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Development & Quality Evaluation of Cookies Incorporated by Millets & Cardamom Powder

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Abstract:
This study was done on "development & quality evaluation of cookies incorporated by millets & cardamom powder". The millets wheat flour was used for cookies preparation. It was incorporated into the traditional recipe to replace wheat flour at levels of 5, 5, 10, 20, 40 and 50 in preparation of cookies. Result of sensory (appearance, color, flavour, texture, taste and overall acceptability) evaluation revealed that the 80-20% addition of millets wheat flour has higher overall acceptability, taste, texture and flavour and it was accepted by the panelists. However, a declining trend in acceptability was observed with increasing level of millets wheat flour for all the sensory characteristics. The nutritional value of the cookies (as determined through nutrient analysis of moisture, protein, fat, ash and fiber) with 70-30% of millets wheat flour fortified protein cookies was higher than other samples.

Keywords: *Cookies, protein, millets wheat flour, bakery products*

1. Introduction

Millets is useful in various ways both as human food and animal feed. The terms biscuits, cookies and crackers are almost synonymously used in India for the products prepared commercially using refined flour, hydrogenated fats and sugar along with emulsifiers and other additives. Cookies are available in different unit packages in various flavours, shapes, sizes and with excellent organoleptic characteristics. Excellent shelf life at ambient conditions, simplicity and ease of handling during use and transport and availability at affordable prices for the diverse consumers make the cookies popular even in traditional food cultures of India. The origin of millet is diverse with varieties coming from both Africa and Asia. Pearl millet for example comes from tropical West Africa and finger millet from Uganda or neighboring areas. From African highlands, finger millet was taken to India about 3,000 years ago and to Europe at the beginning of the Christian era.

Many types of millet have been found in Harrapan & Mohenjadaro archaeological sites. Africa, the cradle of human civilization, the Mayans, Incas & Aztecs were known to use millets in their myriad culinary courses. The leader of the Shang Dynasty in the 2nd millennium BC was known as Hou Chi 'The ruler of Millet'. Our own vedic scriptures like Sathapatha Brahmana have sample references to millets. Kalidasa, in his legendary literary masterpiece 'Shakuntala', has sage Kanva pouring foxtail millet while bidding farewell to Shakuntala in Dushanta's court.The oldest historical roots of millet are to be found in China, where it was considered a sacred crop. The cookies if modified suitably are probably the best vehicles to carry the nutrients to meet the nutritional demand of common consumers. The cookie formula consists of refined flour, hydrogenated fat, sugar and other additives. It is well documented that most of the ingredients used in commercial cookies lack important nutrients. The refined flour lacks in dietary fiber and micronutrients which are important health promoting component.

Foxtail millet *(Setaria italic)* is the second-most widely planted species of millet, and the most important in East Asia. It has the longest history of cultivation among the millets, having been grown in China since sometime in the sixth millennium BC. Other names for foxtail millet include Italian millet, German millet, Chinese millet, and Hungarian millet. Foxtail millet is an annual grass with slim, vertical, leafy stems which can reach a height of 120–200 cm (3.9–6.6 ft). The seed head is a dense, hairy panicle 5–30 cm (2.0–11.8 in) long. The small seeds, around 2 mm (less than 1/8 in.) in diameter, are encased in a thin, papery hull which is easily removed in threshing.

Finger Millet *(Eleusine coracana)* is an annual plant widely grown as a cereal in the arid areas of Africa and Asia. It is commonly known as African finger millet, red millet, caracan millet, koracan, and ragi. E.coracana is native to the Ethiopian Highland It is very adaptable to higher elevations and is grown in the Himalaya up to 2,300 metres in elevation. Finger millet were cultivated since 4000 years in India.

Finger and foxtail millets are potential traditional and novel ingredients used to enhance nutritive quality and acceptability of cookies. Millets is rich in protein, dietary fiber that has health promoting effects. Finger millet is exceptionally rich in protein that is cell protective and is essential for development of brain in children. Finger millet also provides dietary fiber. Foxtail millet is exceptionally rich in calcium. Cardamom provides flavanols that are important for health and are cardio protective.

