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5. Sensory and Nutrient Composition of 'Smoothie' Prepared by Vegetable and Fruits

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ABSTRACT

Smoothies are fruit- and/or vegetable-based products in form of beverages that are typically semi-liquid, thick in consistency, and mainly consist of purees and juices. Other ingredients, such as yogurt, milk, ice cream, sugar, honey, or simply water may also be added. The present study aimed to examine the effect on sensory properties, nutrient and antioxidant content of Smoothie elaborate smoothie products based on bananas, pumpkins, and purple carrots. prepared by incorporation of Papaya, Orange and Carrot in different proportion. Three different types of treatments were prepared by incorporating Vegetable (Carrot) and Fruits (Papaya and Orange) ranging from 35g, 40g and 45g and 5ml, 10ml and 15ml respectively, Carrots ranging from 15g, 10g, 5g, and 10g of Jaggery was also incorporated which remained constant in all three treatments. The products were evaluated for sensory attributes based on 9 Point Hedonic Score. The results suggested that Smoothie incorporated in the ratio of (20:10:40:10:20:10) T2 was liked very much. Whereas, Smoothie incorporated in the ratio of (20:15:45:5:25:10) T3 was liked moderately and Smoothie incorporated in the ratio of (20:5:35:15:15:10) T1 was liked the least and resulted in decreased mean score of Overall Acceptability. The data obtained for Proximate Analysis, Mineral and Antioxidant content was done by using AOAC methods. Differences among the Sensory Score and nutrient content of the developed food product was done by using various Statistical Analysis methods like ANOVA, CD and 't' test. The nutritional composition of the the best treatment (T2) resulted to be higher than that of control (T0). The best treatment of Smoothie had the Moisture content of 71.8%, and Ash content of 2.0g per 100 g and Protein content of 0.84g per 100g. Fat content was 0.22g per 100g, Fiber content was 1.14g per 100g, Carbohydrate content as 17.0g per 100g and the Energy content was 73.34 Kcal. Smoothie also contained 31mg of Calcium per 100g and 1.22mg

of Iron per 100g. The cost of the dry ingredients for preparing Smoothie per 100g were Rs.22.76 for T0, Rs.8.53 for T1, Rs.9.98 for T2 and Rs.11.43 for T3 . This leads to the conclusion that the addition of papaya, orange, and carrot can be used to prepare a variety of foods that have higher nutritional content and better sensory acceptability.

KEYWORDS:

Papaya, Carrot, Orange, Smoothie and Nutrient.

Introduction:

Smoothies are no alcoholic beverages prepared from fresh or frozen fruit and/or vegetables, which are blended and usually mixed with crushed ice to be immediately consumed. Often, some smoothies may include other components like yogurt, milk, ice-cream, lemon water or tea. They have a milk shake-like consistency that is thicker than slush drinks. Accordingly, smoothies represent an excellent and convenient alternative to promote the daily consumption of fruit and vegetables. The smoothie preparation involves a breakdown of plant parenchyma which leads to a dispersed solution consisting in a liquid phase (pectin and other soluble solids) and a solid phase composed of insoluble solids (cell wall). The main issue of the smoothie processing is the limited shelf life of these products since they are susceptible to spoilage **(Palgan *et al.* 2012)** and quality degradation.

Fruits and vegetables are an essential part of the human diet. In particular, they are rich sources of dietary fiber, vitamins, and various phytochemicals. Numerous studies have proved that they play a vital role in health promotion and prevention of certain chronic diseases, e.g., hypertension, cancer, coronary heart disease, stroke, etc. **(Mirmiran *et al.*, 2014).** Nowadays, consumer trends are orientated to ready-to-eat and functional food, and/or the reformulation of typical products to increase nutritional value. Smoothies could fulfill this consumer demand. Smoothies are new products on the market, and are potentially a convenient and palatable way to replace at least one portion of fruit or vegetables from the recommended five portions per day. Smoothies are usually semi-liquid, thick beverages, obtained by blending fruit, fruit juice, and/or fruit puree. To increase sensory sensation, water, ice, sugar, sweeteners, spices, seeds, yogurt, or milk can be added. The main objectives of this study were the development of new smoothie formulations based on the available nutritious ingredients, including bananas, pumpkins, and purple carrots, as well as to investigate bioactive compound contents, sensory characteristics, antioxidant activity, and other quality parameters of the obtained products **(Cagno *et al.*, 2011)**

