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ORGANOLEPTIC EVALUATION OF PRODUCT DEVELOPED FROM BANANA BLOSSOM POWDER AND INDIAN GOOSEBERRY POWDER FOR ANAEMIC POPULATION

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Abstract

Banana blossom, a by-product of the banana cultivation is a nutritional edible flower present on the tip of banana plant. Banana blossom is a good source of iron, a rich source of antioxidants, biologically active compounds such as vitamin C, tannin, phosphates , etc. Along with banana blossom, Indian gooseberry, an exceptionally rich source of vitamin C was used to enhance the bioavailability and absorption of iron. The fresh collected Banana blossom were peeled, cleaned and dried in hot air oven at 50°C for 6 hours and then grinded into a powder and was stored in aluminium foil to prevent exposure from moisture. A recipe was developed using banana blossom powder at varied concentration of 18g, 20g and 25g and 2g, 3g and 5g Indian gooseberry powder per 100g of hummus. Sensory evaluation was done with the help of Composite Scale rating by trained panellists of 50 subjects. The shelf life and microbial analysis of developed product was done. The result revealed that the Hummus Dip developed with concentration of 20g of banana blossom powder and 3g of Indian gooseberry powder was highly acceptable. The acceptable product can further be used for intervention for anaemic patients.

Key words: Banana Blossom, Indian gooseberry powder and anaemia.

Introduction

Iron is an important mineral which plays a major role in delivery of various nutrients across the body and is highly required for growth and development. Low levels of iron in body can lead to deficiency of iron which have a major effect on physical, cognitive ability and behaviour (MesÃasM *et al*., 2013). Iron Deficiency Anaemia (IDA) is counted as a highly common micro-nutritent deficiency across the world which may lead to diminished work ability in adults (Haas and Brownlie, 2001) and has a major effect on motor and mental ability of children and adolescents (Halterman *et al*., 2001). Iron Deficiency without anaemia has shown to affect cognition in adolescent girls (Algarin *et al*., 2003) and cause lethargy, tiredness in adult women (Verdon *et al*., 2003). Anaemia is counted as a serious nutritional problem in India, affecting all categories of the population (50-70%), mostly infants and children of young age, adolescent boys and girls, women of fertile age and pregnant women (NNMB, 2006). Diet, thus, plays an important role in order to provide sufficient iron and, moreover, nutrients providin adequate iron bioavailability to favour positive utilisation of iron and thus be enough for needs at this stage of life (MesÃasM *et al*., 2013).

Banana blossom (*Musa acuminata* Colla), is a product of banana cultivation, is a highly consumed vegetable in many countries like Sri Lanka, Malaysia, Indonesia, and the Philippines (Sheng *et al*., 2011). Often consumed as a curry and also as a boiled or deep fried salad in Sri Lanka (Wickramarachchi and Ranamukhaarachchi, 2005). Having excellent nutritional value, are considered as a good fibre source and biologically active components such as vitamin C, tannin (Alarcon-Aguilara, 1998; Somsub *et al*., 2008; Zhan-Wu *et al*., 2010). The banana bud or flower or blossom is a component in the inflorescence of the banana plant. Banana blossom is generally valued as a fiber-rich source. Along with fibers, proteins and fatty acids, banana flowers also turn out to be a rich source of vitamin E and flavonoids (Glenn, 2011) . Banana flowers, also shown an exceptional resemblance to the fruit as they are good source of potassium, Vitamin A, Vitamin C and Vitamin E. Finger shaped banana blossoms are subtended by large fleshy, reddish or purple coloured scales, which fall off as the fruit matures (Singh, 2017). The banana blossom is a drop-shaped purple flower that hangs at the end of a cluster of bananas. The tough maroon petals that surround the blossoms are known as bracts which need to be removed as they are inedible.

The light-yellow floret encased within the bracts can be diced and eaten raw in salads or they can be cooked in curries. The flowers of the banana blossom oxidize and turn black when they come in contact with air. Banana blossom being a fairly good source of iron, it is beneficial as a functional food and help to overcome anaemia (Singh, 2017).

Indian gooseberry or Amla is regarded as an ancient medicinal plant in traditional systems of medicine in India majorly mentioned in Ayurveda, Unani and Siddha. Amla fruit is largely used as a medicine as diuretic, laxative, liver tonic, refrigerant, stomachic, and for common cold, fever; as alone or in combination with other plants. Amla is packed with major chemical components which consist of tannins, alkaloids, polyphenols, vitamins and minerals (Dasaroju, 2014). It is a rich source of ascorbic acid and it helps to provide the daily requirement of vitamin C of the human body and also increases the bioavailability of iron in the body as Ascorbic acid acts as an essential co-factor in iron absorption. Ascorbic acid has great ability to increase absorption of nonheme iron

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and can also reverse the factors which hinder the effect of such substances like phytates, and oxalates (Lynch *et al*., 1980).

