



Pearl millet cookies incorporated with sugar substitutes: Stevia sugar and coconut sugar

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Abstract

Baked products such as cookies are very popular among all age groups, especially with children. Cookies hold a significant place in the baking industry due to variety in taste, texture and aroma. They are low moisture foods with longer shelf life, generally prepared out of refined wheat flour, fat and sugar. Refined wheat flour is a key ingredient for preparing cookies due to its gluten content. However, refined wheat flour is a product of refining that contains higher proportion of starch, low dietary fiber and minerals and the resultant cookies are characterized with low proteins, fat and mineral content. Therefore, to improve its nutritive value, there is a need for replacing refined wheat flour with flour of better nutritive quality. It has potential for future human use due to its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature and can be grown in areas where other cereal crops, such as maize (*Zea mays*) or wheat (*Triticum aestivum*), would not survive. Pearl millet contains substantial amount of minerals such as iron, calcium, zinc and high level of fat, it is nutritionally comparable and even superior to major cereals due to the energy and protein value. While, pearl millet is nutritious, it is underutilized in developed countries due to non-availability in convenient/ ready to eat form. Replacing of wheat flour with whole pearl millet flour has been researched previously. Cookies produced from 100% pearl millet were described as tough, hard, gritty, and mealy in texture and taste. They lacked spread and top surface cracks, which is a desirable attribute of cookies. Further improvement was made by replacing the refined wheat flour by pearl millet flour with different proportions to achieve desirable texture and nutritional increase. Decreasing the amount of sugar added to biscuits is a good strategy to obtain a healthy product. However, a reduction in the quantity of sugar may affect its nutritional value and quality. Nowadays, health is becoming a main concern for people around the world. However, many people are turning towards nature and seeking foods or food ingredients that not only healthy, but also have a good taste. There is a natural plant derived sweetener that can be used to answer all of this health problem, namely *Stevia rebaudiana*. It is now widely available and rapidly replacing artificial sweeteners in food products. Besides, its level of sweetness is 250 times sweeter than sucrose and it does not cause tooth cavities. Stevia has many natural anti-oxidants that can help to lower blood pressure and cholesterol, and to control diabetes, hence it can prevent many chronic diseases. Coconut sugar is a natural sugar made from coconut palm sap, which is the sugary circulating fluid of the coconut plant. The feasibility of the use of stevia and Coconut sugar for achieving healthier, nutritious and good quality cookies have been investigated. Three Pearl Millet flour cookies formulations were designed. Coconut sugar and stevia were used as sweeteners. The quality of the cookies was evaluated by measuring their moisture, thickness, diameter, ash content, carbohydrate content etc. The quality and safety of the innovative cookies was obtained by an analysis of the sugars, proteins etc. A comparison of the stevia formulated cookies, with the stevia formula and coconut sugar formulated cookies showed that the cookies had a good nutritional quality and improved texture and colour.

Keywords: pearl millet flour, cookies, stevia sugar, coconut sugar, sensory analysis

1. Introduction

Baking is a method of cooking food that uses dry heat, normally in an oven, but can also be done in hot ashes, or on hot stones. The most common baked item is bread but many other types of foods are baked. Heat is gradually transferred "from the surface of cakes, cookies, and breads to their centre. As heat travels through, it transforms batters and doughs into baked goods and more with a firm dry crust and a softer centre". Baking can be combined with grilling to produce a hybrid barbecue variant by using both methods simultaneously, or one after the other. Baking is related to barbecuing because the concept of the masonry oven is similar to that of a smoke pit.

Because of historical social and familial roles, baking has traditionally been performed at home by women for day-to-day meals and by men in bakeries and restaurants for local consumption. When production was industrialized, baking was automated by machines in large factories. The art of baking remains a fundamental skill and is important for

nutrition, as baked goods, especially breads and cookies, are a common and important food, both from an economic and cultural point of view. The present-day consumer looks for new bakery products, better appeal, taste and convenience from bakery foods. Bakery industry has also an important role in popularizing wheat in non-wheat consuming region of the World. With good planning and access to good staff, raw materials and markets, setting up a bakery can represent an excellent enterprise opportunity.

