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FORMULATION OF FRUIT BASED NUTRITIOUS BEVERAGES INCORPORATING CELERY AND MINT, USING A NATURAL SWEETENER

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Abstract: ***The present study was undertaken to analyze the nutritional composition of celery and mint to be used for beverages preparation, using a variety of fruit bases like orange, gooseberry and cherry tomatoes and also to chemically determine the nutritional constituents of the prepared beverages. Celery juice/pulp and mint was incorporated into three beverages using orange, gooseberry and cherry tomato in three different drinks along with Stevia as the natural and zero calorie sweeteners, using the standard ingredients and methods of preparation. The four treatments were T_0 (fruit juice-100% and sugar-20gm), T_1 (fruit juice-78%, celery juice-20% and mint extract-2%), T_2 (fruit juice-76%, celery juice- 20% and mint extract-4%), T_3 (fruit juice-74%, celery juice-20% and mint extract-6%) and T_4 (fruit juice-72%, celery juice-20% and mint extract-8%). The beverages prepared were organoleptically evaluated for color, consistency, taste & flavor and overall acceptability using a 9 point Hedonic Scale. The cherry tomato based celery beverage with mint was best among all the three. The nutritional compositions of beverages were chemically analyzed. The total carbohydrate content ranged from 2.28gm to 33.5gm/100ml, the carotene content ranged from 9µg-486.32µg, the highest being in the cherry tomato based drink. The iron content was between 1.2mg and 2.66mg/100ml, the vitamin-C was between 22.8mg and 600mg/100ml, the highest being in the gooseberry based juice. The calcium content ranged from 5mg-56.56mg/100ml.***

It was concluded from the study that the beverages formulated using celery; mint and Stevia at different levels of incorporation were at par with conventional beverages while improving the vitamin-C, carotene, iron and calcium content in addition to the fact that celery and mint has several other therapeutic benefits.

Keywords: Celery leaves, fruit pulp, Stevia and Mint leaves, acceptability, nine point hedonic scale

Introduction

The stress of modern life and strain causes a host of problems, including stomach problems, high blood pressure, heart attacks and strokes, which is why stress is termed as a silent killer. To combat stress, one needs to induce a sense of relaxation and well-being. Along with that, in developing countries like India, various forms of malnutrition occur. Along with the regular diet, supplementation with a healthy beverage can be a welcome change. Vitamins, fibers and minerals provided by celery juice will ensure good health and immunity from diseases. Problems such as obesity, diabetes, heart diseases and other lifestyle diseases can be prevented by having a healthy beverage made out of celery, gooseberry and mint. Thus, the

use of celery juice and gooseberry as a beverage can give release from a range of problems pertaining to health and incorporating it in the diet to generate low calories. It will be beneficial to health and boost immunity. Cherry tomato is a well-known source of iron and antioxidants. Cherry tomatoes are loaded with insoluble fiber, the type of fiber that sweeps out our gut and helps us have regular bowel movements. Insoluble fiber has been known to relieve bouts of constipation as well. Cherry tomatoes are one of the richest sources of vitamin C. We need vitamin C to keep our immune system in tip-top shape, but it also works as an antioxidant. Vitamin C, along with other antioxidants, neutralizes damaging free radicals that destroy healthy cells. The vitamin C we get from orange juice protects our bodies from the harmful effects of free radicals that cause early aging, and aids in the absorption of essential minerals like calcium. Studies have found that orange juice contains hesperidin, a very healthy, water-soluble plant pigment. It improves the activity of small blood vessels bringing your overall blood pressure into balance and helping to decrease cardiovascular risks. Drinking orange juice regularly is thought to decrease levels of low-density lipoprotein, or LDL, cholesterol. Stevia will be used in this beverage as the sweetening agent instead of sugar. This will make this beverage suitable for diabetic individuals.

Materials and Methods:

1. Procurement of raw materials:-

Celery stalks and cherry tomatoes were purchased from the super-market of Allahabad. Gooseberry was procured from the local fruit market of Mahewa area. Oranges and mint were procured from the local vegetable market. Stevia powder was obtained from the nearby pharmacy.

2. Site of experiment:-

The present investigation was carried out in the Nutrition Research Laboratory of the Department of Foods & Nutrition, Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad.

3. Formulation of beverages:-

Three fruit based nutritious herbal celery beverages was prepared using different fruits in different herbal proportions.

- Orange and celery juice with mint.
- Gooseberry and celery juice with mint.
- Cherry tomato and celery juice with mint.