2. Materials Required

Good quality millets powder was obtained from Delhi. Refined wheat flour and other raw materials was obtained from local market of Allahabad. The flour was of creamy white color and free of bean fragments. Butter was used to replace hydrogenated vegetable oil for cookies making as a leavening agent, which was purchased in local market of Allahabad. Baking powder was purchased from local market of Allahabad. This was used as a leavening agent. Amulspray milk powder was purchased from local market of Allahabad to provide desired moisture content. Salt and sugar was purchased from local market of Allahabad. Sugar was used as sweetener which also plays an important role in caramalization.

3. Methods

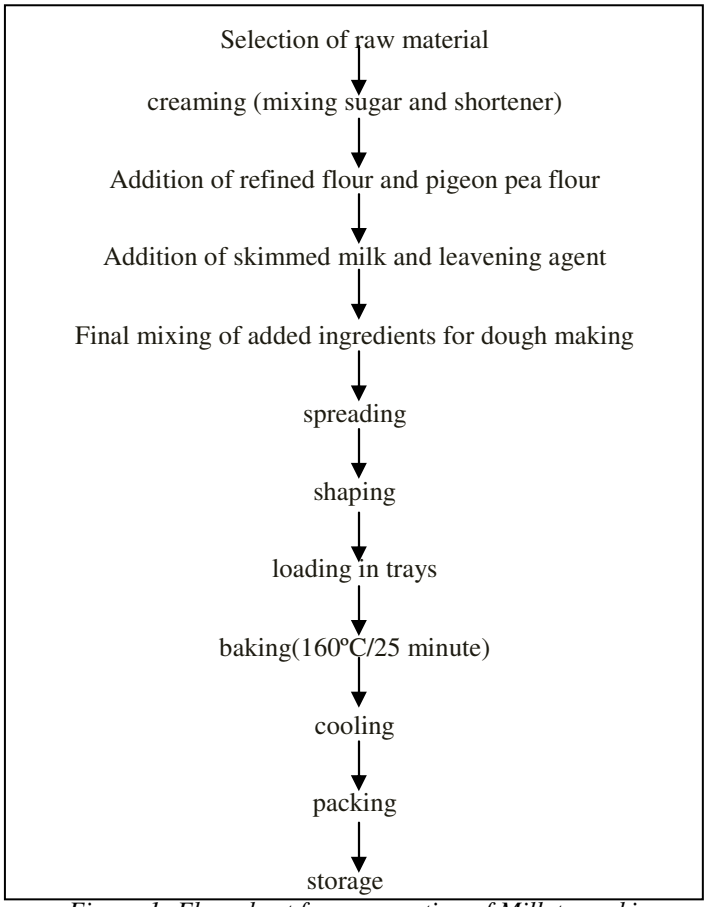

Figure 1: Flow sheet for preparation of Millets cookie.

Sample	Refined Flour %	Foxtail millet Flour %	Finger Millet Flour %
Sample T_0	100	0	0
Sample T_1	95	5	0
Sample T_2	95	0	5
Sample T_3	90	5	5
Sample T_4	80	10	10
Sample T_5	60	20	20
Sample T_6	50	25	25

Table 1: Experimental design

The proportion of ingredient in standardized formulas of cookies was given above millets wheat flour at 5, 5, 10, 20, 40 and 50 was incorporated in the standard formula for cookies with slight modification and standardized process. Millets wheat flour was mixed with half of the dough. Both the portion were rolled and placed over each other and rolled and rolled tightly. The rolled dough was chilled for 1 hour (sweet cookies) sheet of 3-5mm thick and round pieces of 0.7cm were cut and baked at 160^0C-175^0C for 25-30 minute.