The aroma and texture of baked goods as they come out of the oven are strongly appealing but is a quality that is quickly lost. Since the flavour and appeal largely depend on freshness, commercial producers have to compensate by using additives as well as imaginative labelling. As more and more baked goods are purchased from commercial suppliers, producers try to capture that original appeal by adding the label "home-baked." Such attempts seek to make an emotional link to the remembered freshness of baked goods as well as to attach positive associations the purchaser

has with the idea of "home" to the bought product. Freshness is such an important quality that restaurants, although they are commercial (and not domestic) preparers of food, bake their own products. The dry heat of baking changes the form of starches in the food and causes its outer surfaces to brown, giving it an attractive appearance and taste. The browning is caused by caramelization of sugars and the Maillard reaction. Maillard browning occurs when "sugars

break down in the presence of proteins. Because foods contain many different types of sugars and proteins, Maillard browning contributes to the flavour of a wide range of foods, including nuts, roast beef and baked bread.

2. Materials and Methods

Ingredients: Pearl millet flour, Refined wheat flour, Fat, Milk, Sugar, Sugar replacers such as stevia sugar and coconut sugar, Baking soda

2.1 Method of Preparing Cookies

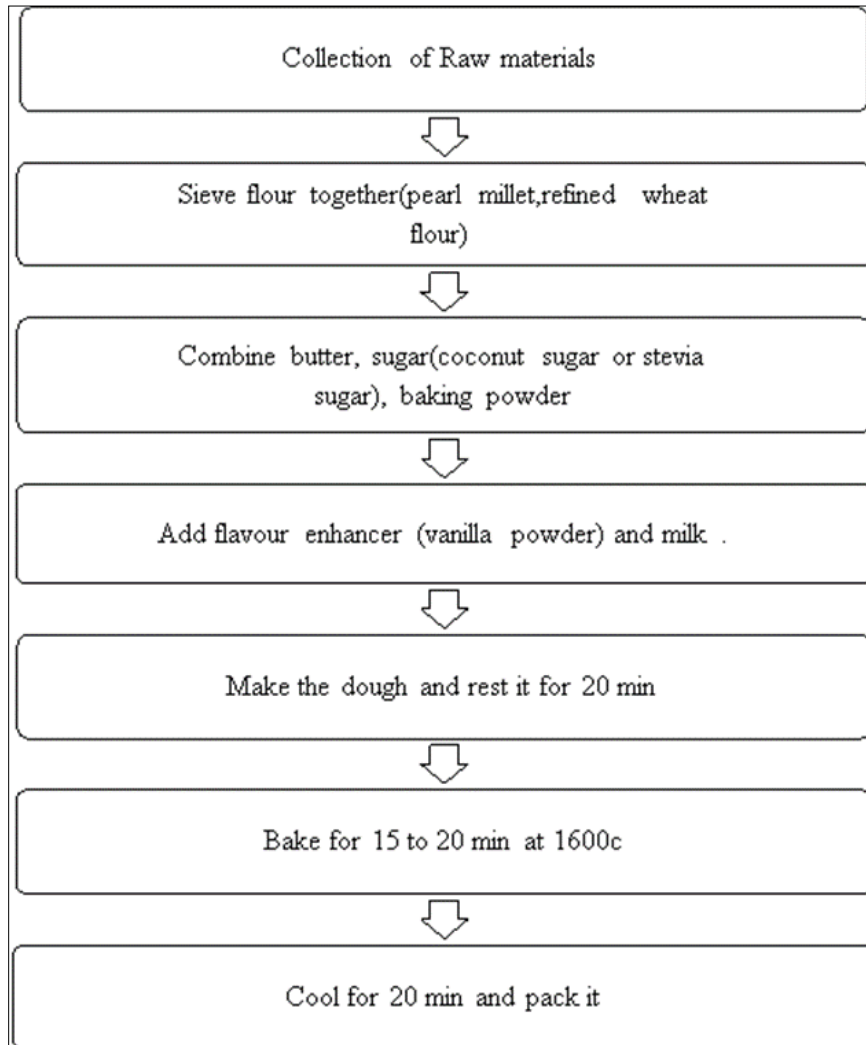


Fig 1

Formulations (%)