3.1. Treatment and replication of the formulation of fruit based herbal beverage:-

Treatment	Fruit juice/pulp (ml)	Celery juice(ml)	Sugar (gm)	Mint extract (ml)	Stevia (mg)
T_0	100		**20**		
T_1	78	20	-	2	17.5

T_2	76	20	-	4	17.5
T_3	74	20	-	6	17.5
T_4	72	20	-	8	17.5

Preparation of beverage (Source: Srivastava 2009)

3.2.3Preparation of mint extract- mint leaves were washed then blended in mixer grinder and filtration was done by muslin cloth.

4. Treatments and replications of value added food products enriched with fruit juice, celery juice and mint were as follows:-

➢ Treatment of products:-

The basic fruit beverage with sugar (20gm) was served as control (T_0) for each product. Four value addition treatments were done with celery juice (20ml), mint extract at 2ml, 4ml, 6ml and 8ml were referred to as T_1, T_2, T_3 and T_4 respectively. The amount of fruit juice was varied at each treatment at 78ml, 76ml, 74ml and 72ml in accordance to all the four treatments. The amount of Stevia was kept constant at 17.5mg for all the products prepared, namely, Amla based celery beverage with mint, Orange based celery beverage with mint and Cherry tomato based celery beverage with mint. Control and treatments for each preparation were replicated 4 times respectively.

➢ Table of treatments of products:-

Table of ingredients:-

Treatments / Products	T_0	T_1	T_2	T_3	T_4
Orange juice	100ml	78ml	76ml	74ml	72ml
Celery juice	---	20ml	20ml	20ml	20ml
Mint extract	---	2ml	4ml	6ml	8ml
Sugar	20gm	---	---	---	---
Stevia powder	---	17.5mg	17.5mg	17.5mg	17.5mg

5. Organoleptic analysis of prepared nutritious beverages:-

Sensory evaluation of the products was done by a panel of five judges among the faculty members of Ethelind School of Home Science for the sensory attributes, i.e., color and appearance, consistency, taste and flavor and overall acceptability of the prepared beverages by using Nine Point Hedonic Scale. The samples were placed before the judges with sample code, T_1, T_2, T_3 and T_4 incorporation with celery juice (20%), and mint at 2%, 4%, 6% and 8% respectively. The panel of judges graded the coded samples of the beverages.

6. Chemical analysis of fruit based herbal nutritious beverages:-

The analysis of the nutrient composition and determination of the physico-chemical properties of the prepared beverages was done chemically, under the following heads:-

- Determination of pH by AOAC (2005) method.
- Determination of viscosity by AOAC (2005) method.
- Determination of TSS.

- Determination of vitamin C.
- Determination of total carbohydrate.
- Determination of carotene.
- Determination of iron and calcium.

7. Statistical analysis:-

- After tabulating the data obtained from the sensory evaluation, it was statistically analyzed by using two way Analysis of variance techniques. Significant difference between the treatments was determined by using CD (critical difference) test. **(Gupta et. al., 2005)**

RESULTS AND DISCUSSION

The data of the present study "Formulation of fruit based nutritious beverages incorporating celery, using Stevia as a natural sweetener" on different aspect as per methodology was tabulated analyzed statistically. The result obtained from the analysis is presented and discussed in this chapter.

ORGANOLEPTIC CHARACHTERISTICS OF PREPARED BEVERAGES:-

1. The effects of treatments in 'Orange and celery drink flavored with mint'.
2. The effects of treatments in 'Gooseberry and celery drink flavored with mint'.
3. The effects of treatments in 'Cherry tomato and celery drink flavored with mint'.

8.1 The average sensory scores of different parameters in control and treated samples of "Orange and celery drink with mint".

Treatment	Color	Consistency	Taste & Flavor	Overall acceptability
T_0	7.7	7.6	7.85	8.7
T_1	8.75	8.7	8.8	8.95
T_2	7.9	8.5	8.05	8.35
T_3	7.7	7.5	7.9	8.4
T_4	7.4	7.5	7.75	8
F%	Significant	Significant	Significant	Significant
C.D.	0.2	0.2	0.17	0.4

The result illustrated in the above table 8.1 pertains to the average sensory scores of different parameters in treated samples of the prepared beverage. This clearly indicates that the treatment T_1 of the beverage has the highest score in terms of color (8.75), consistency (8.7), taste & flavor (8.8) and the overall acceptability (8.95). This is followed by T_2 and T_3 respectively. T_1 was found to be the acceptable by the panel of judges.

