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Processing quality of ginger (*Zingiber officinale)* land races in Himachal Pradesh

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ABSTRACT

The study aims at nutritional evaluation of ginger grown in different agroclimatic zones of Sirmour and Solan districts of Himachal Pradesh. The data revealed that wide variability in respect to phenols, antioxidant activity and ash was evidenced. Wide variation was observed in phenol content of ginger procured from different locations. High phenol content was found in cv Himgiri (7.09±0.25 mg/100 g) of ginger procured from university farm followed by Pandah (6.5±0.21 mg/100 g) while low phenols were found in ginger procured from Dharja area (3.20±0.13 mg/100 g) of Solan district. The ginger rhizomes contained appreciable amounts of antioxidant activity (%) where the maximum (74.57±0.42%) was found in Nauradhar (Sirmour) and Dharja (Solan) area while comparatively less antioxidant activity (27.11±0.22%) was found in ginger rhizomes of Nahan (Sirmour) area. Among the different methods use of mechanical peeler and polisher procured from Maharana Pratap University of Agriculture and Technology, Udaipur was found optimum in terms of minimum peeling losses, ease in handling, cost affectivity and efficiency of operation.

Keywords: Ginger; land races; nutritional composition; peeling methods

INTRODUCTION

Ginger (*Zingiber officinale* L Roscoe, Zingiberaceae) is one of the most important cash crops and principal spices in India and abroad (Bartley and Jacobs 2000). It is grown for its pungently aromatic underground stem or rhizome which is an important export crop valued for its powder, oil and oleoresin all of which have food and medicinal value (Eze and Agbo 2011). Dry ginger contains essential oil 1-3 per cent oleoresin 5-10 per cent, starch 50-55 per cent and moisture 7-12 per cent with small quantities of protein, fiber, fats and ash. Ginger contains polyphenol compounds such as gingerol and its derivatives (Chen et al 1986, Rehman et al 2003) such as zingiberone, bisabolene, camphene, geranial, linalool and borneol an oleoresin (combination of volatile oils and resin) that account for the characteristic aroma and

therapeutic properties for the treatment of poor digestion, heartburn, vomiting and nausea, prevents motion sickness and also stimulates the appetite (Platel and Srinivasan 2000).

Ginger originated from India from where it was introduced to Africa and Caribbean. It is now cultivated throughout the humid tropics (Meadows 1998). In India it is grown in an area of 1,07,540 hectare with a production of 3,85,330 metric tons while in Himachal Pradesh ginger is an important cash crop of mid-hill regions covering an area of 3,335 hectare with an annual production of 32,680 metric tons (Anon 2010). It is grown in the districts of Sirmour, Solan, Shimla, Bilaspur, Mandi, Hamirpur, Una and Kangra districts of the state and district Sirmour alone accounts for more than 74 per cent of total production. Despite the fact that ginger production is dominated by Sirmour and Solan districts the available information on nutritional status of ginger grown in different locations of the state is scanty.

MATERIAL and METHODS

Depending upon the intensity of cultivation ginger land races from different locations viz Dharja, Pandah, Solan (Solan district) and Nauradhar, Rajgarh and Nahan (Sirmour district) were selected. Further Himgiri cultivar released from Dr YS Parmar University of Horticulture and Forestry was also evaluated for its nutritional characteristics. Fresh ginger rhizomes were procured at tender optimum maturity in the month of October to November 2013. The investigations were carried out in the department of Food Science and Technology, Dr YS Parmar University of Horticulture and forestry, Nauni, Solan during 2013-2014.

