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Bioactive compounds and acceptance of cookies supplemented with ginger flour

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Abstract
The study was carried out to develop antioxidant-enriched cookies with good nutritional and physical quality from wheat flour supplemented with ginger powder. The ginger (*Zingiber officinale* Roscoe) rhizome were washed, peeled, cut into thin slices of 2 mm thickness, blanched, dried in a mechanical dehydrator (50+5 ºC), milled and sieved. Nutritionally ginger powder contained water activity of 0.356±0.004 with a crude fat and crude protein as 5.73±0.05 per cent and 6.63 ± 0.61 per cent respectively. The level of total phenols and antioxidant activity respectively were found to be 243.86±0.06 mg/100g and 83.73±0.04 per cent, and therefore ginger appeared to be suitable for successful supplementation with wheat flour for production of cookies. For preparation of cookies, different blends of ginger supplementation were made by adding ginger powder in a concentration varying from 2-14 percent in wheat flour. The combination of wheat flour (100%) with 12.0% ginger powder was optimized for the formulation of composite cookies with better physical, nutritional and organoleptic qualities within universally accepted standards. The supplementation of ginger powder for the preparation of cookies showed an increase in total phenols, antioxidant activity, crude fibre and ash content in the final product.

Keywords: Cookies, ginger powder, wheat flour, nutritional characteristics, organoleptic quality

Introduction
Ginger (*Zingiber officinale Roscoe.*) is one of the most important cash crop and principal spice of India and abroad. India is a largest producer and exporter of ginger to more than 50 countries, particularly to the Middle East, accounting for more than 70 percent of the world production (Pruthi, 1993) [22]. Being a medicinal plant ginger has been widely used all over the world since antiquity, for a wide array of unrelated ailments like arthritis, cramps, rheumatism, sprains, sore throats, muscular aches, pains, constipation, vomiting, hypertension, indigestion, dementia, fever and infectious diseases (Ali *et al*. 2008) [4].

It is a common additive used in number of foods and beverages and is valued due to the aromatic compounds which give a spicy, pungent and pleasant flavor (Bartley and Jacobs, 2000) [7]. Depending upon the prevailing demand, ginger rhizome is harvested after six months of sowing for value addition and consumption due to its tenderness and presence of low fibre content. However, fresh ginger rhizome is perishable in nature and gets spoiled due to improper handling, growth of spoilage microorganism, action of naturally occurring enzymes, chemical reactions and structural changes during storage (Sagar and Kumar, 2009) [24]. Thus, dehydration of ginger is therefore a low cost method which can be implemented to reduce the post harvest losses with minimal changes in its physical, chemical and organoleptic properties (Kubra and Rao 2012) [5] due to reduced water activity. Further, in food industry, application of compaction of fresh ginger into powder is an excellent alternate for overcoming problems associated with post-processing handling, packaging and storage of fresh horticultural commodities. Bakery products range in complexity and include items such as bread, cakes, biscuits (crackers and cookies), which contain wheat flour as main ingredient as it provides bulk and structure (Lai and Lin, 2006) [18]. Bakery products give a mouth watering feel and are consumed in large quantities on a daily base and have an important role in human nutrition. Cookies are a form of confectionary product and nutritious snack produced from unpalatable paste that is transformed into appetizing product through the application of heat in the oven which confers a long shelf life (Kure *et al.* 1998 and Wade, 1998) [17, 30] due to low moisture content. Further, cookies as a snack food are consumed extensively all over the world on a large scale in developing countries where malnutrition is prevalent (Chinma and Gernah, 2007) [8]. The addition of functional ingredients to bakery products has risen in popularity due to the ability to reduce risk of chronic diseases beyond basic nutritional functions (Eswaran *et al*. 2013).

The use of ginger powder in bakery products will substantially increase the functional properties of these products apart from minimizing postharvest losses of ginger rhizomes. (Zuraida, 2013). Ginger supplemented products are of good health qualities and could certainly compete with the existing products in the market (*Sneha et al*. 2012) [26]. The objective of the present study was to supplement the wheat flour based cookies with ginger powder in order to increase the fibre and other nutrients and develop healthful cookies with accepted standards.