Table 1: For Cookies incorporated with stevia and coconut sugar the control Sample is taken as Sample based on sensory and proximate analysis.

Ingredients	Control Sample	Sample 1 (S1)	Sample 2 (S2)	Sample 3 (S3)	Sample A	Sample B	Sample C	Sample a	Sample b	Sample c
Refined wheat flour	100	30	50	60	50	50	50	50	50	50
Pearl Millet Flour	60	70	50	40	50	50	50	50	50	50
Fat	50	50	50	50	50	50	50	50	50	50
Baking Powder	2	2	2	2	2	2	2	2	2	2
Milk	12	12	12	12	12	12	12	12	12	12
Sugar	60	60	60	60	45	30	---	45	30	
Stevia sugar	---	---	---	---	0.05	0.1	0.2	---	---	---
Coconut sugar	---	---	---	---	---	---	---	15	30	60



Fig 2: Pearl millet cookies



Fig 3: Sample A



Fig 4: Sample B



Fig 5: Sample C



Fig 6: Sample a



Fig 7: Sample b

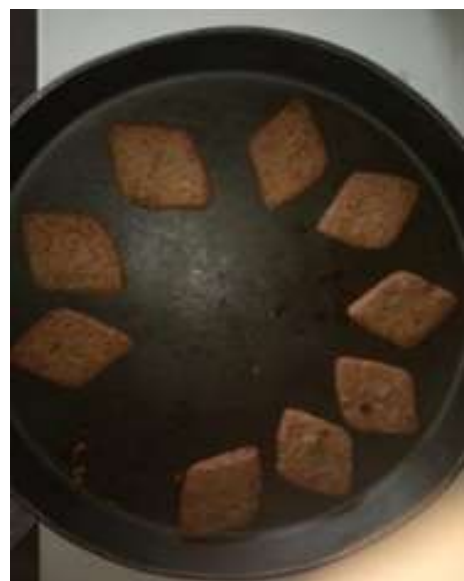


Fig 8: sample c

3. Results and Discussion

Per 100g

Table 2

Content	Control Sample	Sample 1 (S1)	Sample 2 (S2)	Sample 3 (S3)	A	B	C	a	b	c
Protein (%)	6.50	8.98	8.02	7.35	8.02	8.02	8.02	8.12	8.22	8.42
Moisture Content (%)	4	3.72	3.51	3.33	3.39	3.45	3.73	3.39	3.45	3.73
Ash (%)	0.48	0.93	0.82	0.63	0.82	0.82	0.82	0.82	0.82	0.82
Crude fibre(gm)	3.9	7.75	7.3	6.5	7.3	7.3	7.3	7.3	7.3	7.3
Iron content(mg)	3	6	5.2	4.7	5.2	5.2	5.2	5.2	5.2	5.2
Fat (%)	16.95	19.25	18.43	17.65	19.01	19.75	20.05	19.03	19.79	20.14
Calcium (mg)	35	40	38.5	37.2	55.78	40.80	10.91	71	71.25	71.95
Carbohydrates	72	71.13	70.75	70.02	38.5	38.5	38.5	39.23	40.57	41.21
Energy (kcal)	467	494	483	470	421.67	361.75	242.19	485	491.21	500