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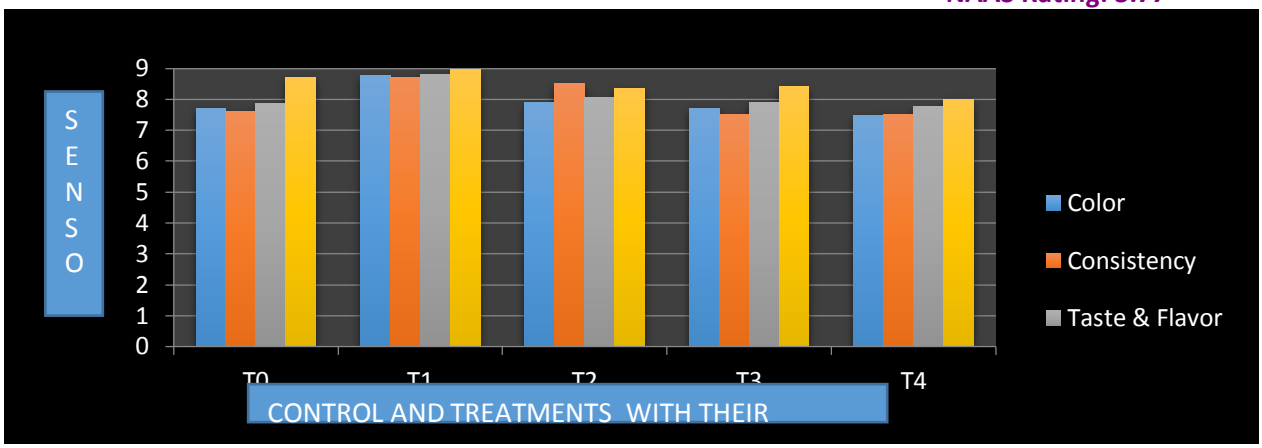

Fig: 6 the effect of incorporation of celery juice and mint extract on the sensory characteristics of the Orange juice.

8.2 Average sensory scores for different parameters in control and treated samples of "Gooseberry based celery drink with mint".

T_0	8.3	7.9	7.7	8
T_1	8.35	7.9	7.9	7.9
T_2	8.55	7.8	7.9	7.9
T_3	8.8	8	8.9	9
T_4	8.5	8	8	8
F%	Significant	Non-significant	Significant	Significant
C.D.	0.2		0.2	0.1

Clearly from the above table number 8.2, we can see that the treated sample T_3 of the prepared beverage has the highest score in terms of its sensory evaluation. It had increased acceptability as according to the panel of judges. This was followed by T_2, T_4 and T_1. These were moderately appreciated by the panel of judges.

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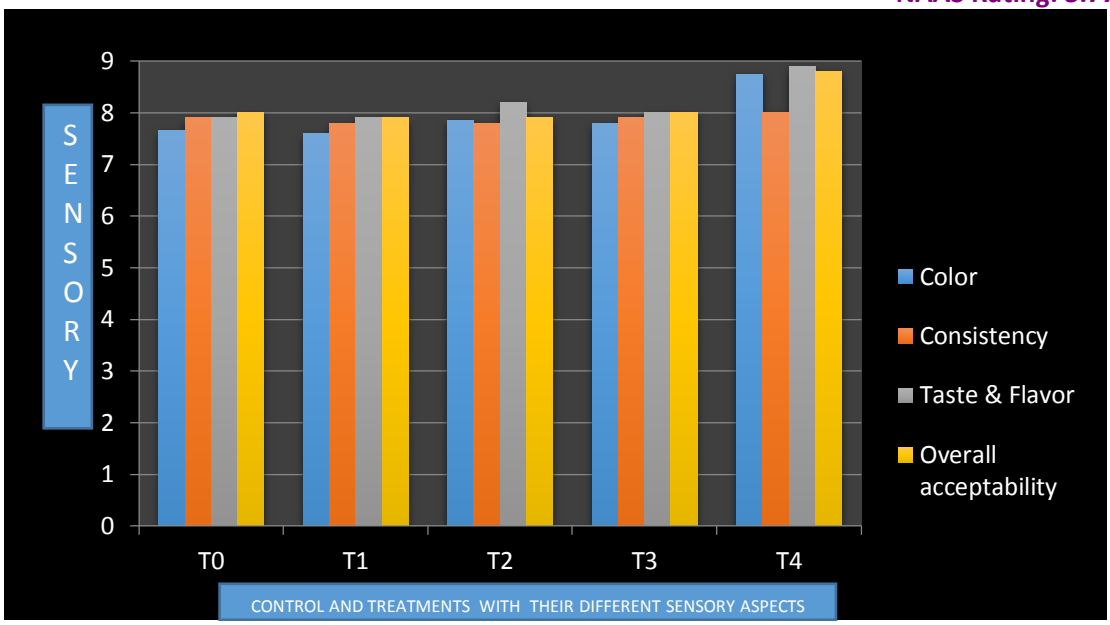

Fig: 7 the effect of incorporation of celery juice and mint extract at different levels on the sensory characteristics of gooseberry juice.