Papaya is a nutrient-rich fruit, high in antioxidants, vitamins A, C, and E, promoting blood sugar regulation, digestion, and heart health. It contains iron, calcium, and potassium, and its phytochemicals like lycopene and quercetin offer anticancer properties. Papaya leaf extract supports liver function, lowers cholesterol, and has antiglycemic benefits. Oranges, a hybrid of pomelo and mandarin, are packed with vitamin C, fiber, and minerals like potassium and iron. They contain flavonoids like hesperidin, benefiting cardiovascular health and reducing stroke risk by 25%. Carrots, root vegetables rich in antioxidants and provitamin A, offer cost-effective nutrition and health benefits. Incorporating these foods enhances overall well-being.

Materials and Method:

Procurement of raw materials- Raw materials which was required in product development like carrot, orange, papaya, pineapple, grapes and all the other materials was purchased from local market of Naini, Prayagraj.

Development and standardization of value added chutney- *Smoothie* was developed by the incorporation of vegetable (carrot), fruit (papaya and orange). The basic recipe was served as control (T_0) and three treatments i.e., incorporation of carrot, papaya and orange on different level was referred as T_1, T_2 and T_3 respectively. Each treatment was replicated three times to get an average standard value.

(T_0) (Control) The product was prepared from 40g Pineapple, 32g Yogurt, 64ml Orange Juice, (T_1) The product was prepared from 20g Pineapple, 5ml Orange Juice, 35g Papaya, 15g Carrot, 15g Grape, 10g Jaggery, (T_2) The product was prepared from 20g pineapple, 10g orange juice, 40g papaya, 10g carrot, 20g grape, 10g jiggery, (T_3) The product was prepared from 20g Pineapple, 15ml Orange Juice, 45g Papaya, 5g Carrot, 25g Grape, 10g Jaggery.

Fresh fruits and vegetable were collected (Orange, papaya & carrot). They were washed, peeled & cut in preferable size. Add all the Fruits (Papaya, Pineapple, Grapes) and vegetable (Carrot) into a grinding jar with Jaggery powder. Then add orange juice to it. Grind until smooth texture is obtained. At last add soaked chia seeds (in water) for garnishing.

Sensory evaluation of developed value-added food products- Sensory evaluation of the food products for their acceptability was done with the help of a score card based on the 9-point Hedonic Scale on the basis of attributes like Color and Appearance, Body and Texture, Taste and Flavor and Overall Acceptability. The mean score of Control and Treatments were then calculated **(Srilakshami, 2018).**

Nutritional analysis- Nutritional analysis was conducted following procedures to determine the nutritional composition of the developed food products, including moisture, Ash, Fibre by **AOAC (2007)**, total carbohydrates (difference method), Fat (Soxhlet method), Protein (Lowery's method), Calcium (titration method), Iron (colorimetric method), and Total Energy (Kcal/100g) = (4 X Protein) % + (9 X fat) % + (4 X CHO) %.

Cost calculation- The cost of the prepared product was calculated by taking into account the cost of individual raw ingredients used in the preparation of food products as the prevailing market price.

Statistical analysis- The data was analysed using analysis of variance technique (ANOVA) to get the difference between the variables. Critical Difference and 't' test and other appropriate statistical analysis methods was used to interpret the data **(Gacula & Singh 2008).**

Result and Discussion:

(A) Sensory evaluation of fruit and vegetable chutney:

The experimental Smoothie was sensory evaluated by a panel of five members on a 9 point hedonic scale and marking was done on the basis of six parameter Body and Texture, Colour and Appearance, Flavour and Taste and Overall Acceptability.