3.1 Sensory Analysis of Developed Cookies

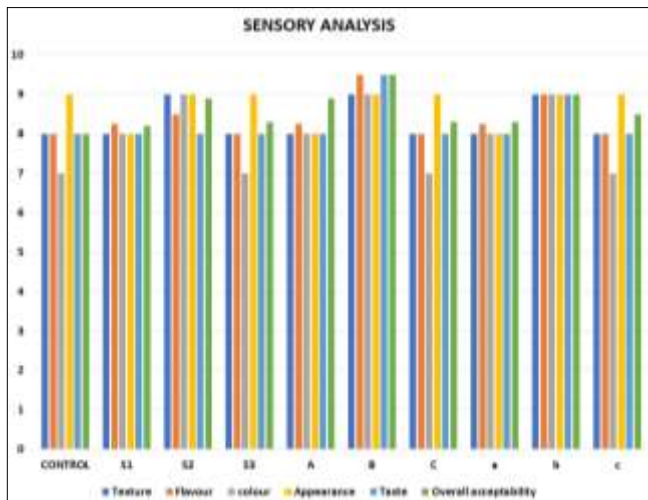


Fig 9: The bacterial and Fungal Count of Pearl Millet Cookies incorporated with Stevia Sugar and Coconut Sugar showed NIL in all the samples up to 3 months of the studies conducted.

3.2 Physical Analysis

The physical characteristics of cookies prepared by replacing wheat flour with Pearl millet flour and sugar with coconut sugar and stevia sugar are presented in table.

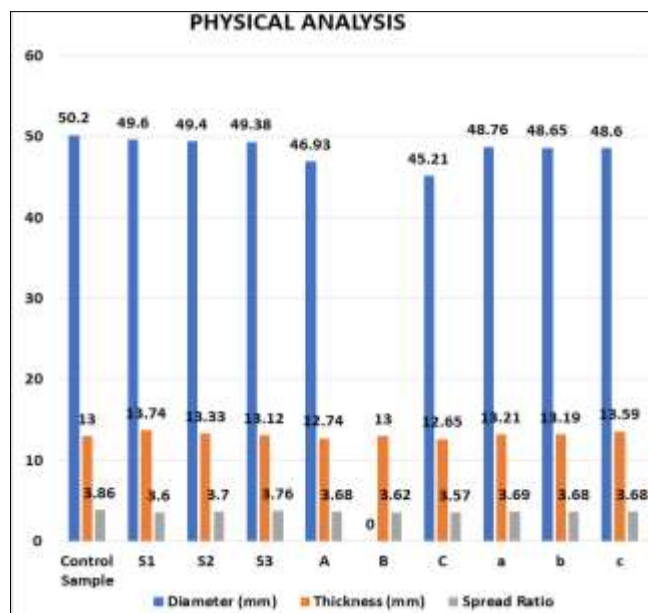


Fig 10

3.3 Shelf life studies of Pearl Millet Cookies Incorporated with Stevia Sugar and coconut sugar

Moisture content of the Pearl Millet cookies incorporated with stevia sugar and coconut sugar

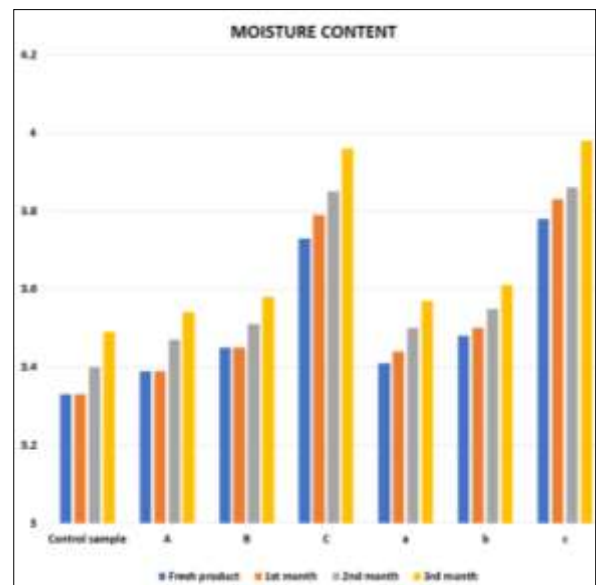


Fig 11: Protein content of Pearl Millet cookies incorporated with stevia Sugar and coconut sugar