8.3 Average sensory scores of different parameters in control and treated samples of "Cherry tomato based celery beverage":-

Treatments	Color	Consistency	Taste & flavor	Overall acceptability
T_0	7.65	7.9	7.9	8
T_1	7.6	7.8	7.9	7.9
T_2	7.85	7.8	8.2	7.9
T_3	7.8	7.9	8	8
T_4	8.75	8	8.9	8.8
F%	Significant	Non-Significant	Significant	Significant
C.D.	0.2		0.03	0.1

From the above table 3.1, we can say that the treated sample T_4 was most acceptable to the panel of judges. It scored the highest in terms of sensory score. This was followed by T0, T3, T2 and T1.

In case of the overall acceptability of the product, T_4 scored the highest. It was most acceptable in every way by the panel of judges. This was followed by T3, T0, T2 and T1. From the ANOVA table it clear that the calculated value of F (68.3) was higher than the tabulated value of F (3.26). Therefore we can say that there is a significant difference in the overall acceptability of the product when different amount of celery juice was added to the treated products. The overall acceptability of the product increased.

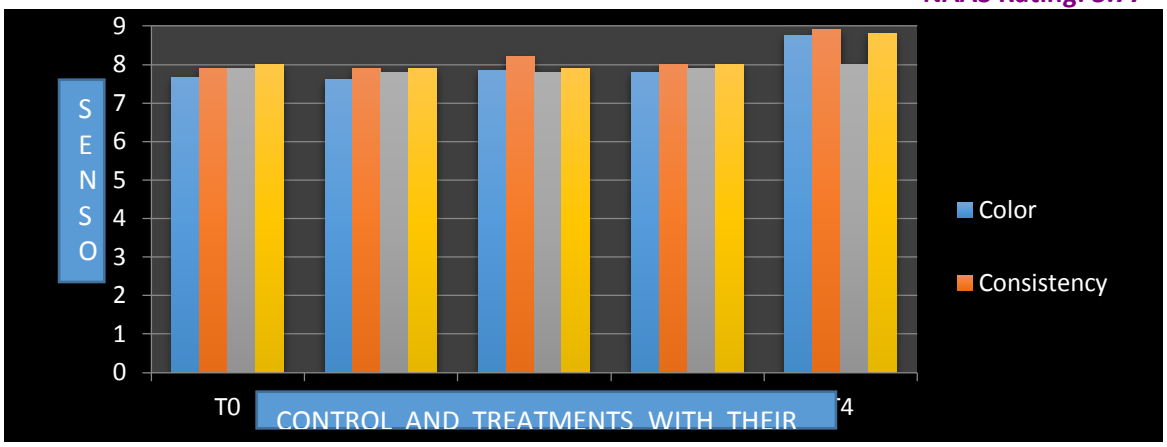

Fig: 8 the effect of incorporation of celery juice and mint extract on the sensory characteristics of the cherry tomato juice.

9. NUTRITIONAL COMPOSITION OF THE PRODUCTS

9.1 Average percentages of nutrients in control and treated samples of "Orange and celery beverage with mint":-

Treatments / Nutrients	T_0	T_1	T_2	T_3	T_4
Energy (kcal)	**88.6**	11.58	12.36	13.14	13.92
Total carbohydrate (gm)	**21.7**	2.28	2.34	2.4	2.46
Vitamin-C (mg)	**64**	51.66	50.92	50.18	49.44
Carotene (µg)	15	148.1	180.2	212.3	**244.4**
Iron (mg)	0.7	1.77	2.7	2.4	**2.11**
Calcium (mg)	5	13.9	17.8	21.7	**25.6**

The above table shows the nutritional composition of the beverage containing only orange juice (100ml) and sugar (20gm) as the control T_0. It has an appreciable amount of energy and carbohydrate. The vitamin-C content is good, but carotene, iron and calcium amounts are not up to the mark. In the treated samples, where celery juice and mint extract has been incorporated along with Stevia powder as the natural sweetener instead of using sugar, the carbohydrate and energy amounts have been reduced considerably. 20ml celery juice has been added to all the treated samples and mint extract as T_1 (2ml), T_2 (4ml), T_3 (6ml) and T_4 (8ml).