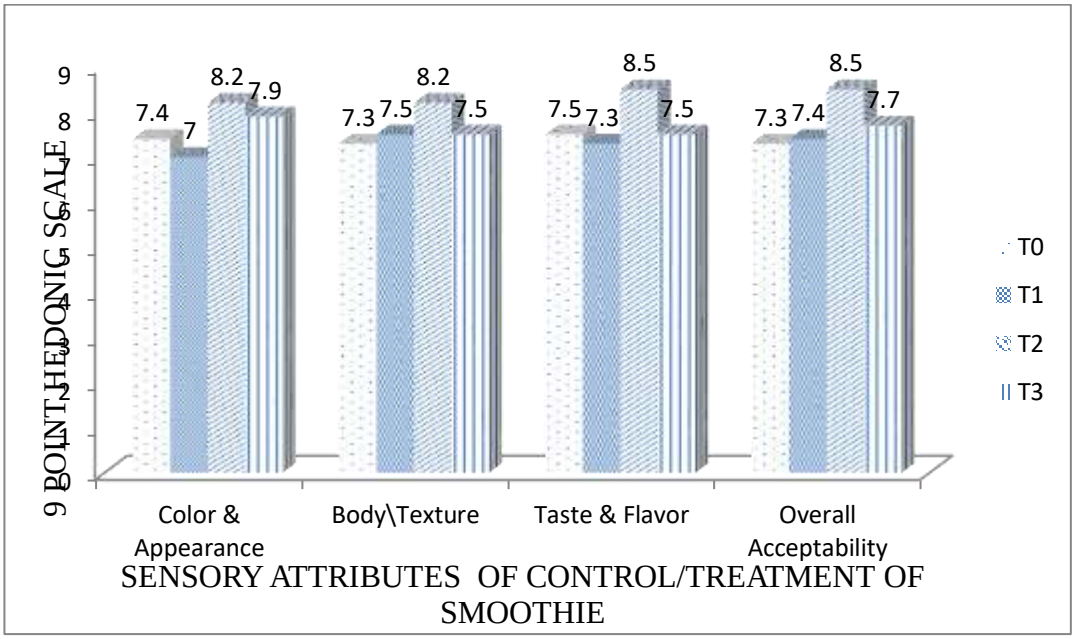

Fig no.1 Average sensory score for different attributes of *Fruit and Vegetable Smoothie*

The mean sensory scores of the *Fruit and Vegetable Smoothie* in relation to color and appearance indicates that T_2 had the highest score 8.2 followed by T_3 (7.9), T_0 (7.4), T_1 (7) respectively. It is quite obvious from the **Fig-1** that the treatment T_2 Papaya 40g, Orange Juice 10g, Carrot 10g, Jaggery 10g, Pineapple 20g, Grapes 20g was liked very much, treatment T_0 and T_3 was liked moderately regarding the colour and appearance of *Fruit And Vegetable Smoothie.* All three experimental smoothie treatments were visually pleasing to the eye because they had black grapes, which gave them a violet hue. T_2 was determined to be the greatest treatment and most visually appealing to the eye compared to the rest which has more violet hue. The findings indicated that youngsters visually favoured smoothies and yoghurts devoid of discernible fruit. The outcomes also supported the notion that food product's colour have a large influence on visual choices. **(Khildegard *et al*., 2011).**

The statistical analysis carried out in relation to Color and Appearance the calculated value of 'F' (164.8) due to treatment is more than table of 'F' (4.75) on 3, 6 degree of freedom at 5 percent probability level, Hence the difference was significant.On comparing the average score for color and appearance against critical difference value (C.D.) the result was significant because the difference in mean values of T_0T_1, T_0T_2, T_0T_3, T_1T_2, T_1T_3 is greater than CD (0.46) therefore the difference was significant.

