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RESEARCH ARTICLE

ORGANOLEPTIC AND NUTRITIONAL QUALITY OF COOKIES DEVELOPED USING COCONUT FLOUR, COCONUT SUGAR AND VIRGIN COCONUT OIL

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ABSTRACT

Cookies have become one of the most desirable snacks for both youth and elderly people. Maida is rich in carbohydrate and poor in protein and fiber. It is essential to have healthy alternative to maida and coconut flour being rich in fiber and protein is ideal to replace maida in cookies. The present study was framed in that direction to formulate a value added cookie using coconut flour (CF), coconut sugar (CS) and virgin coconut oil (VCO). Experimental cookie (EC) were prepared with 20% CF:80% maida, 30% CS:20% cane sugar and 30% VCO:20 % butter and compared against standard cookie (SC) made with maida, cane sugar and butter. The cookies were stored in airtight containers for a period of 56 days. Sensory evaluation was carried out on 0th day and periodically every week upto 56th day. Selected nutrients were analysed by standardized procedures on 0th day and 56th day. Incorporation of coconut products in the preparation of cookies received optimum sensory quality characteristics. Lauric acid, being a unique fatty acid present only in coconut was 8.3 ± 0.10g in EC while it was 0.42 ± 0.02g in SC. EC were found to be rich in all the nutrients on comparison with SC and can be promoted to use as a therapeutic food suitable for supplementing the diets of malnourished children and patients with metabolic diseases.

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INTRODUCTION

Cookies are nutritive snacks obtained from single or composite dough which has been transformed into digestible and more appetizing products through the action of heat in the oven (Singh *et al*., 2000). Cookies have become one of the most desirable snack for both youth and elderly people due to their low manufacturing lost, more convenience, long shelf-life and ability to serve as a vehicle for important nutrients (Akubor, 2003; Hooda and Jood, 2005). Coconut has been a traditional food in almost all the countries where it is grown (Jena and Das, 2006). In India, coconut is consumed in the form of tender nuts, raw kernel, copra, coconut oil and desiccated coconut. Since dishes made from coconuts are rich in fat, protein and some vitamins, they counterbalance some of the deficiencies inherent in the predominantly starchy foods consumed in the countries concerned (Palaniappan and Subramaniam, 2010). Coconut flour is prepared from coconut residue called "sapal" which is the meal usually discarded after coconut milk extraction (Trinidad *et al*., 2001). The coconut flour can provide not only value added income to the country, but also a nutritious and healthy source of dietary fiber (Trinidad *et al*., 2003). Coconut flour is extremely high in fiber with almost double the amount found in wheat bran (Bawalan, 2000). Coconut flour plays a role in controlling cholesterol and sugar levels in blood and prevention of colon cancer. Studies revealed that consumption of high fiber coconut flour increases faecal bulk (Arancon, 2009).Coconut sugar (coco sap sugar, brown sugar or *gula kelapa*) is produced from fresh coconut sap, which is tapped from the coconut flower stalks and boiled (Prakobsil *et al*., 2010). This type of sugar has been widely used as an ingredient in food and beverages in Asian communities. This sugar has a low glycemic index and is also a nutrient powerhouse, with vitamins, minerals and amino acids (Singsoong *et al*., 2010). VCO is defined as the oil resulting from the fresh and mature kernel of the coconut (*Cocos nucifera* L.) through mechanical and natural means, either with the use of heat or not provided that it does not lead to alteration or transformation of the oil (APCC, 2003). VCO has many advantages, which include the health benefits from the retained vitamins and antioxidants, the antimicrobial and antiviral activity from the lauric acid components and through its easy digestibility from the medium chain fatty acids (MCFA). In the past, clinicians, food and nutrition scientists have been unaware of the potential benefits of coconut but currently, several researchers have recognized the antiviral, antibacterial,

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antiprotozoal and anti-cancer effects of coconut (Enig, 1998). People are increasingly seeking wholesome, health promoting and illness preventing foods. It looks as though the list of ingredients on the labels is the key factor that sells food these days. In order to focus our attention on matters of serious public health concern in todays scenario, this study intends to formulate cookies with CF, CS and VCO. There are several varieties of cookies available commercially, but with the effective combination of all the coconut products in the preparation of cookies is yet unexplored. Thus the present study has been taken up with the following objectives:

- To formulate and standardise the level of incorporation of coconut flour, coconut sugar and virgin coconut oil in the preparation of cookies.
- To assess the organoleptic acceptability and nutritional quality of cookies on storage

MATERIALS AND METHODS

Source of Raw Materials

The ingredients used for the preparation of cookies were maida, coconut flour, cane sugar, coconut sugar, butter, virgin coconut oil, milk, baking powder, cashew nuts and raisins. Two of the ingredients namely milk and coconuts were obtained fresh from the investigator's farm. From the matured dry coconut, coconut flour was prepared. The remaining ingredients were purchased from the reputed departmental store.

