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Studies on physico-chemical characteristics of ginger (*Zingiber officinalis* L.) rhizomes

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Abstract
Two types of ginger rhizomes locally known as Pahari and Desi were subjected to physico-chemical analysis. Average rhizome weight was appreciably higher than Pahari ginger and it had greater content of flesh and juice. Juice obtained from Desi rhizomes possessed remarkably higher content of total carotenoids but it turned brown rapidly following the extraction.

Keywords: Studies, physico-chemical, *Zingiber officinalis* L.

Introduction
Ginger (*Zingiber officinalis* L.) is an important spice crop of the world. It belongs to the family Zingiberaceae and is indigenous to India. Ginger is produced in almost all the states but Kerala is the leading producer. India ranks first among the ginger producing countries and its share is 35% of world production (Subulakshmi and Naik, 2002) [12]. Ginger is valued in medicine as a carminative and stimulant of the gastro-intestinal tract. It is also effective against migraine, headache and diarrhea. Many authors have reported the anti-oxidative and antimicrobial characteristics of ginger extract (Salzer, 1982; Lee *et al*., 1986; Meena and Sethi, 1994; Kim and Lee, 1995: Naveena *et al*. 2001) [6, 7-9, 11]. Ginger extract has also been investigated as an effective tenderizing agent for beef and buffalo meat (Lee *et al*., Syed Ziauddin *et al*., 1986) [6, 7, 13]. The rhizomes are used in fresh and dried forms. Fresh ginger is used in kitchens as a flavouring agent and is also employed for preparing syruped ginger, crystallized ginger, jam, sauce, marmalade, pickle and chutney. Dry ginger is used for manufacture of ginger powder oil, oleoresins, beverages and candy (Goyal and Korla, 1997) [4]. However, exploration with regards to the industrial utilization of this spicy and aromatic produce in the preparation of popular beverages like ready-to-serve, squash and syrup requires information on the physico-chemical characteristics of ginger rhizomes. The present study was therefore, undertaken with this aim.

Materials and Methods
Two types of ginger rhizomes locally known as Pahari and Desi were purchased from Kumarganj, Faizabad (U.P.) for conducting the experiments. Ten randomly taken rhizomes were used for assessing the physical characters in triplicate. Rhizomes were weighed and their average weight was computed. Colours of rhizome and juice were observed visually. Skin was manually scrapped by employing a stainless steel knife and its weight was recorded. One hundred gram of rhizome was peeled and the edible portion was slashed finely by a grater. The content was squeezed through a layer of muslin cloth by hands and the volume of juice thus obtained was measured. The content of peel, flesh and juice was expressed on the basis of rhizome weight.
Juice extracted from rhizomes was subjected to chemical analysis in triplicate. Total soluble solids (TSS) content of juice was determined by hand refractometer and the readings were corrected to 20 ^{o}C. Ash content was estimated by compete ashing of 10 ml of juice at 500 +25 °C in a muffle furnace. Acidity (as anhydrous citric acid) and ascorbic acid were determined as usual by titration against 0.1 N NaOH and 2,6 di-chloroph-enol indophenol solutions, respectively as described by Ranganna (1986) [10].

Carotenoids were extracted from 10 ml of juice using acetone-hexane solvent system and the absorbance of extract following several washings with distilled water was measured at 452 nm. The content of total carotenoids was expressed in terms of B-carotene (Ranganna, 1986) [10]. Vitamin-A value (as retinol) of juice was calculated by multiplying the carotenoids content by 0.5 (Gopalan, *et al*., 1984) [2].

Table 1: Physical characteristics of ginger rhizomes

S. No.	Characters	Pahari	Desi
1.	Rhizome Colour	Light Brown	Pale Brown
2.	Rhizome Weight, g	27.36	9.54
3.	Peel, Percent	12.83	15.18
4.	Flesh, Percent	87.17	84.82
5.	Juice Percent	56.03	43.92
6.	Juice Colour	Bright Yellow	Pale Yellow

Table 2: Chemical characteristics of ginger rhizomes

S. No.	Characters	Pahari	Desi
1.	TSS, Percent	2.67 (1.50)	3.17 (1.39)
2.	Total Minerals, Percent	0.73 (0.41)	0.46 (0.20)
3.	Acidity, Percent	0.09 (0.05)	0.14 (0.06)
4.	Vitamin C, mg/100 ml.	5.11 (2.86)	2.83 (1.24)
5.	Total Carotenoids, mg/100 ml	175.45 (98.30)	314.27 (138.03)
6.	Vitamin A, μg/100 ml	87.73 (49.16)	157.14 (69.02)

*Figures in parentheses indicate values expressed on the basis of rhizome weight

Results and Discussion

Data furnished in Table-1 indicates considerable differences in certain physical characteristics of both the rhizomes. Pahari and Desi rhizomes appeared as light brown and pale brown, respectively. Govindarajan (1982) [3] also reported variations in the colour of ginger rhizomes in the green mature stage and that varied from pale brown to yellow or reddish brown. In the present studies Pahari recorded appreciably higher rhizome (84.82%) and juice (43.92%) and higher content of peels (15.18%). Apparently smaller surface area of Pahari rhizomes might be responsible for their lower peel content and so the weight (27.36 g) and it was about thrice the weight of Desi rhizome. Flesh content (87.17%) and juice (56.03%) were also reasonably higher with Pahari and it possessed lower content of peels (12.83%). Desi registered lower content of flesh higher flesh content as an inverse relationship exists between the size and surface area of the objects.

Results presented in Table 2 show that juice obtained from Pahari rhizomes had greater content of minerals (0.73%) as compared to that present in juice obtained from Desi (0.46%). Many authors have reported ash content of ginger rhizomes that 1984; Hug *et al*., 1985, Winton and Winton, 1939) [14]. Ascorbic acid was higher (5.11 mg/100 ml) in Pahari juice than in Desi juice (2.83 mg/100 ml). Juice extracted from Desi rhizomes recorded considerably higher values of total carotenoids (314.27 ug/100 ml.) and vitamin A (157.14 ug/100ml.), This also possessed ranged from 1.2-6.5% (Dei-Tutu and Risch, 1976 [1]; Gopalan *et al*. relatively more content of TSS (3.17%) and acidity (0.14%) but it is interesting to mention here that such minor differences also reduced if the values of these components are expressed on the basis of rhizome weight. Gopalan *et al*., (1984) [2] found that 100 g. of edible portion of ginger rhizomes contained 6.0 mg. vitamin C and 40 ug carotene.

In general both types of ginger rhizomes were observed to have sufficient amount of juice. But juice had lower content of TSS, acidity, ascorbic acid and higher content of total carotenoids. Pahari ginger is available abundantly and it contains greater amount of juice having attractive bright yellow colour, moreover that does not turn brown. Hence, these rhizomes may be concluded to have better potentiality for making beverages.

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