Materials and Methods

Fresh ginger rhizomes (*Zingiber officinale* Roscoe) var. Himgiri procured locally from the vegetable farm of the University of Horticulture and Forestry, Nauni, Solan Himachal Pradesh, India was used for powder preparation. The rhizomes harvested at optimum maturity were washed to make them free from soil and other foreign materials, rotting or insect damage. The washed rhizomes were peeled mechanically in a mechanical peeler cum polisher machine procured from MPUAT, Udaipur, sliced (approximately 2mm thickness) and blanched in solution of 1.0 per cent citric acid (Dhiman, 2015) [9] followed by drying in mechanical dehydrator at 50±5 ºC till the moisture content of slices reached below 10.00 cent (Jayashree *et al.* 2014) [15]. The dried slices were powdered into a pulverizer, sieved in 18 mesh/inch (1.04mm) mesh to obtain uniform size powder which was then packed in air tight container and stored under ambient conditions until analysis and product development. Other ingredients like wheat, refined oil and sugar etc. for the formulation of cookies were procured from the local market.

Development of ginger powder supplemented cookies

Cookie dough was prepared according to the following formula: whole wheat flour 500g; refined flour 500g; sugar 440g and refined oil 600 ml to which different levels of ginger powder (0,2,4,6,8,10,12 and 14%) were added, while cookies made from wheat flour without ginger powder served as control. The cookie dough was cut in equal batter weight followed by baking in oven (Glen Make appliances GL 656 TURBO) at 175 ºC for 26 minutes to produce cookies. Cookie samples were cooled and stored in airtight containers and evaluated for various physico-chemical and organoleptic quality characteristics.

Analysis

Physico-chemical analysis of ginger powder and formulated cookies were conducted by using standard analytical procedures. Cookies diameter (D) and thickness (T) were determined using a vernier calliper while spread ratio was calculated as described by Giami *et al* (2004) [13].

Baking weight loss (BWL) was determined by measuring the cookie weight before and after baking where the cookies weight was determined as an average value of 8 independent measurements. Baking weight loss was calculated according to the equation given by Saric *et al.* (2014) [25].

$$\text{BWL (\%)} = \frac{\text{Initial cookie weight (g) - Weight after baking (g)}}{\text{Initial cookie weight (g)}} \text{X } 100$$

Estimate of proximate composition, including the moisture, fat, ash, fibre, and protein content, were determined by the AOAC methods (AOAC, 2000) [26].

Sensory evaluation:

A 9 point hedonic scale (1= lowest desirability, 9= highest desirability) was designed to evaluate the sensory characteristics of ordinary cookies and formulated (wheat flour: ginger powder) cookies by using ten trained panellists (Amerine *et al* 1965) [5]. The tested attributes were texture, colour, taste, aroma and overall acceptability.

Results and Discussion

Quality characteristics of ginger powder

The rheological characteristics of ginger powder shown in Table 1.0 indicated water absorption index, per cent water solubility index and bulk density of ginger powder as 0.79 ± 0.02, 14.00±0.01 per cent and 0.50±0.01 respectively which signifies its water retention and oil retention capacities that are essential in bakery and other related food applications (Traynham *et al*. 2007) [28].

The results of the proximate composition in Table 1 shows that ginger powder had a moisture content of 7.05±0.62 per cent (water activity of 0.356±0.004) with crude fat and crude protein content as 5.73±0.05 per cent and 6.63 ± 0.61 per cent respectively. Ginger powder is found to be a good source of phenols (243.86±0.06 mg/100g), crude fibre (10.11 ±0.03%) and minerals (5.33±0.03% ash) thus signifies its incorporation for product development.