Preparation of Coconut Flour

Coconut flour was prepared from the fully mature dry coconut. The coconut endosperm after the removal of shell and paring, was shredded and the coconut gratings were grounded to extract the coconut milk. The meal remaining called the *"sapal"* was washed in hot water to reduce the oil content. The residue was then sundried for 48 hours and ground (Trinidad *et al*., 2001). The flour obtained was stored at room temperature and used for further preparations and analysis.

Formulation and Standardisation of Cookies

Standardization is a process in which the value of potential standard is fixed by a measurement made with respect to a standard whose value is known (Wageningen, 2003). Two different cookies were formulated namely standard cookie (SC) and the other experimental cookie (EC). Standard cookie was prepared with maida, cane sugar, butter, baking powder, cashew nuts and raisins. Experimental cookie was prepared with maida, CF, cane sugar, CS, butter, VCO, milk, baking powder, cashew nuts and raisins. A pilot study was initially conducted using different proportions of coconut flour, coconut sugar and virgin coconut oil. Maida and coconut flour were combined in the different proportions (90:10, 80:20 and 70:30) (Table.1). Coconut sugar and cane sugar were added at the levels of 50:0, 40:10 and 30:20.VCO and butter were added in the proportions of 50:0, 40:10 and 30:20. The cookies that had obtained maximum scores were selected for further study.

Preparation of Cookies

Flour and baking powder were sifted. The preliminary step for the preparation of cookies was creaming. Creaming was carried out by using shortening and sugar and subsequently added the sifted flour, baking powder, cashewnuts and raisins. The mixing was carried out for five minutes till a soft dough was formed. At regular intervals, the dough was scraped from the sides of the bowl to avoid unequal distribution of the ingredients. The prepared dough was rolled out into sheets and cut into pieces by cookie cutters. These cut pieces were transferred to aluminum trays and baked at 180°C for 20 minutes followed by cooling at 27º C for 30 minutes before packing and sealing in an air tight box.

Organoleptic Evaluation of The cookies

Sensory evaluation is the process of evaluating according to the knowledge acquired via human senses like sight, taste, touch and smell (Yager, 2000). The cookies prepared were evaluated for their sensory characteristics like colour, texture, taste, flavour, and overall acceptability, by a panel consisting of ten semi trained judges. A 9 point Hedonic scale score-card method was used to determine the sensory characteristics (Amerine *et al*., 1965). The tests were conducted at a convenient time of the day at 12 noon (Ranganna, 1986). The organoleptic test was carried out on 0^{th} day and periodically every week upto 56^{th} day. Since EC showed pronounced coconut flavour at end of 8^{th} week and SC exhibits the slight change in texture the storage period was stopped on the 56^{th} day.

Analysis of Selected Nutrients

As soon as food is harvested, deterioration of quality attributes or nutrients begins and increases with time. Nutrients are lost by food processing operations, sensitivity of nutrients to pH, oxygen, light, heat and enzyme action (Gordon, 2001). The nutrients namely energy, protein, carbohydrate, fat, fibre, iron and calcium were analysed in triplicates using the AOAC standard methods for SC and EC on the 0^{th} day and 56^{th} day. Lauric acid and saturated fatty acid were analysed only on 0^{th} day as they are not economical.

RESULTS AND DISCUSSION

Mean Organoleptic Scores of Variants

Different composition of flour, sugar and shortenings were tried to arrive the acceptability levels of each. In variant I, II and III the flour composition is alone altered, the other ingredients remains similar to the standard cookie. The level of 80:20 (maida:coconut flour) had scored highest value for texture, taste and overall acceptability on comparision with II and III, hence this proportion was selected for flour combination.

The scoring for colour of the cookies decreases with the increase in the level of coconut flour (Table 2a). The texture of the cookies enhanced with the increasing levels of coconut flour.