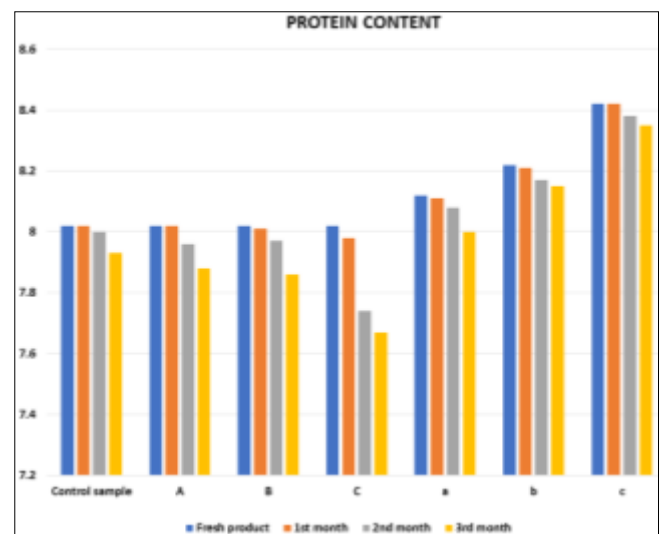


Fig 12: Ash content of Pearl Millet cookies incorporated with stevia Sugar and coconut sugar

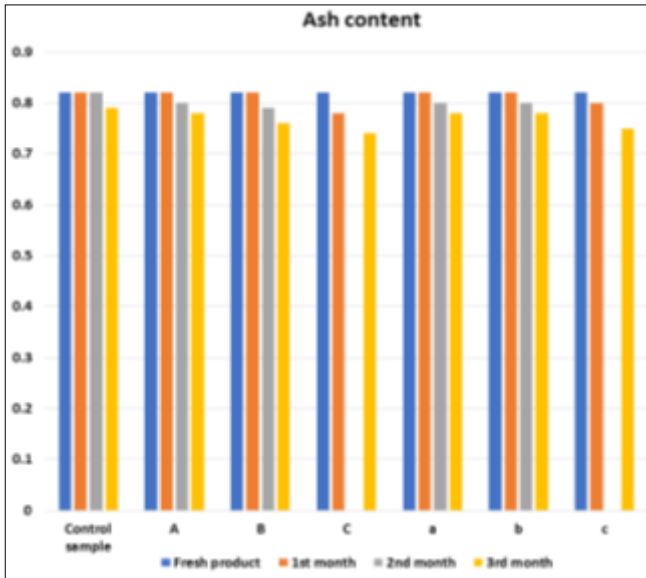


Fig 13: Fat content of Pearl Millet cookies incorporated with stevia Sugar and coconut sugar

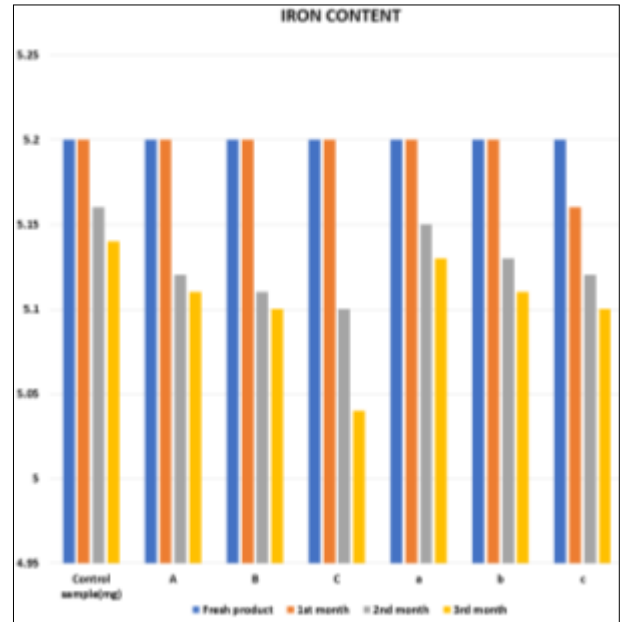


Fig 16: Carbohydrate content of the Pearl Millet cookies incorporated with stevia sugar and coconut sugar

