content in Red rice Flour Papaya cookies have higher value of 1.57% where as Refined wheat flour has lowest value of 0.6%. The ash content increased with the increase of bread fruit proportion. The inclusion of bread fruit has improved the ash content of cookies [17]

Gluten

The gluten content was not present in Red rice Flour Papaya cookies and refined wheat flour has gluten of 1.31%. The gluten must be eliminated from the diet of patient suffering from celiac disease due to its serious intestinal damage [18].

Vitamin C Analysis

Vitamins play vital functions in the body, they are needed for formation of hormones, cell growth, needed for formation of hormones, cell growth, needed for proper functioning of the immune system and enhances clear vision etc, The vitamin C is a strong water soluble antioxidant that helps the body develop resistance against infectious agents and scavenges harmful free radicals[19]. Red rice Flour Papaya cookies resulted as 27.77 %..The Red and black brown rice flours gave more bioactive compounds and antioxidant activities than white and brown rice flour[20]

Iron Analysis

The iron content in Red rice Flour Papaya cookies were resulted in 0.19 .The iron content of the cookies prepared from African bread fruit flour has increased from 3. 3.97mg/ 100g in the control sample (100% wheat bread) to 6.11mg/ 100g in the millet bread substituted with 40% African bread fruit flour[21].The regular fortified brown sugar cake can full fill %DV of added nutrients in order to alleviate micro nutrient deficiencies[22].

Sensory analysis of cookies

Table 3 implies the results of sensory evaluation and overall acceptability of prepared cookies.

The panellist has given the preference to the reddish colour cookies and scored high value in colour. Inclusion of Brown sugar in red rice may improved the palatability of the cookies . Abundant Maillard reaction products (such as pyrazines and furanones) were detected in brown sugar[23].The sweetness in Red rice Flour Papaya cookies were resulted high due to the

Table 3: Sensory analysis of cookies

Items	Colour	Texture	Flavour	Sweetness	Overall Acceptability
Foxtail Millet Flour Cookies	3.2	3.6	3.2	3.6	3.4
Brown Rice FlourCookies	3.4	3.6	3.2	3.6	3.45
Refined Wheat Flour Cookies	3.2	3.6	3.2	3.2	3.3
Red rice Flour Papaya cookies	3.6	3.8	3.4	3.8	3.65

presence of brown sugar and papaya fruit extract. The 37 aroma-active compounds were obtained, mainly including ketones, pyrazines, alkanes, phenols and alcohols, which contributed caramel, sweet and fruity notes to brown sugar. Among them, furfural, benzeneacetaldehyde, 2,3-butanedione, â-damascenone, 2-methoxyphenol, dihydro-2-methyl-3(2H)-furanone, 2-furanmethanol and butyrolactone could significantly enhance the sweetness of sugar solution because of the congruency of the aroma attributes and sweetness.[24]

Texture of the Red rice Flour Papaya cookies were predominant due to the presence of Rice flour and less shortening. Inclusion of 40% of papaya pulp has not affected the crunchiness and chewing ability is good. Raise in buckwheat flour content from 10 to 20% resulted in an increase in sensory scores for flavour, rupture and chewiness.[25].

Flavour of the Red rice Flour Papaya cookies seems to be higher when compared to other cookies .The presence of 40% of the papaya fruit pulp enhances the flavour. Flavour is the perception influenced by taste and smell impression even the appearance and texture may also affect this attribute[26]

Overall Acceptability

The results of overall acceptability were correlated with all the sensory attribution tested. It can be concluded that all the cookies were accepted by the panellist. Red rice cookies with papaya incorporation has the highest potential to be commercialized as it was received well by the consumers.

CONCLUSION

This study provided information regarding nutrient analysis of the developed cookies. Addition of papaya pulp to the red rice cookies is a good functional food of great nutritional benefit. Fruit incorporated cookies will indirectly support to include the fruit in the daily diet pattern. The entrepreneur can introduce the red rice cookies with papaya fruit as a new combination to the market. The Diet planners may include the red rice papaya cookies to enjoy the nutritional benefits. Customer can include the red rice in their daily diet in different form. The biscuits can be popularised in Food expos for community outreaches.

RECOMMENDATION

Microbial activity and shelf life assessment may be done in future studies. The vitamin c and Iron content may be analysed in all samples. The dehydrated papaya flour can be included in cookies. Sensory evaluation may be carried to different age groups.

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