Physico-chemical analysis: Freshly harvested rhizomes were used for biochemical analysis. Physico-chemical characteristics such as moisture, total soluble solids (TSS), titratable acidity, sugars, crude fibre and ash were calculated as per the method described by Ranganna (1986). Antioxidant activity was determined by radical scavenging ability as described by Mensor et al (2001). For ascorbic acid analysis 1.0 g sample was extracted in 3 per cent metaphosphoric acid and the extract was titrated against the 2, 6-dichlorophenol-indophenols dye of known strength (Anon 2004). The antioxidant activity was analysed by free radical scavenging activity as per the method of Brand-Williams et al (1995). DPPH (2, 2-diphenyl-1-picrylhydrazyl) was used as a source of free radical. A quantity of 3.9 ml of $6x10^{-5}$ mol/l DPPH in methanol was put into a cuvette with 0.1 ml of sample extract and the decrease in absorbance was measured at 515 nm for 30 min or until the absorbance became steady. Methanol was used as blank. The remaining DPPH concentration was calculated using the following equation:

$$\text{Antioxidant activity (\%)} = \frac{Ab_{(B)} - Ab_{(S)}}{Ab_{(B)}} \times 100$$

where

$Ab_{(B)}$ = Absorbance of blank
$Ab_{(S)}$ = Absorbance of sample

Standarization of peeling method: In order to standardize the most suitable, quick and efficient method of peeling different peeling methods like hand peeling, gunny bag peeling, abrasive peeling, lye peeling and mechanical peeling (mechanical peeler cum polisher procured from Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan) were evaluated on the basis of time of peeling (sec), peeling losses (%) and recovery (%) of peeled rhizomes calculated and reported for each kg of ginger. The method which took minimum time for peeling with minimum losses and maximum recovery of peeled ginger coupled with complete peeling and easy handling was standardized. Conventional hand peeling method consists of peeling of presoaked individual ginger pieces using knives. For gunny bag peeling the presoaked ginger pieces were placed in gunny bags and peeling was done by rubbing and scrapping the ginger pieces in between layers of gunny bags. In abrasive peeling the ginger is fed into abrasive peeler, the disc made of carborundum crystals revolves, water is sprayed onto peeler thus washing away the grated peelings and facilitating peeling process. For Lye peeling presoaked ginger was immersed in 2 per cent NaOH solution for 2 hours followed by manual removal of peel under constant flow of tap water (Joshi et al 1991). Mechanical peeler cum polisher fabricated and procured from Maharana Pratap University of Agriculture and Technology, Udaipur was also evaluated in terms of minimum peeling losses, ease of handling, cost affectivity and efficiency of operation. The mechanical peeler is a roller drum whose inner surface is made of carborundum such that the rough surface and rolling of drum facilitate complete peeling. Further there is a water supply provided to the drum. The drum inside contains a pipe with holes through which the water is sprinkled all over inside to remove the peel and wash simultaneously.

RESULTS and DISCUSSION

Depending upon the intensity of cultivation commercially grown ginger from different locations in Solan and Sirmour districts of Himachal Pradesh was selected and evaluated for physico-chemical characteristics. The local material was known as land races pertaining to the respective area.

The physico-chemical characteristics (proximate composition) of

fresh ginger from different locations presented in Table 1 show that the mean vertical diameter (mm) ranged between 52.26 to 84.36 mm and horizontal diameter (mm) varied between 90.0 to 124.37 mm. The values were in conformation with those observed by Mohanty and Panda (1994). Moisture content in fresh ginger grown at different locations ranged between 84.2 to 93.4 per cent when procured during the months of October-November. Earlier Chauhan (1995) had recorded 88.22 per cent moisture in fresh ginger rhizomes grown in Bhariarighat area of Solan district (1200 m amsl). The total soluble solids of fresh ginger rhizomes ranged between 4-5° B. Wide variations were observed in phenol content of ginger procured from different locations. High phenol content was found in cv Himgiri of ginger procured from university farm followed by Pandah while low phenols were found in ginger procured from Dharja area of Solan district. The ginger rhizomes contained appreciable amounts of antioxidant activity (%) where the maximum was found in Nauradhar (Sirmour) and Dharja (Solan) area while comparatively less antioxidant activity was found in ginger rhizomes of Nahan (Sirmour) area with a value of 27.11per cent. Difference in the agroclimatic conditions probably leads to variations in physico-chemical characteristics of ginger rhizomes

Standardization of peeling method : The peeling method having minimum peeling losses (%w/w) was considered optimum for standardization and further studies. Among the different methods use of mechanical peeler and polisher procured from Maharana Pratap University of Agriculture and Technology, Udaipur was found optimum in terms of ease in handling, cost affectivity and efficiency of operation (Table 2).