4. Physico-Chemical Analysis of Millets Flour Cookies

There are different physical characteristics of cookies such as spread ratio, volume and density. In the case of millets flour cookies spread ratio, volume and density was calculated including sample T_1, T_2, T_3, T_4, T_5, T_6 and control sample (T_0) (AACC, 2000). The physical characteristics of cookies prepared replacing wheat flour with 0 to 50% millets flour. The present data in Table 2 indicate reduction of spread ratio of cookies was attributed to better binding strength of millets wheat flour protein, also resulting in increase of thickness. The average spread ratio of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 5.43, 5.33, 5.27, 5.25, 5.22, 5.19 and 5.16 respectively. It shows that the spread ratio of the cookies was decreased significantly with increasing level of millets wheat flour flour. The results showed that increase in level of millets wheat flour resulted in linear decrease of spread ratio Other research workers also reported reduction in spread ratio when soy flour and fenugreek flours were substituted for wheat flour (Singh et al., 1996). Reduced spread ratios of millets wheat flour cookies were attributed to the composite flours form aggregates with increased number of hydrophilic sites available competing for limited free water in cookies dough. The average volume of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets cookies was found to be 26.80, 26.36, 26.24, 25.62, 25.38, 25.11 and 24.90 cm3 respectively. The decrease in the volume of the millets wheat flour is due to decrease in the mass of the cookies prepared, the mass decreases due to the loss of protein, fat and other nutrient content of the sample. There was also a decrease in the volume during incorporation of millets is due to decrease in the spread ratio because they are interrelated to each other as spread ratio is decreasing the volume which is also decreasing. Likewise, the same result was obtained by (Anonymous 1983) in defatted soy flour. The average density of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 0.45, 0.48, 0.51, 0.54, 0.57, 0.61 and 0.64 g/cm3, respectively. The increase in the density is due to the increase in the millets wheat flour in the cookies because millets wheat flour has the fat retaining capacity during baking and it decrease during the storage because fat, protein and vitamins present in the cookies are loss during the storage. Likewise the same result was obtained by (Goyle and Gujral 1993) in defatted soy flour.

Treatment	Spread ratio	Volume (cm^3)	Density (g/cm^3)
T_0	5.43	26.80	0.45
T_1	5.33	26.36	0.48
T_2	5.27	26.24	0.51
T_3	5.25	25.62	0.54
T_4	5.22	25.38	0.57
T_5	5.19	25.11	0.61
T_6	5.16	24.90	0.64

Table 2: Effect of different treatments on physical analysis of millets flour cookies

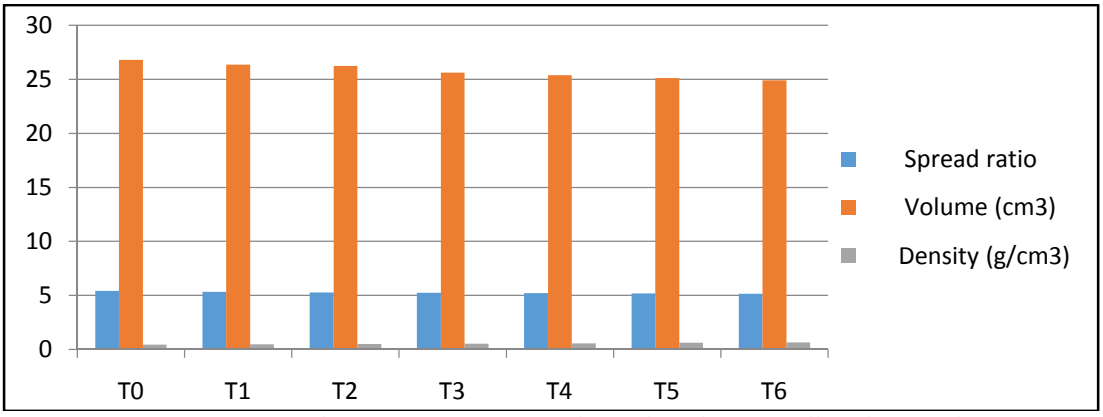

Figure 2: Effect of different treatments on physical analysis of millets flour cookies