Table 1. Quantification of Ingredients for 100g of Cookies

Variant	Ingredients								
	Maida (g)	Coconut flour (g)	Cane Sugar (g)	Coconut Sugar (g)	Butter (g)	Virgin coconut oil (g)	Milk (ml)	Baking powder (g)	Cashewnut and raisins (g)
Standard cookie	100	-	50	-	50	-	-	1	5
Experimental cookie	80	20	20	30	20	30	10	1	5

Table 2a. Mean Organoleptic Scores of Experimental Cookie Variants for flour

Criteria	Mean Scores		
	Variant I (Maida+Coco flour) 90:10	Variant II (Maida+Coco flour) 80:20	Variant III (Maida+Coco flour) 70:30
Colour	8.5±0.7	7.9±0.7	7.4±0.5
Texture	8.1±0.8	8.3±0.6	8.3±0.6
Taste	7.7±1.4	8±1.0	7.9±1.1
Flavour	7.7±1.1	7.8±1.0	8±1.0
Overall Acceptability	7.8±1.4	8±0.9	7.8±1.0

Table 2b. Mean Organoleptic Scores of Experimental Cookie Variants for Sugar

Criteria	Mean Scores		
	Variant IV (coco sugar + cane) 50:0	Variant V (coco sugar + cane) 40:10	Variant VI (coco sugar + cane) 30:20
Colour	7.9 ± 0.3	7.8 ± 0.4	7.8 ± 0.4
Texture	8.1 ± 0.8	8 ± 0.9	8.4 ± 0.8
Taste	7.2 ± 1.4	7.6 ± 1.2	8 ± 1.3
Flavour	7.3 ± 1.4	7.7 ±1.0	8 ± 0.9
Overall Acceptability	7.3 ± 1.0	7.7 ± 0.9	8 ± 1.1

Table 2c. Mean Organoleptic Scores of Experimental Cookie Variants for Shortenings

Criteria	Mean Scores		
	Variant VII (VCO + Butter) 50:0	Variant VIII (VCO + Butter) 40:10	Variant IX (VCO + Butter) 30:20
Colour	8.2 ± 0.9	8 ± 0	8.2 ± 0.4
Texture	7.7 ± 1.0	8.4 ± 0.9	8.5 ± 0.7
Taste	7.6 ± 1.1	8.1 ± 0.7	8.2 ± 0.9
Flavour	7.9 ± 0.9	8 ± 0.6	8.1 ± 0.5
Overall Acceptability	7.8 ± 1.0	8.1 ± 0.7	8.5 ± 0.7

Table 3. Mean Organoleptic Scores of cookies during the storage period

Days	Groups	Mean Scores				
		Colour	Texture	Taste	Flavour	Overall acceptability
0th day	SC	8.4 ± 1.35	7.6 ± 1.07	7.3 ± 1.16	7.5 ± 1.35	7.1 ± 1.19
	EC	7.6 ± 0.51	8.9 ± 0.32	8.5 ± 0.84	8.4 ± 0.84	8.4 ± 0.84
7th day	SC	8.4 ± 1.35	7.6 ± 1.07	7.1 ± 1.10	7.4 ± 1.26	6.9 ± 1.20
	EC	7.6 ± 0.51	8.8 ± 0.42	8.4 ± 0.84	8.4 ± 0.84	8.3 ± 0.82
14th day	SC	8.4 ± 1.07	7.6 ± 0.97	7.1 ± 0.74	6.9 ± 1.20	6.8 ± 1.03
	EC	7.5 ± 0.52	8.4 ± 0.96	8.1 ± 1.10	8.1 ± 0.88	8 ± 0.94
21st day	SC	8.3 ± 1.05	7.5 ± 0.85	7 ± 0.67	6.8 ± 0.63	6.7 ± 0.48
	EC	7.5 ± 0.53	8.3 ± 0.94	7.9 ± 0.74	7.8 ± 0.78	7.8 ± 0.63
28th day	SC	8.3 ± 1.06	7.4 ± 0.84	6.9 ± 0.56	6.8 ± 0.63	6.8 ± 0.42
	EC	7.5± 0.52	8.2 ± 0.91	7.8 ± 0.63	7.7 ± 0.67	7.7 ± 0.48
35th day	SC	8.2 ± 1.03	7.4 ± 0.96	6.6 ± 0.84	6.4 ± 1.57	6.2 ± 1.14
	EC	7.1 ± 1.28	8 ± 1.15	7.7 ± 1.34	7.3 ± 0.82	7.3 ± 1.16
42nd day	SC	7.9 ± 1.45	7.4 ± 0.97	6.3 ± 1.16	6.2 ± 1.62	6 ± 1.15
	EC	7.1 ± 1.28	8 ± 1.15	7.7 ± 1.34	7.2 ± 0.91	7.3 ± 1.16
49th day	SC	7.6 ± 1.71	6.2 ± 1.23	6.1 ± 0.56	5.4 ± 0.69	5.6 ± 0.84
	EC	6.8 ± 1.62	7.7 ± 0.48	7.2 ± 0.78	6.1 ± 0.87	6.3 ± 0.48
56th day	SC	7.3 ± 1.70	6 ± 1.41	6.1 ± 0.56	5 ± 1.24	5.3 ± 0.67
	EC	6.7 ± 1.49	7.4 ± 0.51	7.1 ± 0.56	5.6 ± 0.84	6.2 ± 0.42