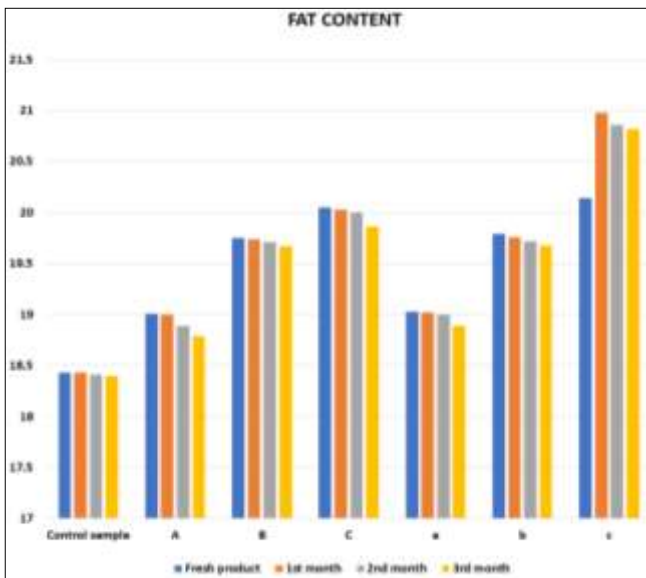


Fig 14: Fibre content of Pearl Millet cookies incorporated with stevia Sugar and coconut sugar

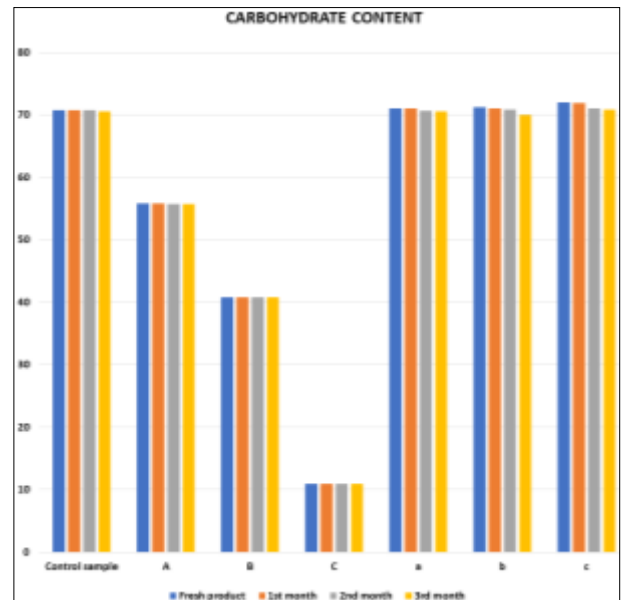


Fig 17: Calcium content of the Pearl Millet cookies incorporated with stevia sugar and coconut sugar