The mean sensory scores of the *Fruit And Vegetable Smoothie* in relation to body and texture indicates that T_2 had the highest score 8.2 followed by T_3 (7.5), T_0 (7.3), T_1 (7) respectively. It is quite obvious from the **Fig-1** that the treatment T_2 papaya 40g, orange juice 10g, carrot 10g, jaggery 10g, pineapple 20g, grapes 20g was liked very much, treatment T_0 and T_3 was liked moderately regarding the body and texture of *Fruit And Vegetable Smoothie.* The experimental treatments of smoothie contain papaya which has creamy, smooth flesh with soft, buttery texture, giving the smoothie a creamier, softer texture. The taste of the smoothie is sweet because of the presence of sugars in papaya, the sweetness of glucose is only around 55 to 60 percent as sweet as that of fructose or sucrose and contains a slight sweetness, but sucrose contributes the most to the sweetness taste giving the smoothie the sweet taste **(Zhou *et al*., 2021)** And the orange have added a bit tartness because of the presence of a chemical component limonin **(Zhenyu Zhou *et al*., 2023)** in it making smoothie more.

The statistical analysis carried out in relation to Body and Texture the calculated value of 'F' (24.4) due to treatment is more than table of 'F' (4.75) on 3, 6 degree of freedom at 5 percent probability level, Hence the difference was significant.On comparing the average score for Body and Texture against critical difference value (C.D.) the result was significant because the difference in mean values of T_0T_1, T_0T_2, T_0T_3, T_1T_2, T_1T_3 is greater than CD (0.19) therefore the difference was significant.

The mean sensory scores of the *Fruit and Vegetable Smoothie* in relation to Taste and Flavor indicates that T_2 had the highest score 8.5 followed by T_3 (7.5), T_0 (7.5), T_1 (7.3) respectively. It is quite obvious from the **Fig-1** that the treatment T_2 Papaya 40g, Orange Juice 10g, Carrot 10g, Jaggery 10g, Pineapple 20g, Grapes 20g was liked very much, treatment T_0 and T_3 was liked moderately regarding the body and texture of *Fruit and Vegetable Smoothie.* The experimental treatments of smoothie contain Papaya, pineapple, and other ingredients combine to produce a sweet, energising flavour that is reminiscent of a tropical place. **(Souza *et al*.,2019)** bromelain is the main chemical component in pineapple that contributes to its unique taste, pineapple also contains citric and malic acids, which contribute to its acidity and tangy taste which enhances the taste of the smoothie.

The statistical analysis carried out in relation to Body and Texture the calculated value of 'F' (80.0) due to treatment is more than table of 'F' (4.75) on 3, 6 degree of freedom at 5 percent probability level, Hence the difference was significant.On comparing the average score for Body and Texture against critical difference value (C.D.) the result was significant because the difference in mean values of T_0T_2, T_0T_3, T_1T_2 is greater than CD (0.19) therefore the difference was significant.

The mean sensory scores of the *Fruit and Vegetable Smoothie* in relation to overall acceptability indicates that T_2 had the highest score 8.5 followed by T_3 (7.5), T_0 (7.5), T_1 (7.3) respectively. It is quite obvious from the **Fig-1** that the treatment T_2 Papaya 40g, Orange Juice 10g, Carrot 10g, Jaggery 10g, Pineapple 20g, Grapes 20g was liked very much, treatment T_0 and T_3 was liked moderately regarding the body and texture of *Fruit and Vegetable Smoothie.*

The three experimental treatment of smoothie contain Jaggery (Gur), which is a natural sweetener made by concentration of sugarcane juice, gives smoothie a sweet taste

(lamdande *et al.*, 2018).Smoothies represent an excellent and convenient alternative to promote the daily consumption of fruit and vegetables. The smoothie preparation involves a breakdown of plant parenchyma which leads to a dispersed solution consisting in a liquid phase (pectin and other soluble solids) and a solid phase composed 66 of insoluble solids (cell wall) **(Palgan *et al.*, 2012)**

The statistical analysis carried out in relation to Body and Texture the calculated value of 'F' (15.18) due to treatment is more than table of 'F' (4.75) on 3, 6 degree of freedom at 5 percent probability level, Hence the difference was significant. On comparing the average score for Body and Texture against critical difference value (C.D.) the result was significant because the difference in mean values of T_0T_2, T_0T_3, T_1T_2 is greater than CD (0.39) therefore the difference was significant.