Table 4. Nutrient content of the cookies

Parameter	Initial		't' Value	Final		't' Value
	SC	EC		SC	EC	
Energy (kcal)	482.06 ± 0.61	507.55 ± 0.41	48.942**	480.66 ±0.52	505.66 ± 0.48	50.107**
Protein (g)	5.48 ± 0.39	8.74 ± 0.36	8.560**	5.14 ± 0.17	8.82 ± 0.22	8.251**
Carbohydrate (g)	72.30 ± 0.06	66.71 ± 0.06	86.7**	71.16 ± 0.15	65.29 ± 0.04	51.31**
Fat (g)	16.74 ± 0.25	21.39 ± 0.02	26.081**	16.37 ± 0.04	20.35 ± 0.36	15.3**
Fiber (g)	1.11 ± 0.02	7.49 ± 0.38	23.2**	1.27 ± 0.22	7.54 ± 0.23	27.581**
Iron (mg)	0.41 ± 0.01	6.08 ± 0.13	57.422**	0.44 ± 0.02	6.06 ± 0.05	123.13**
Calcium (mg)	262.66 ± 0.57	290.33 ± 0.57	47.92**	269.33 ± 1.15	287.33 ± 0.57	19.718**

* - Significant at 5% ($t<0.05$); ** - Significant at 1% ($t<0.01$); NS – Not significant

Coconut sugar having a slight brown colour has imparted a pleasant and acceptable golden brown colour to the finished cookie. Variant IV which was prepared only with coconut sugar had received the highest mean score for colour (7.9 ± 0.3) on comparision with variants V (7.8 ± 0.4) and VI (7.8 ± 0.4) (Table.2b). Variant VI (30: 20 coconut sugar and cane sugar proportion) had received the highest score for texture (8.4 ± 0.8), taste (8 ± 1.3), flavour (8 ± 0.9) and overall acceptability (8 ± 1.1), and was selected for the preparation of EC. The mean scores obtained for all the sensory attributes by variant IX was the maximum, followed by VIII and VII. Variants IX and VII both had obtained the similar mean score for colour. The least score was obtained by variant VII for all the attributes on comparison with other two variants (Table.2c), thus showing that cookies prepared with 100 % virgin coconut oil is not acceptable. Variant IX was prepared with 30% VCO and 20 % butter was found to be the right proportion for shortening.

Mean Organoleptic Scores of cookies during the storage period

Colour

The mean scores obtained by SC and EC for colour on 0^{th} day was 8.4 ± 1.35 and 7.6 ± 0.51respectively. The colour characteristics of cookies showed to be darker with the addition of coconut sugar and coconut flour. Coconut sugar is a wonderful natural sweetener that can be used in many ways. It is the perfect natural sweetener for baking and cooking. Chocolate, toffees and confectionery items can be prepared by using coconut sugar. Coconut sugar is much more versatile and is easily substituted for cane sugar in baking recipes 1:1. It is sweet with no coconut flavour and does not drastically alter the flavour of the dish. Coconut sugar caramelizes well and imparts nice brown colour to the recipes (Sarah, 2013). If EC had been presented as a standalone product, the colour would have been highly acceptable like chocolate cookies, but on comparision with SC, which was cream in colour it had received lowest scores. Even though a decreasing trend in the colour of both cookies was noticed on storage, the scores of SC (7.3 ± 1.70) was higher than EC (6.7 ± 1.49) (Table.3). Sujirtha and Mahendran (2015) reported that the colour of the cookies increased with the addition of defatted coconut flour, which results in the reduction of quality score for the colour of the cookies. Amino acids react with reducing sugars during baking and as a result maillard reaction takes place. This has been supported by Dhingra and Jood (2000), who has also observed in his study on the preparation of wheat breads supplemented with soyabean and barley flour.