Table 1: Physico-chemical characteristics of ginger powder (*Zingiber officinale*)

Parameters	Mean±SD*
Water absorption index	0.79 ± 0.02
Per cent water solubility index	14.00 ± 0.01
Bulk density (g/ml)	0.50 ± 0.01
Moisture content (%)	7.05 ± 0.62
Water activity (aw)	0.356 ± 0.004
Total phenols (mg/100g)	243.86 ± 0.06
Antioxidant activity (%)	83.73± 0.04
Crude fat (%)	5.73 ± 0.05
Crude protein (%)	6.63 ± 0.61
Crude fibre (%)	10.11 ± 0.03
Ash content (%)	5.33 ± 0.03

* values based on 10 replications

Experimental result shows the significant physicochemical and nutritional characteristics of ginger powder in terms of all functional constituents. Moreover, the significant availability of antioxidant and high dietary fibre proves its health beneficial importance.

Standardization of formulation of ginger supplemented cookies

The mean scores of sensory attributes of ginger supplemented wheat flour cookies presented in Figure 1 shows that inclusion of ginger in the formulation had significant effect on all the sensory parameters. Cookies prepared without ginger powder (T_1R_C) had overall acceptability scores of 7.65 as against 8.70 for treatment T_7R_C having 12.0 per cent ginger powder in wheat flour. The formulation of cookies containing 14.0 per cent ginger powder was comparatively not liked by the panelists due to high pungency and bitter taste of cookies as contributed by ginger powder. The increasing concentration of ginger powder up to 12.0 percent was liked by the panelists due to characteristic taste, colour and flavour of the product. Thus, the experiment suggests that combination of ginger powder (12%) and the recipe (R_C) can successfully be used for the preparation of nutritionally enriched cookies.

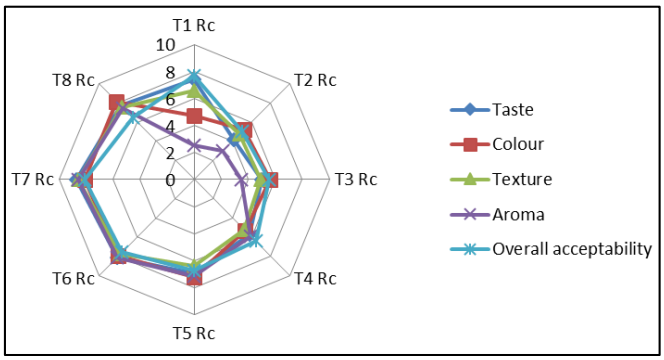

Fig 1: Sensory scores of different formulations of ginger supplemented cookies

Thus, the modification of ingredients reflects not only on the sensory properties of food but also manifests on the physical and chemical composition.

Physico-chemical characteristics of cookies

The results obtained from the physical measurements showed a mean diameter (D) of 31.19±0.09 mm with 13.07±0.08 mm thickness (T) and a spread ratio of 2.44±0.04 in ginger supplemented cookies and 32.44±0.05 mm diameter and mean thickness of 12.98±0.07 mm and 2.49±0.03 spread ratio in control cookies. The spread ratio indicates a good cohesion of network between the ingredients (Noor *et al.* 2012 and Miller *et al.* 1997) [20, 19] and lower the spread ratio better the crispiness and acceptability of baked products (Esuoso and Baamiro, 1995) [12]. The average bake loss in ginger supplemented cookies was observed as 5.27±0.06 per cent which was less than the control cookies (5.32±0.06%). The water activity of both the cookies ranged from 0.321 to 0.324 which fall within the range of intermediate moisture foods and thus may not have adverse effect on the quality attributes of the product (Kure *et al.* 1998) [17]. Nutritionally, there was an evident increase of total phenolic content (31.84±0.15 mg/100g) in cookies supplemented with 12.0 percent ginger powder as compared to cookies without ginger powder which had total phenols of 13.59±0.13 mg/100g. The crude fibre (1.38±0.01%), antioxidant activity (25.72±0.21%) and total ash (5.71±0.03%) was significantly higher in ginger powder supplemented cookies as compared to the cookies without ginger powder. Ash is an indicative of the amount of mineral content in any food sample (Adepeju *et al.* 2015) [2]. The result supports the aforementioned data that ginger is a good source of phenols, antioxidants, fibre and minerals.