Being a functional food, it can be used for various other researches and interventions in the food industry. Hummus is an Arabic dip or spread made by boiling and mashing chickpeas , blended with tahini, olive oil, lemon juice, salt, and garlic (Sami Zubaida, 1994). Largely consumed in the Middle East, Mediterranean, as well as regarded as a popular in Middle Eastern cuisine around the globe. Chickpea act as an excellent iron - chelating agent , which in turn increases iron solubility and bio-availability (Fuentes *et al*., 2012).

Materials and Methods

Fresh banana blossom was procured from different areas of Delhi, NCR which was then cleaned, peeled and dried and at 50ºc for 6 hours. Dried blossoms were then converted into powder through the process of grinding and stored in aluminium foil to prevent exposure to moisture. Value added product "Hummus" was developed with incorporation of banana blossom powder in varied concentrations of 18g, 20g and 25g and Indian gooseberry powder in varied concentrations of 2g, 3g, 5g. One standard Hummus recipe (without banana blossom) was also developed for sensory evaluation.

The hummus recipe incorporated with banana blossom powder and Indian gooseberry powder was made using these steps: Chickpea (100g), garlic (5g), lemon (20g), honey (5g), olive oil (30g). The recipe included steps like - Soak the chickpeas overnight and then boil them. Blend them to make a fine paste. Add olive oil, a little water and the required spices. Blend them all again into a paste. Add banana blossom powder and Indian gooseberry powder in desired concentrations add honey and lemon according to taste. Sensory evaluation of developed product for colour, texture, taste, appearance, mouth-feel, aroma and overall acceptability was done by 50 subjects using composite scale. Nutritional analysis and shelf life and microbial analysis were done for the highly acceptable product. The obtained data was analyzed by ANOVA and Post Hoc test using SPSS version 21.

Results and discussion

The developed products with varied concentrations (18g, 20g, 25g) of banana blossom powder and (2g, 3g, 5g) of Indian gooseberry powder were analyzed for their colour, texture, taste, appearance and aroma by using composite scale.

Sample T1: Hummus incorporated with 18g of banana blossom powder and 2g of Indian gooseberry powder.

Sample T2: Hummus incorporated with 20g of banana blossom powder and 3g of Indian gooseberry powder.

Sample T3: Hummus incorporated with 25g of banana blossom powder and 5g of Indian gooseberry powder.

ANOVA ($p<0.05$) mean value with same superscripts are significantly different as tested by ANOVA Post Hoc Test.

Table 1 depicts mean acceptability score of attribute between the samples: Hummus by composite scoring.

The color parameter depicted statistically significant difference between the sample which was determined by one way ANOVA i.e. ($p<0.05$). The standard sample had the highest mean value *i.e.* 8.16 ± 1.16 whereas T2 sample had the highest mean value *i.e.* 7.74 ± 1.22 as compared to T1 and T3. The result revealed that T2 was the most acceptable regarding color as compared to other samples.

Sample standard had the highest mean value for taste *i.e.* 17.58 ± 1.34where as sample T2 had highest mean value *i.e.* 16.66±1.96 among products of different concentration of banana blossom and Indian gooseberry powder but differences were not statistically significant among samples ($p=0.003$). The result revealed that sample T2 was most acceptable regarding taste as compared to other samples.

Regarding texture the highest mean value was of standard *i.e.* 7.98±1.09 and among developed products the highest mean value was of sample T2 *i.e.* 7.38±0.94 . However the differences are statistically significant *i.e.* ($p<0.05$) which means that sample T1 was most acceptable regarding texture as compared to other products.

For appearance, there was no statistically significant difference between the sample as determined by one way ANOVA ($p=0.042$). Standard had the highest mean value *i.e.* 17.12±2.13 where as in products of different concentration the highest mean value was of sample T1 *i.e.* 16.46±2.05. The results revealed that the most acceptable product according appearance was Sample T1.

In aroma, standard is having the highest mean value *i.e.* 7.76±1.00 where as among developed samples of different concentration sample T2 is having the highest mean value i.e. 7.20±1.32 and sample T3 is having least mean value *i.e.* 6.76±1.50. The differences are statistically significant *i.e.* ($p<0.05$) which shows that T2 is most acceptable sample regarding aroma as compared to other samples.

Standard had the highest mean value for mouth feel *i.e.* 7.76±1.25whereas sample T2 is on highest among other samples of different concentration with mean value *i.e.* 7.22±1.43. the differences were statistically significant among samples *i.e.* ($p<0.05$). The result determined that T1 was most acceptable regarding mouth feel as compared to other samples.