Chemical analysis of millets cookies was calculated on the basis of moisture, ash, fat, protein and fibre content. The data presented in Table 3 indicate that the average ash content of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 2.56, 2.59, 2.63, 2.66, 2.76, 2.97 and 3.08%, respectively. The ash content in food stuff not necessarily accounts for exactly the same composition as the mineral matter present in the original food, there may be some losses due to volatilization or some interaction between the constituents. (Uthira and Laxmi 2009) reported non-significant effect of storage on ash content of wheat flour

samples. Therefore, it can be concluded that significant effect of ash content of sample T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were observed. The data presented in Table 3 indicate that the average moisture content of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 7.46, 7.60, 7.74, 7.89, 8.32, 9.19 and 9.63% respectively. The moisture content of cookies decreased linearly with increase in concentration of millets flour, this is attributed to low water binding capacity of millets wheat flour which retained lower moisture content in the ultimate products. Therefore, it can be concluded that significant effect of moisture content of sample T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were observed. The results for moisture content of the cookies was similar to the results obtained by other researchers who incorporated cocoyam flour in preparation of the cookies and decreased moisture content of product of the cocoyam flour also decreased. The data presented in Table 3 indicate that the average protein content of different T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 9.65, 9.72, 9.54, 9.62, 9.60, 9.55 and 9.52%, respectively. Protein content justifies the suitability of incorporating millets wheat flour in making nutritionally enhanced cookies. The protein content of the cookies was found to increase linearly with increase in the millets wheat flour because the millets wheat flour contains good amount of protein content (16.13%). Therefore, it can be concluded that significant effect of protein content of sample T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were observed. The results obtained on the protein content of the protein pea cookies are similar; other researchers incorporate legumes in the cassava based composite flour (Akingbala *et al.* 2009). The data presented in Table 3 indicate that the average fat content of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 5.64, 5.56, 5.43, 5.07, 5.06, 4.48 and 4.19%, respectively. The results in the present study showed that there was a significant decrease in the fat content of millets wheat flour cookies during storage. The fat deterioration during storage may be due to activity of lipase enzyme which split off the fat into free fatty acids and glycerol in the presence of catalyst like moisture, light and heat and there is an increase in the fat content during the storage which is due to fat retaining capacity of millets wheat flour during baking. Therefore, it can be concluded that significant effect of fat content of sample T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were observed with an decrease in the fat content of cookies by Tyagi *et al.* (2007) was reported and explained to be largely due to the incorporation of defatted mustard flour. The data presented in Table 3 indicate that the average fibre content of different samples T_0, T_1, T_2, T_3, T_4, T_5, and T_6 of millets wheat flour cookies was found to be 2.41, 2.68, 2.46, 2.38, 2.36, 2.32 and 2.30%, respectively. The mean fibre content of the cookies increased with the increase in amount of the millets flour. Therefore, it can be concluded that significant effect of fiber content of sample T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were observed. This result is in the agreement with the reported by Shariff *et al.* (2009), where the millets wheat flour has high amount of fibre. Fibre content of control cookies was 0.846%. A slight decrease or variation in the fibre content of the cookies was because of pectin, starch, cellulose and other carbohydrates denature after a long storage, decrease in the fibre content was also reported by Mridula and Gupta (2008).

Treatments	Ash (%)	Moisture (%)	Protein (%)	Fat (%)	Fibre (%)
T_0	2.56	7.46	9.65	5.64	2.41
T_1	2.59	7.60	9.72	5.56	2.68
T_2	2.63	7.74	9.54	5.43	2.46
T_3	2.66	7.89	9.62	5.07	2.38
T_4	2.76	8.32	9.60	5.06	2.36
T_5	2.97	9.19	9.55	4.48	2.32
T_6	3.08	9.63	9.52	4.19	2.30

Table 3: Effect of different treatments on chemical analysis of millets flour cookies