Maximum recovery of peeled rhizome was obtained by mechanical peeler with peeling losses to a tune of only 4.51 per cent. Abrasive peeler was also found suitable in small quantities as compared to other methods with respect to time, cost and ease in handling. However the peeling

Unpeeled ginger rhizome

Mechanical peeler

Peeled ginger rhizome

Table 1. Physico-chemical analysis of ginger from different locations in Himachal Pradesh

Parameter	Dharja (Solan)	Himgiri (UHF)	Pandah (Solan)	Solan (Solan)	Nauradhar (Sirmour)	Rajgarh (Sirmour)	Nahan (Sirmour)
Horizontal dia (mm) (H)	94.32±6.91	90.0±6.82	101.10±7.10	111.24±7.26	123.77±8.13	124.37±8.26	115.09±7.4
Vertical dia (mm) (V)	52.26±4.12	56.36±4.43	80.22±5.01	72.91±4.77	72.17±4.84	84.36±5.23	83.16±5.11
Quotient (V/H)	0.55±0.01	0.62±0.01	0.79±0.02	0.65±0.02	0.58±0.01	0.678±0.02	0.72±0.02
Moisture (%)	91.23±0.46	84.76±0.32	84.2±0.34	90.54±0.42	91.83±0.41	93.40±0.47	88.84±0.37
TSS (^{o}B)	5.0±0.02	4.0±0.01	5.0±0.02	4.2±001	5.0±0.01	4.2±0.01	5.0±0.01
Titratable acidity (%)	0.04±0.01	0.05±0.01	0.03±0.01	0.03±0.01	0.03±0.01	0.06±0.02	0.03±0.01
pH	6.74±0.21	6.69±0.23	6.78±0.19	6.66±0.31	6.71±0.19	6.76±0.27	6.80±0.28
Phenols (mg/100g)	3.20±0.13	7.09±0.25	6.5±0.21	3.22±0.15	3.68±0.16	5.90±0.23	5.15±0.19
Antioxidant activity (%)	71.18±0.41	69.49±0.32	62.71±0.23	55.24±0.24	74.57±0.42	50.84±0.21	27.11±0.22
Fibre (%)	0.50±0.03	0.40±0.02	0.40±0.02	0.39±0.62	0.43±0.02	0.30±0.01	0.35±0.02
Ash (%)	0.69±0.06	0.66±0.07	0.67±0.08	0.62±0.07	0.62±0.07	0.73±0.08	0.72±0.08

Table 2: Standardization of peeling methods of ginger

Method	Time (min/kg)	Recovery*	Peeling cost (Rs/kg)	Peeling loss (%w/w)	Ease in handling	Remarks
Conventional hand peeling	20.0	866.66 g (86.6%)	20.00	13.10	Too much laborious	Rhizome peeling complete but much time consuming
Gunny bag peeling	30.0	818.64 g (81.8%)	30.00	18.0	Laborious and not easy to handle in bulk	Rhizome not peeled completely
Mechanical peeler cum polish machine	4.0	953.46 g (95.3%)	0.30	4.51	Very easy to handle at economical stage	Peeling complete and least time consuming
Abrassive peeling	1.0	885.00 g (88.5%)	0.10	11.35	Very easy to handle for less quantity of ginger	Peeling complete and least time consuming
lye peeling (2% NaOH, 1 h dip)	-	725.00 g	19.20 (72.5%)	28.00	Manual removal of peel after lye Peeling is difficult	Treated rhizome beomes very soft with dark brown colour

*on the basis of per kg ginger

losses were almost similar to that of conventional hand peeling method. Conventional hand peeling and gunny bag peeling methods were much time consuming and rhizomes were not peeled completely by the bag method. The time taken for peeling each kilogram of ginger by hand and gunny bag ranged between 20-30 minutes. The lye peeling (2% NaOH, 1 h dip) method was not recommended as treated rhizome became very soft with dark brown colour and manual removal of peel after lye peeling was also found difficult. Earlier Attri (1999) also did not find lye peeling an appropriate method with respect to colour and texture of rhizome.

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