The overall acceptability was highest for standard with the mean value *i.e.* 17.16±1.63, however among the developed products of different concentration, mean value is highest for sample T2 *i.e.* 16.38±1.94 and it was lowest for sample T3 with the mean value 16.18±2.13. The difference were not statistically significant *i.e.* ($p=0.045$). The results depicts the sample T2 (20 g banana blossom and 3g Indian gooseberry powder) was more acceptable regarding all the attributes as well as had the highest overall acceptability as compared to other products.

Table 2 depicts the Proximal analysis of the product - hummus incorporated with 20g banana blossom and 3g Indian gooseberry powder (100g). The content of iron is 16.9 mg / 200 gm which is approximately the daily iron requirement of female. Also the product provides adequate amount of Vitamin C , has an effective role in absorption of iron. (ICMR, RDA 2010)

Table 3 and table 4 depicts the physical analysis and microbial analysis of Developed Product Hummus Dip for determining the shelf life. Shelf life of the Hummus dip incorporated with 20g banana blossom powder and 3g Indian gooseberry powder was 4 days from date of manufacturing.

Conclusion

Banana blossom, being a good source of iron , protein and fibre and Indian gooseberry powder being rich in Vitamin C which increases the bio-availability of iron is beneficial for patients with anaemia as this when incorporated with hummus helps to reduce risk of reduced iron levels in the body and

decrease the risk of onset of diseases that an occur due to anaemia. The study concluded that the product developed with concentration of 20g of banana blossom and 3g Indian gooseberry powder was highly acceptable by composite scale rating. The content of iron per serving is 16.9 mg / 200 gm which is approximately the daily iron requirement of female. Further the study can be used for intervention of developed product for human trials.

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Table 1: Mean acceptability score of attributes between the samples Hummus by composite scoring

Parameters	Mean and Std. Deviation				ANOVA
	Standard	Sample a	Sample b	Sample c	
Color (10)	8.16 ± 1.16	7.46 ± 1.21	7.74 ± 1.22[ac]	6.86 ± 1.52[adb]	.000
Taste (20)	17.58 ±1.34	16.20±2.59	16.66±1.96[ac]	16.10±2.58[ad]	.003
Texture (10)	7.98±1.09	7.22±1.11	7.38±0.94	6.96±1.41	.000
Appearance (20)	17.12±2.13	16.28±2.32[ab]	16.46±2.05[ac]	15.76±2.90[ad]	.042
Aroma (10)	7.76±1.00	7.04±1.33	7.20±1.32[ac]	6.76±1.50[ad]	.002
Mouthfeel (10)	7.76±1.25	6.84±1.54	7.22±1.43[ac]	6.70±1.64[ad]	.002
Overall Acceptability (20)	17.16±1.63	16.18±2.13	16.38±1.94	16.24±2.03	.045

Standard: Normal Hummus

Table 2: Proximal analysis of the product - hummus incorporated with 20g banana blossom and 3g Indian gooseberry powder (100g)

S. No.	Parameters	Amounts (100gms)
1	Iron	8.45 mg
2	Vitamin C	1.15mg

Table 3: Physical analyses of developed product - Hummus Dip

S. No.	Parameter	Test results
1	Appearance	Smooth
2	Odour & flavour	Good
3	Taste	Sweet
4	Moisture	35.2%
5	Ash Content	0.77%
6	Acid insoluble ash	0.41%
7	Ph	7.09
8	Acidity of extracted fat	0.76%

Table 4: Microbial analyses of developed product - Hummus Dip

Name of microorganism	Incubation time	Temp.	No. of colonies	Temp.	No. of colonies	Max. limit	Total average colony	Total colonies
TPC	72 hr. max	28-30 ^{o}C	215 cfu	35 ^{o}C	426 cfu	10000cfu/gm	641/2	320.5 cfu/gm
Coliform	24 hr. max	30 ^{o}C	Absent	35 ^{o}C	Absent	Absent /gm	Absent	Absent/ gm
Yeast and mould	120 hr. max	22- 24 ^{o}C	15	28 ^{o}C	86	50 cfu / gm	101/2	50.5 cfu/gm
Enterobacteriacea	48 hr. max.	22 - 24 ^{o}C	Absent	28 ^{o}C	Absent	Absent	Absent	Absent/ 0.1 g

Total colonies of TPC: 126.5 =320.5 cfu

320.5×1=320.5÷1=**320.5 colony forming unit**

Total colonies of Coliform: Nil

Total colonies of Yeast and Mould: 50.5 = 50.5 cfu

50.5×1=50.5÷1=**50.5 colony forming unit**

Total colonies of Enterobacteria: Nil