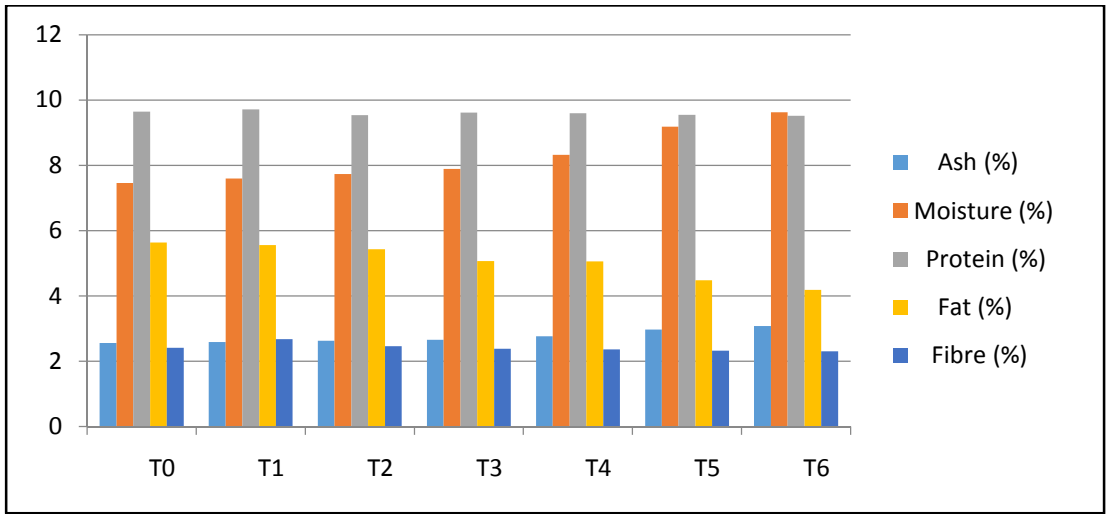

Figure 3: Effect of different treatments on chemical analysis of millets flour cookies.

5. Conclusion

The present investigation was carried with the development of millets wheat flour in the preparation of millets cookies. Millets is a good source of protein and seven treatments were used (controlled sample, 5, 5, 10, 20, 40 and 50) of millets flour. The cookies containing 20% millets wheat flour were found to be satisfactory after testing physio-chemical analysis like ash, moisture, fat, protein, fibre and depending on different sensory attributes like color, texture, taste and overall acceptability during shelf life study in comparison with 5, 5, 10, 20, 40 and 50 % millets wheat flour cookies which was found significantly different in their physicochemical and organoleptic characteristics change for a storage period of 60 days self-life study. There was significant variation in these 5, 5, 10, 20, 40 and 50 % treatment but 20% sample was found to be more satisfactory as compared to other sample in the case of protein content.

