Nutritional composition of ginger powder prepared using various drying methods

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Abstract A study was undertaken to prepare ginger powder using various drying methods and their nutritional evaluation was carried out. Ginger (*Zingiber officinale*) was dried using shade, solar, oven and microwave drying methods. All the samples were ground in grinder to make fine powder. Sensory analysis indicated that acceptability of all types of ginger powders were in the range of ‘liked very much’ to ‘liked moderately’ by the panelists. The mean score obtained for colour was higher in shade dried ginger powder i.e., 8.20 as compared to oven dried (7.60), solar dried (7.70) and microwave dried ginger powder (7.80). Moisture content ranged from 3.55 % in solar dried ginger powder to 3.78 % in shade dried ginger powder. Slightly higher moisture content was found in shade dried ginger powder. Protein, crude fiber, fat and ash contents ranged from 5.02 to 5.82, 4.97 to 5.61, 0.76 to 0.90 and 3.38 to 3.66 %, respectively. β -carotene and ascorbic acid content was found maximum in shade dried ginger powder i.e., 0.81 mg/100 g and 3.83 mg/100 g, respectively. Polyphenol content was almost similar in all the samples whereas calcium was slightly higher in the shade dried ginger powder i.e., 69.21 mg/100 g. Results have shown that ginger powder prepared from various drying methods had good sensory and nutritional profile.

Keywords *Zingiber officinale* · Ginger powder · Drying methods · Nutritional composition

Introduction

Ginger (*Zingiber officinale*) is one of the oldest spice with a distinct flavour and pungency. India is the largest grower of ginger and also the largest producer of dry ginger in the world (Dhingra and Kumar 2005). Other countries cultivating ginger extensively are : West Indies, Brazil, China, Japan and Indonesia. In India, Kerala, Orissa, Andhra Pradesh, Himachal Pradesh, Meghalaya and West Bengal are important growing states. The total production of ginger was 2, 75,000 million tonnes in 2008. The average yield of ginger is 3.43 metric tonnes per hectare (Charan 2007).

Ginger is used as a main seasoning material in the diet. It plays significant role as taste enhancer because it contains essential oils. Ginger is fair sources of vitamins i.e., β -carotene, vitamin C and minerals and used in whole, ground paste or liquid form mainly for flavouring and seasoning food. It also finds use as a flavouring substance in soft drinks, alcoholic and nonalcoholic beverages and confectionery. A variety of pickles are prepared from ginger. As it is known to possess medicinal properties, it is also used in pharmaceutical preparations. Since the cost of fresh raw gingers is widely fluctuating, the housewives can prepare and preserve ginger powders during or in the off season. It saves money, time and energy of a house wife. Moreover in dehydrated stage, ginger powder is less prone to microbial contamination (Patel and Srinivasan 2004) Therefore, present study was conducted on the development of ginger powder using four different drying methods viz. shade, solar, oven and microwave.

Materials and methods

Ginger (*Zingiber officinale*) was procured from the local market of Hisar city for experimental work, Blanching and

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sulphiting: To improve the colour and shelf life, gingers were subjected to blanching by steeping in boiling water for 10–15 s and then immersing in 0.2 per cent Potassium metabisulphite (KMS) solution for 5 min at room temperature (Singh *et al.* 1997). Treated gingers were chopped into small pieces and dried by four different drying methods.

- i) Shade drying- Gingers were dried in shade at room temperature
- ii) Oven drying- Gingers were dried in oven at 50 plus/minus 5 degree C for 6–8 h.
- iii) Microwave drying- Gingers were dried in microwave of 800 W power for 3 to 4 min.
- iv) Solar drying- Gingers were dried in hot air solar dryer.

Dried ginger pieces were ground in grinder to make fine powder. The sensory quality of the developed powders in respect of colour, appearance, flavour and texture was judged by panelists using 9-point hedonic scale (Lawless and Klein 1999). Moisture content, protein, Crude fibre, fat, ash, β -carotene and vit. C in the sample were estimated by employing the standard method of analysis (AOAC 1995). Antinutrient polyphenol was estimated by the method of Singh and Jambunathan (1981). Total calcium, iron and copper contents were determined by atomic absorption spectrometer 2380, Perkin Elmer (USA) according to the methods of Lindsey and Norwell (1969).

Statistical analysis The data obtained in 3 replications were subjected to statistical analysis by completely Randomized Design (CRD) as suggested by Gomez and Gomes (1984).

The critical difference (C.D.) value at 5 % level of probability was used for comparison among treatment means.

Results and discussion

Sensory quality Ginger powder prepared using different drying methods were found to be acceptable by the panelists. Mean scores for colour appearance, flavour, texture and overall acceptability ranged from 7.6 to 8.2, 7.5 to 7.8, 7.7 to 7.9, 7.4 to 7.6 and 7.6 to 7.8, respectively, (Table 1). However, the score obtained for colour was higher in shade dried ginger powder i.e. 8.2 as compared to other powders. Mean scores for organoleptic parameters indicated that ginger powder prepared using different drying of methods were in the range of 'liked very much' to 'liked moderately'.

The moisture content of ginger powder dried using four different methods i.e., shade, solar, oven and microwave ranged from 3.5 % in solar dried ginger powder to 3.7 % in shade dried ginger powder (Table 1). Slightly higher moisture content was found in shade dried ginger powder. The moisture content obtained in oven and solar dried ginger powder was close to that reported earlier by Ahmed (2002).