(B) Nutrient Analysis of developed '*Smoothie*'

Table no. 1 Nutrient content in control and value added Smoothie.

Nutrients	T_0	T_2	(Difference) T_0 -T_2	t.cal.	t.tab	Result
Proximate Analysis						
Moisture (%)	84.8	71.8	13	61.3	2.447	**S***
Ash (g)	1.40	2.0	0.6	6.72	2.447	**S***
Protein(g)	1.0	0.84	0.16	3.10	2.447	**S***
Fat (g)	1.16	0.22	0.94	74.56	2.447	**S***
Fiber (g)	0.2	1.14	0.94	10.04	2.447	**S***
Carbohydrate(g)	6.96	17.0	10.0	70.6	2.447	**S***
Energy (kcal)	42.28	73.34	31.06	16.84	2.447	**S***
Minerals						
Calcium (mg)	30	31	1	5.51	2.447	**S***
Iron (mg)	1.16	1.22	0.06	4.81	2.447	**S***
Vitamin						
Vitamin-C (mg)	37	40	3	25.66	2.447	**S***
Antioxidant Activity						
DPPH (%)	20	45	25	20.7	2.447	**S***
TPC	16	39	23	20.5	2.447	**S***

S*= Significant, NS=Non-Significant, P<0.05**

The data depicted in **Table no.1** shows that the nutrient composition of the Control and Best Treatment of Smoothie prepared in this study shows slight increase in nutrient content and this conclude that incorporation of Papaya, Orange and Carrot improves the nutritional composition of Smoothie. The antioxidant activity was slightly higher because the ingredients used contain high level of antioxidants in them.

The above **Table-1** shows the "t" value of control and best treatment for Smoothie. The table indicates a significant difference between the nutrient content of the control (T_0) and the best treatment (T_2) as the calculated value of "t" which was found to be 3.10 for protein content, 74.56 for fat content, 10.04 for fiber content , 70.6 for carbohydrate content , 5.51 for calcium content and 4.81 for iron content was higher than the tabulated value of "t" which is 2.447 at 5 percent probability level.

Papaya, Orange, and Carrot are excellent sources of fiber. Fruits and Vegetable Smoothie, which incorporate these fruits, contain dietary fiber and are generally healthier than fruit juices due to their fiber content. Nutritional quality of a smoothie depends on the ingredients used Pineapples (Ananas comosus) have exceptional juiciness and a vibrant tropical flavour that balances the tastes of sweet and tart **(Yong e*t al*., 2009)**. They are the only source of bromelain (bioactive compound)– Bromelain is associated with many health benefits, such as enhanced immune function, cancer prevention, improved wound healing and better gut health **(Uzodinma *et al*., 2020)**

It is quite obvious from the above **Table-1** that because of incorporation of Papaya, Orange and Carrot in different ratios resulted in improved nutritional content. Smoothie was concluded to be rich in Iron, Calcium, Carbohydrate, Vit-C, Fat, Energy and Fiber. The comparison between the nutritional composition of the control and the best treatment are as follows.

(C) Cost of the value added food product:

The cost of the raw materials of "*Fruit And Vegetable Smoothie*" was Rs. 22.76 for T_0, Rs. 8.53 for T_1, Rs. 9.98 for T_2 and T_3 its 11.43. It is therefore concluded that control has the highest cost and **T_3, T_2 and T_1** had the lowest cost because the incorporation level of pineapple did decrease the cost of the prepared product.

Conclusion:

Thus it can be concluded that the Smoothie made with Fruits (Papaya, Orange, Pineapple and Grapes) and Vegetable (Carrot) were having a greater health benefits and contain many nutrients. The study showed that the not so common used Fruits and vegetable combinations were given priority and also sensorially highly accepted well by the panel members. A combination of Fruit and Vegetable was best selected by panel members and it also possesses a wide range of nutrients.

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