6. References

i. Agrawal, S. R., 1990, Prospects for small-scale biscuit industry in the nineties. Indian Food Indus., 9: 19–21.
ii. Ajila, C. M., Leelavathi, K. and Rao, U. T. S., 2008, Mango peel powder in cookies. J. Cereal Sci., 48: 319-326.
iii. Akingbala, J. O., Falade, K. O. and Ogunjobi, M. A., 2009, The Effect of root maturity, preprocess holding and flour storage on the quality of cassava biscuit. Food Bioprocess Tech. DOI 10.1007/s11947-009-0185-Z.
iv. Akubor, P. I., 2003, Functional properties and performance of cowpea/plantain/wheat flour blends in biscuits. Plant Food Hum Nutr., 58: 1–8.
v. Anonymous, 1983, Annual Report, National Institute of Nutrition (ICMR). Hyderabad, pp.1-4.
vi. Begum, M.J., Vijayakumari, J., Shamshad Begum, S. and Anupama, P., 2003, Sensory quality and storage quality of finger millet papad-A conventional dietary adjunct. Paper presented at the 5th International Food Convention, Mysore, 5-8 December, p.76.
vii. Devaraju, B., Mushtari Begum, J., Shamshad Begum, S. and Vidya, K., 2003, Nutritional quality, sensory attributes and storage study of finger millet (Eleusine coracana) composite flour pasta. Paper presented at the 5th International Food Convention, Mysore, 5-8 December, p.116.
viii. Goyle, A. and Gujral, S., 1993, Keeping quality of mixes and biscuits from malted and raw wheat (Triticum Avestivum)-bengal gram grains (Cicer Arietinum) with or without a green leafy vegetable. Ind. J. Nutr. Dietet., 30: 186- 191.
ix. Itagi, S., 2003, Development and evaluation of millet based composite food for type II diabetics. Ph.D., Thesis, University of Agricultural Sciences, Dharwar.
x. Kaced, I., Hoseney, R.C. and Varriano-Marston, E., 1984, Factors affecting rancidity in ground pearl millet (Pennisteum americanum, L. Leeks). Cereal Chem., 61 (12) : 187-192.
xi. Kulkarni, L.R. and Naik, R. K., 1999, Chemical composition and protein quality of Italian millet. Karnataka J. Agric. Sci., 12 : 164-167.
xii. Lakshmi, R. V. S., 1991, Dietetic baked products for obesity, diabetes mellitus and hypertensive conditions. M. Sc. Thesis, Univ. Agric. Sci., Bangalore (India).
xiii. Mridula, D. and Gupta, R. K., 2008, Effect of bajra flour on quality of biscuits fortified with defatted soy flour. The Ind. J. Nutr. Dietet., 45: 17-25.
xiv. Pathak, P. and Srivastava, S., 1998, Development and evaluation of food formulation based on foxtail millet for their suitability in diabetic diet. Proceedings of Nutr. Soc. India, NIN, p. 59.
xv. Prentice, N., Kissell, L. T., Lindsay, R. C. and Ymazaki, W. T., 1978, High fiber cookies containing brewers' spent grain. Cereal Chem., 55 (5): 712-721.
xvi. Pushpamma, P., 1989, Utilization of small millets in Andhra Pradesh. In : Small millets in Global Agricultural. Seetharam, A., Riley, K.W., Harinarayana, G., (Eds.) Oxford and
xvii. IBH. Pub. Co., New Delhi, pp.
xviii. Ranhotra, G. S., Gelroth, G. A., Eisenbraun, G. J., 1991, High fiber white flour and its use in cookie products. Cereal Chem., 68 (4): 432-434.
xix. Shariff, M. K., Butt, M. S., Anjm, F. M. and Nawaz, H., 2009, Fiber and mineral enriched cookies supplemented with defatted rice bran. Pakistan J. Nutr., 8 (5): 571-577.
xx. Singh, R., Singh, G. and Chauhan, G. S., 1996, Effect of incorporation of defatted soy flour on the quality of biscuits. J. Food Sci. Technol., 33 (4): 355-357.
xxi. Tyagi, S. K., Manikantan, M. R., Oberoi, H. S. and Kaur, G., 2007, Effect of mustard flour incorporation on nutritional, textural and organoleptic characteristics of biscuits. J. Food Engin., 80: 1043–1050.
xxii. Ugare, R., 2008, Health benefits, storage quality and value addition of barnyard millet (Echinochloa frumentacaea L.) M. H. Sc. Thesis, Univ. Agric. Sci., Dharwad (India).
xxiii. Uthira, L. and Laxmi, U. K., 2009, Value addition in biscuits using whey protein concentrate (WPC). Ind. J. Nutr. Dietet., 46: 14-18.
xxiv. Veena, B., Chimmad, B. V., Naik, R. K and Malagi, U., 2004, Development of barnyard millet based traditional foods, Karnataka J. Agric. Sci., 17 (3): 522-527.
xxv. Yahya, M. N., 2004, Physico-chemical and shelf life studies on reduced fat legume based cookies using sago flour as a fat replacer. Theses submitted in fulfillment of the requirement for the degree of Master of Science http://eprints.usm.my/6315/.