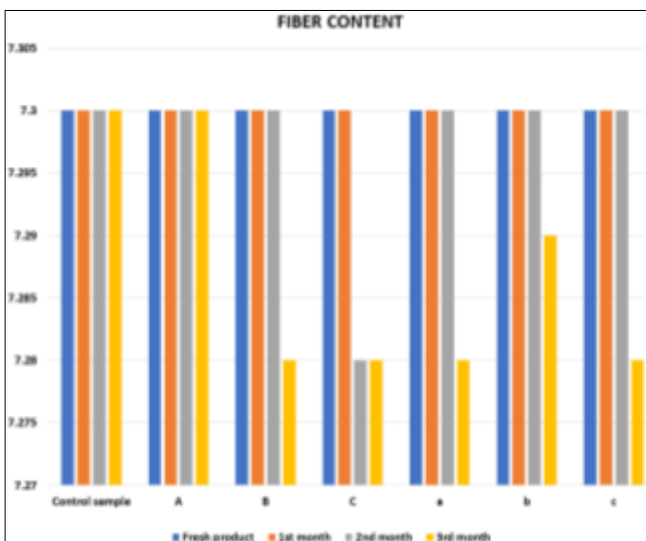


Fig 15: Iron content of the Pearl Millet cookies incorporated with stevia sugar and coconut sugar

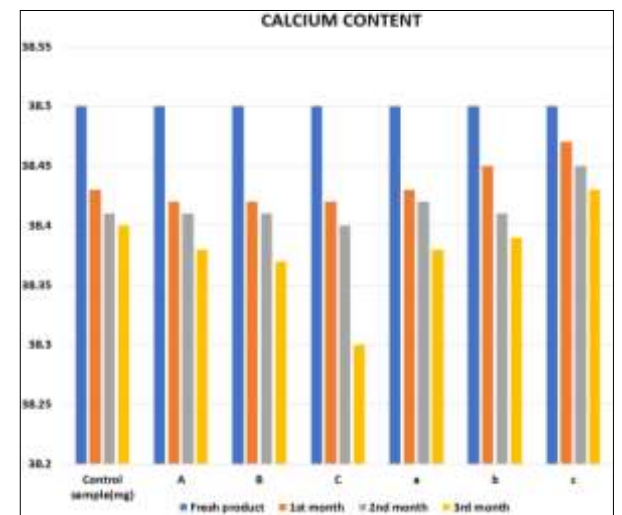


Fig 18

4. Conclusion

Pearl millet flour as a replacement for refined wheat flour in the preparation of cookies was effective in enhancing its nutritional and sensory attributes. Nutritive value of the cookies improved in terms of protein, ash and mineral content (iron, calcium) after replacing refined wheat flour with semi refined flour of pearl millet. Of the samples prepared by replacing refined wheat flour with pearl millet flour Sample S1 showed high increase in nutrition compared to control sample. Sample s3 showed a little increase in nutrition while S2 showed more acceptability both nutrition wise and sensory wise. Therefore, Sample S2 Was selected for further proceedings such as replacing the sugar with sugar substitutes. The absence of gluten in pearl millet did not negatively affect the physical properties of the cookie which was similar to that of the control. QDA revealed that cookies from pearl millet were found to have higher overall quality compared to control. They had a combination of desirable and lasting vanilla-like aroma coupled with typical baked millet aroma. In addition, crisp and crumbly texture perceived in these cookies further enhanced their sensory appeal making them highly palatable. This study has shown that pearl millet has a good potential for use in cookie formulation with the objective to enhance its nutritional quality and sensory properties and replace the sugar in those cookies with sugar substitutes like stevia and coconut sugar. The Pearl millet cookies replacing sugar with stevia showed decrease in browning and decrease in the carbohydrate content by maintaining the sweetness' as sample S2 which is taken as control sample here. Replacing sugar with stevia sugar partially affected the texture of the cookies but are acceptable. The aroma is desirable and lasting but the yield is less compared to the control. The pearl millet cookies which are replaced with coconut sugar showed increase in protein and iron content compared to the control. They had a desirable and lasting vanilla-like aroma. The crispiness of the cookies with coconut sugar got enhanced, browning was decreased but the colour of the product got changed compared to control and the sweetness of the product is desirable which makes the coconut sugar get accepted as a sugar replacer in baking. Stevia and coconut sugar can be used as a healthy alternative to other sugars to make our diet more wholesome and nutritious Further studies on effect of storage on sensory attributes and chemical composition as affected by various packaging materials and adding bulking agents to increase the yield in stevia cookies are in progress.

5. References

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