Texture

SC and EC had obtained the mean score of 7.6 ± 1.07 and 8.9 ± 0.32 respectively on 0^{th} day. The mean scores showed a marginal decrease on 56^{th} day (SC - 6 ± 1.41 and EC - 7.4 ± 0.51). Textural profile plays an important role in justifying the acceptability of cookies. Addition of 20% of coconut flour had its influence on the textural property of EC, hence secured better scores. Present results are in fair agreement to that of Zaker *et al*. (2012) who have stated that incorporation of 20 percent of defatted soya flour had acceptable texture while cookies containing 30 per cent reported dryness of mouth.

Taste

The taste of EC (8.5 ± 0.84) was higher than SC (7.3 ± 1.16) on 0^{th} day. The same trend was noticed on 56^{th} day (SC - 6.1 ± 0.56, EC- 7.1 ± 0.56). Sujirtha and Mahendran (2015) stated that the substitution of 50 percent of defatted coconut flour had decreased the score for taste from 6.17 to 4.80. The significant decreasing trend of taste may be due to the own taste of coconut flour which dominated when used in high amount (Hussain *et al*., 2010). Thus in the present study, addition of 20 percent of coconut flour, 60 percent of coconut sugar and 60 percent of VCO seems to be the better proportion in EC, hence received highest scores for taste than SC.

Flavour

The flavour of SC and EC was 7.5 ± 1.35 and 8.4 ± 0.84 respectively on 0^{th} day. Addition of coconut flour, coconut sugar and virgin coconut oil contributed the incredible coconut flavour to EC, which was a key factor for receiving highest score than SC. A similarly study on development of coconut based gluten free cookies by Dhankhar (2013) also showed highest mean score for aroma due to its strong distinctive flavour of coconut powder. On storage the flavour of both variants had decreased (SC- 5 ± 1.24, EC- 5.6 ± 0.84), yet still EC had obtained marginally higher scores than SC.

Overall acceptability

The overall acceptability of EC (8.4 ± 0.84) was higher than SC (7.1 ± 1.19) on 0^{th} day. On storage, noticeable decrease was seen in both variants (SC - 5.3 ± 0.67, EC - 6.2 ± 0.42) but the panel members did not report any adverse comments about the cookies on the 56^{th} day. On the basis of overall acceptability scores of SC and EC, it can be concluded that the incorporation of coconut products in the preparation of cookies will give optimum sensory quality characteristics.

Nutrient Content of the Cookies

Energy

The energy value of the EC (507.55 ± 0.41kcal) was significantly greater than SC(482.06 ± 0.61kcal) on 0^{th} day and on 56^{th} day (EC- 505.66 ± 0.48kcal, SC- 480.66 ±0.52kcal). Addition of coconut products in EC had increased the caloric value (Table 4).

Protein

The partial substitution of coconut flour signifcanlty increased the protein content of EC (8.74 ± 0.36g) than SC (5.48 ± 0.39g). The protein content of the all purpose wheat flour for bread making generally ranges from 10-14%. The protein content of coconut flour is about 18 % (Gunathilake *et al*., 2009). On storage the loss of protein content was negligible in both SC and EC. Therefore the incorporation of coconut flour into all purpose flour had improved the protein content of EC

than SC. According to Bressani *et al*. (1960) cereal protein including wheat is limited in lysine content and they also recommend that the biological value of wheat flour can be significantly improved by the addition of lysine. Boceta, as cited by Barrett *et al*. (2004) stated that coconut flour when incorporated into wheat flour increases the amino acid content, especially lysine. Rastogi and Raghavarao (1996), also stated that coconut proteins are fairly rich in lysine, methionine and tryptophan.

Carbohydrate

The carbohydrate level of SC and EC was 72.30 ± 0.06g and 66.71 ± 0.06g respectively on 0^{th} day and 71.16 ± 0.15g and 65.29 ± 0.04g respectively on 56^{th} day. Refined flours are concentrated in simple carbohydrates which are rapidly metabolized and cause destructive blood sugar fluctuations in the body. In opposition to this, carbohydrate coupled with high fiber in coconut flour, which has resulted in reduced amount of digestible carbohydrate in EC.