Table 2: Physico-chemical characteristics of cookies

Parameters	Cookies (Control) (T_1R_C)	Ginger supplemented cookies (T_7R_C)
	Mean±SE*	
Bake loss (%)	5.32±0.04	5.27±0.06
Diameter (D, mm)	32.44±0.05	31.19±0.09
Thickness (T, mm)	12.98±0.07	13.07±0.08
Spread ratio (D/T)	2.49±0.03	2.44±0.04
Water activity (a_w)	0.324±0.004	0.321±0.001
Moisture (%)	10.21±0.03	10.27±0.21
Total phenols (mg/100g)	13.59±0.13	31.84±0.15
Antioxidant activity (%)	19.78±0.017	25.72±0.21
Crude fat (%)	19.97±0.05	22.88±0.07
Crude protein (%)	8.11±0.14	8.32±0.16
Crude fibre (%)	0.83±0.03	1.38±0.01
Ash content (%)	4.13±0.02	5.71±0.03
Total energy (Kcal/100g)	481.71±0.27	516.21±0.35

*All values are mean of 3 observations
* SD = Standard deviation

Conclusion

The finding of the present research revealed that ginger contains considerable amount of phenols, dietary fibres and minerals, so that a successful combination with wheat flour for cookie production would be nutritionally advantageous and also has significant effect on the physical properties of the cookies. Ginger powder (12%) incorporated cookies have highly acceptable functional and organoleptic quality characters compared to control. The outcome of the present research can be used as valuable information for the development of high fibre and antioxidant rich cookies. The results obtained could be very valuable in decision making for industries that want to take nutritional advantage of ginger powder with medicinal properties as a supplement in cereal flours for product development.

References

1. Adel SPR, Prakash J. Chemical composition and antioxidant properties of ginger root (*Zingiber officinale*). Journal of Medicinal Plants Research. 2010; 4:2674-79.
2. Adepeju AB, Abiodun OA, Otutu OL, Pele IG. Development and quality evaluation of wheat/ breadfruit cookies. International Journal of technical Research and Application. 2015; 3(6):7-11.
3. Agu CS, Igwe JE, Amanze NN, Oduma O. Effect of oven drying on proximate composition of ginger. American Journal of Engineering Research. 2016; 5:58-61.
4. Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): a review of recent research. Food and Chemical Toxicology. 2008; 26:409-20.
5. Amerine MA, Pangborn RM, Roessler EB. Principles of Sensory Evaluation of Foods. In: Food Science and Technology Monographs Academic Press New York. 1965, 338-339.
6. AOAC. Official Methods of Analysis. Assosiation of Official Analytical Chemists 17th edition, Gaithersburg, Marylan, USA, 2000.
7. Bartley J, Jacobs A. Effects of drying on flavour compounds in Australian-grown ginger (*Zingiber officinale*). Journal of Food Science and Agriculture 2000; 80:209-15.