Protein content of shade, solar, oven and microwave dried ginger powder was 5.8, 5.5, 5.0, 5.7 per cent, respectively. Non-significant difference ($P < 0.05$) was observed in protein content of ginger powder prepared using different drying methods. Similar findings for moisture content have been reported earlier by Ranganna (1986).

Table 1 Quality characteristics of Ginger powder prepared by different drying methods

Ginger powder	Shade dried	Solar dried	Oven dried	Microwave dried	CD at 5 %
Sensory ($n=9$ panelists)					
Colour	8.2 $\pm$ 0.15	7.7 $\pm$ 0.16	7.6 $\pm$ 0.13	7.8 $\pm$ 0.10	0.62
Appearance	7.7 $\pm$ 0.18	7.5 $\pm$ 0.10	7.8 $\pm$ 0.10	7.5 $\pm$ 0.16	0.4
Flavour	7.8 $\pm$ 0.14	7.8 $\pm$ 0.13	7.9 $\pm$ 0.16	7.7 $\pm$ 0.16	0.44
Texture	7.5 $\pm$ 0.21	7.4 $\pm$ 0.16	7.6 $\pm$ 0.16	7.6 $\pm$ 0.16	0.5
Overall acceptability	7.7 $\pm$ 0.06	7.6 $\pm$ 0.08	7.8 $\pm$ 0.11	7.7 $\pm$ 0.04	0.3
Chemical ($n=3$)					
Moisture	3.7 $\pm$ 0.08	3.5 $\pm$ 0.08	3.6 $\pm$ 0.07	3.7 $\pm$ 0.09	0.28
Protein	5.8 $\pm$ 0.09	5.5 $\pm$ 0.10	5.0 $\pm$ 0.05	5.7 $\pm$ 0.09	0.81
Crude fibre	5.4 $\pm$ 0.08	4.9 $\pm$ 0.07	5.4 $\pm$ 0.09	5.6 $\pm$ 0.10	0.62
Fat	0.90 $\pm$ 0.02	0.76 $\pm$ 0.04	0.78 $\pm$ 0.02	0.80 $\pm$ 0.02	0.1
Ash	3.5 $\pm$ 0.04	3.4 $\pm$ 0.07	3.3 $\pm$ 0.04	3.6 $\pm$ 0.05	0.18
β -carotene	0.81 $\pm$ 0.01	0.68 $\pm$ 0.02	0.71 $\pm$ 0.05	0.78 $\pm$ 0.07	0.02
Ascorbic acid	3.8 $\pm$ 0.07	2.2 $\pm$ 0.08	2.3 $\pm$ 0.09	3.5 $\pm$ 0.10	0.36
Polyphenols	12.5 $\pm$ 0.13	11.8 $\pm$ 0.15	12.4 $\pm$ 0.10	12.4 $\pm$ 0.12	0.78
Calcium	69.2 $\pm$ 1.02	65.3 $\pm$ 1.04	64.4 $\pm$ 1.02	67.6 $\pm$ 1.03	2.12
Iron	1.8 $\pm$ 0.05	1.6 $\pm$ 0.06	1.5 $\pm$ 0.03	1.6 $\pm$ 0.02	0.15
Copper	0.75 $\pm$ 0.03	0.46 $\pm$ 0.06	0.68 $\pm$ 0.03	0.70 $\pm$ 0.02	0.18

Crude fibre content of ginger powder prepared using shade, solar, oven and microwave drying methods was almost similar on dry matter basis. It varied from 4.9 per cent in solar dried ginger powder to 5.6 per cent in microwave dried ginger powder.

Fat and ash contents of ginger powder dried in shade, solar dryer, oven and microwave ranged from 0.76 to 0.90 and 3.3 to 3.6 per cent, respectively. Gopalan et al. (2004) also observed almost similar fat and ash contents in solar and oven dried ginger powder.

β -carotene and ascorbic acid content of ginger powder was found to be 0.81, 0.68, 0.71, 0.78 mg/100 g and 3.8, 2.2, 2.3 and 3.5 mg/100 g, respectively on dry matter basis (Table 1). Gopalan et al. (2004) reported almost similar results for β -carotene and ascorbic acid in shade dried ginger powder.

Polyphenol content of Shade, solar, oven and microwave dried ginger powder was 12.5, 11.8, 12.4 and 12.4 mg/100 g, respectively. The values were almost similar to each other. Bawa et al. (2007) have reported almost similar polyphenol content i.e., 13.73 mg/100 g in oven dried ginger powder.

The total calcium content was slightly higher in shade dried ginger powder i.e. 69.2 mg/100 g followed by microwave dried (67.6 mg/100 g), solar dried (65.3 mg/100 g) and oven dried ginger powder (64.4 mg/100 g). Non-significant differences ($P < 0.05$) were observed in total calcium content of ginger powder dried by different drying methods. However, Pezzutti and Crapiste (1997) reported slightly higher value of Ca content in shade dried ginger powder i.e., 71.28 mg/100 g than solar dried ginger powder i.e., 66.79 mg/100 g, which might be due to varietal difference in ginger selected for the study and atmospheric conditions (Table 1).

The total iron and copper content of shade, solar, oven and microwave dried ginger powder varied from 1.5 to 1.8 and 0.46 to 0.75 mg/100 g, respectively.

Conclusion

From the above study we can conclude that ginger powders prepared using shade, solar oven and microwave

drying methods have good sensory and nutritional profile. When market rates of ginger are fluctuating, we can make powder of it and can use in many culinary preparations in the off-session also. It saves our precious time, money and energy.

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