Fat

The fat content of EC (21.39 ± 0.02g) was much higher than SC (16.74 ± 0.25g), and the difference was significant statistically ($p \leq 0.01$) on 0^{th} day. On Storage the level remained almost the same in both SC and EC. Presence of coconut products in EC is responsible for higher fat content. VCO is rich in medium chain fatty acids (MCFA). MCFA are transported directly from the intestinal tract to the liver, where they are likely to be directly burned off as fuel and raise the metabolic rate slightly, and is less available to be circulated throughout the body and deposited in fat tissues (Che Man and Marina, 2006; and Marten *et al*., 2006). Consumption of coconut kernel with coconut oil had a beneficial effect that it reduced total cholesterol and lowered triglycerides. It also raised HDL cholesterol levels and lowered the LDL cholesterol /HDL cholesterol ratio (Sadikot, 2004). Even though the fat content of EC is higher than SC, the presence of MCTs exhibit beneficial effects to the body. The level of lauric acid in the SC (0.42 ± 0.02g) was significantly less on comparison to EC (8.3 ± 0.10g). MCT in coconut oil make it different from all other fats and for the most part it gives its unique character and healing properties. Lauric acid is a chief contributor (49%) of medium-chain fats in coconut oil which is similar to fats in mother's milk and have same nutraceutical effects. Apart from mother's milk coconut is the only natural source that contains lauric acid. These health effects were recognized centuries ago in Ayurvedic medicine (Shimada *et al.*, 1997).

The saturated fatty acid of EC (22.31 ± 0.17g) was higher than SC (19.50 ± 0.44g). Coconut consists of more than 90 % of saturated fats, with traces of few unsaturated fatty acids, such as MUFA and PUFA. Saturated fatty acids present in plant origin are entirely different from animal origin. There is a misconception spread among many people that coconut is not good for the heart. This is because it contains a large quantity of saturated fats. In coconut, saturated fatty acids are mostly made up of MCT of which lauric acid is the chief contributor, contributing more than 40 %, followed by capric acid, caprylic acid, myristic acid and palmitic. VCO is composed mainly of MCT (Kaunitz, 1986) which does not carry the same risks as other saturated fats (Trani *et al*., 2006; Marina *et al*., 2009). Nevin and Rajamohan (2004) showed that VCO lowered total cholesterol, triglycerides, phospholoipids, low density lipoprotein (LDL), very-low-density lipoprotein (VLDL), and increased high density lipoprotein (HDL)-cholesterol levels.

Fiber

The fiber content was 1.11 ± 0.02g and 7.49 ± 0.38 g for SC and EC respectively on 0^{th} day and the levels remained the same on 56^{th} day. The high fiber content of EC could be due to the addition of coconut flour. The present result is highly comparable with those of Sujirtha and Mahendran (2015) who have reported 12.0% of fiber content in cookies prepared with 50% defatted coconut flour. Coconut is a natural low-carb, high-fiber food ideally suited for low carbohydrate diets. One cup of shredded fresh coconut (80 grams) contains 3 grams of digestible carbohydrate and 9 grams of fiber. The remaining 68 grams consists primarily of water, fat, and protein. Trinidad *et al*. (2006), showed that the dietary fibre content of coconut flour was 60.0 +/- 1.0g/100g sample, 56% insoluble and 4% soluble. Further, they described that the total dietary fibre content of coconut flour was greater than other dietary fibre sources such as oat bran (8.3g/100g) and flaxseed (28.0g/100g).

Iron

The iron content of EC (6.08 ± 0.13mg) was higher than SC (0.41 ± 0.01mg). According to The Philippine Food and Nutrition Research Institute, the iron content of coconut sugar is 21.9mg/l and cane sugar is 1.2 mg/l. The higher iron content in EC comprises mainly due to addition of 30g of coconut sugar. On storage the iron level remains similar in both the cookies (SC - 0.44 ± 0.02 mg, EC- 6.06 ± 0.05 mg).

Calcium

The calcium content of EC (290.33 ± 0.57mg) was higher than SC (262.66 ± 0.57mg) on 0^{th} day and 56^{th} day (EC – 287.33 ± 0.57mg, SC - 269.33 ± 1.15mg)

Conclusion

The prepared experimental cookies had received highest mean scores than standard cookie for all the sensory attributes except for colour and are highly comparable to that of standard cookie in terms of nutritional value especially for fiber and lauric acid. Use of coconut products in the preparation of baked foods is a novel variant for the manufacturers to satisfy todays consumers' expectations. To conclude, the incorporation of coconut products in bakery foods produces acceptable cookies rich in nutrition.

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