8. Chinma CE and Gernah DI. Physicochemical and sensory properties of cookies produced from cassava/soyabean/mango composite flours. J. Food Technology. 2007; 5(3):256-260.
9. Dhiman A. Development and evaluation of novel products from ginger (*Zingiber officinale*). M.Sc. Thesis. Department of Food Science and Technology. Dr YS Parmar University of Horticulture and Forestry, Solan. 2015, 115.
10. Ehsanullah, Raheem MI, Ahmad T and Hayat S. Effect of potassium metabisulphite and salt solution on ginger puree and its storage. Journal of Agriculture Research. 2013; 51:297-305.
11. Eswaran S, Jane M, William DC. Fibre and functional gastrointestinal disorders American J Gastroenterol 2013; 108:718-727.
12. Esuoso KO, Baamiro FO. Studies on the baking properties of non wheat flours: Breadfruit (*Artrocarpus altilis*). International Journal Food Sc. Nutri. 1995; 45(3):257-73.
13. Giami SY, Amasisi T, Ekiyor G. Comparison of bread making properties of composite flour from kernels of roasted and boiled African breadfruit (*Treculia Africana* Decne) seeds. Journal of Raw Material Research. 2004; 1:16-25.
14. Gumusay OA, Borazan AA, Ercal N, Demircol O. Drying effects on the antioxidant properties of tomatoes and ginger. *Food Chemistry*. 2015; 173:156-62.
15. Jayashree E, Visvanathan R, John ZT. Quality of dry ginger (*Zingiber officinale*) by different drying methods. Journal of Food Science and Technology. 2014; 51:3190-98.
16. Kubra IR, Rao LJM. Effect of microwave drying on the phytochemical composition of volatiles of ginger. International Journal of Food Science and Technology 2012; 47:53-60.
17. Kure OA, Bahayo EJ, Daniel EA. Studies in the proximate composition and effect of flour particle size on acceptability of biscuit produced from blends of soya beans and plantain flours. Namida Tech-scope J. 1998; 3:17-2.
18. Lai HM, Lin TC. Bakery products: science and technology. In:Hui YH, Corke HH, De Leyn HI, Nip WK, Cross N (eds) Bakery products: science and technology. Blackwell Publishing, Hobo-ken, 2006, 3-65.
19. Miller RA, Hoseney RC, Morris CF. Effect of formula water content on the spread of sugar-snapcookies. Cereal Chemistry. 1997; 74:669-671.
20. Noor Aziah AA, Mohamad Noor AY, Ho LH. Physicochemical and organoleptic properties of cookies incorporated with legume flour. International Food Research Journal. 2012; 19:1539-1543.
21. Nwinuka NM, Ibeh GO, Ekeke GI. Proximate composition and levels of some toxicants in four commonly consumed spices. Journal of Applied Science Environment Management. 2005; 9:150-55.
22. Pruthi JS. Major spices of India; crop management post harvest technology. New Delhi, Indian Council of Agricultural Research. 1993, 244-88.
23. Rahman MJ, Talukder MAI, Rani L, Saha KC, Nahid MSI. The effect of processing techniques on the shelf life, nutritional and sensory quality of ginger (*Zingiber officinale*) powder and paste. Journal of Innovation and Development Strategy. 2013; 7:60-66.
24. Sagar VR, Kumar R. Effect of packaging and storage on the quality of ginger, onion and garlic (GOG) mix powder. Indian Journal of Horticulture. 2009; 66:367-73.
25. Saric BM, Nedeljkovic NM, Simurina OD, Pestoric MV, Kos JJ, Mandic AI *et al.* The influence of baking time and temperature on characteristics of gluten free cookies enriched with blueberry pomace. Food and Feed Research. 2014; 41:39-46.
26. Sneha ST, Genitha Y, Vrijesh. Preparation and quality evaluation of flour and biscuit from sweet potato. J. Food Process Technol. 2012, 3.
27. Stoilova I, Krastanov A, Stoyanova A. Antioxidant activity of ginger extract. Food Chemistry 2007; 102:764-70.
28. Traynham TL, Deland JM, Carriquiry AL, Johnson LA. Evaluation of Water-Holding Capacity for Wheat–Soy Flour Blends. J Amer Oil Chem Soc. 2007; 84:151-155.
29. Virendra V, Tattari S, Kota N, Nimgulkar C, Polasa K. In vitro evaluation on antioxidant and antimicrobial activity of spice extracts of ginger, turmeric and garlic. Journal of Pharmacognosy and Phytochemistry. 2013; 2:143-48.
30. Wade P. Biscuit, Cookies and Crackers: The Principles of the Craft. (1stEdn.) London, UK: Elsevier Applied Sciences, 1988.
31. Zuraida N. Sweet potato as an alternative food supplement during rice shortage. Journal Lit bang Pertanian. 2003; 22(4):150-155.