The vitamin-C content has almost remained constant but the amount of carotene, calcium and iron have spiked to a great extent. The iron, calcium and carotene content of T_4 is the highest, that is, 2.7mg, 25.6mg and 244.4µg respectively followed by T_3, T_2 and T_1. This has been noted to be the lowest for T_0 being 0.7mg, 5mg and 15µm respectively. The amount of Stevia was kept constant for each treatment (17.5mg). Only the control T_0 has 20gm of sugar which causes its calories content and carbohydrate to go high, that is, 88.6 kcal and 21.7 gm respectively. This amount has been considerably lowered in the treated samples of the

product, that is, 11.58 kcal and 2.28gm for T_1, 12.36 kcal and 2.34 gm for T_2, 13.14 kcal and 2.4 gm for T_3 and 13.92 kcal and 2.46 gm for T_4. Thus T_1 has the lowest amount of carbohydrate and energy among all the treated samples of the product.

9.2Average percentages of nutrients in control and treated samples of "Gooseberry and celery beverage with mint":-

Treatments / Nutrients	T_0	T_1	T_2	T_3	T_4
Energy (kcal)	**137.6**	50	49.6	49.4	49.2
Total carbohydrate (gm)	**33.5**	11.48	10.78	10.62	10.46
Vitamin-C (mg)	**600**	569.74	558.28	546.82	535.6
Carotene (µg)	9	143.42	175.64	207.86	**240.08**
Iron (mg)	1.2	2.2	2.72	3	**3.28**
Calcium (mg)	50	49	52	55	**58**

The above table shows the nutritional composition of the beverage containing only gooseberry juice (100ml) and sugar (20gm) as the control T_0. It has an appreciable amount of energy and carbohydrate. The vitamin-C content is good (600 mg), but carotene (9µg) and iron (1.2mg) amounts are not up to the mark. It has a fair amount of calcium (50mg). In the treated samples, where celery juice and mint extract has been incorporated along with Stevia powder as the natural sweetener instead of using sugar, the carbohydrate and energy amounts have been reduced considerably. 20ml celery juice has been added to all the treated samples and mint extract as T_1 (2ml), T_2 (4ml), T_3 (6ml) and T_4 (8ml).

The vitamin-C content has reduced slightly in the treated samples only slightly due to the gradual reduction in the amount of amla juice and addition of celery juice. The content of iron and calcium has increased gradually as 2.2mg & 49mg in T_1, 2.72mg & 52mg in T_2, 3mg & 55mg in T_3 and 3.28 mg & 58mg in T_4 respectively. The carotene content in the control is only about 9 µg, whereas it is as high as 143.42µg, 175.65µg, 207.86µg and 240.08µg in T_1, T_2, T_3 and T_4 respectively. Therefore we can see that treatment T_4 has the highest amount of carotene, iron and calcium but lowest amount of vitamin-C which however is still as high as 435.36 mg. This amount is the highest in control (600mg) but it is very low in carotene, iron and calcium as compared to the treated samples.

9.3 Average percentages of nutrients in control and treated samples of "Cherry tomato and celery beverage with mint":-

Treatments / Nutrients	T_0	T_1	T_2	T_3	T_4
Energy (kcal)	**99.6**	20.16	20.72	21.28	21.84
Total carbohydrate (gm)	**23.4**	3.6	3.63	3.66	3.69
Vitamin-C (mg)	**27**	26.81	26.8	26.8	26.8
Carotene (µg)	351	410.18	435.56	460.94	**486.32**
Iron (mg)	0.64	1.67	2.06	2.36	**2.66**
Calcium (mg)	48	47.44	50.48	53.52	**56.56**

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The above table shows the nutritional composition of the beverage containing only cherry tomato juice (100ml) and sugar (20gm) as the control T_0. It has an appreciable amount of energy and carbohydrate. The vitamin-C content is low (27 mg) and carotene is 351 µg. It has a fair amount of calcium (48mg) but iron content is low (0.64 mg). In the treated samples, where celery juice and mint extract has been incorporated along with Stevia powder as the natural sweetener instead of using sugar, the carbohydrate and energy amounts have been reduced considerably. 20ml celery juice has been added to all the treated samples and mint extract as T_1 (2ml), T_2 (4ml), T_3 (6ml) and T_4 (8ml).

The amount of carbohydrate and energy has decreased considerably in the treated samples. The vitamin-C content of the beverage remains almost constant in the treated samples of the product (22.8mg). However, the carotene, iron and calcium content of the beverage has increased gradually as 410.18 µg, 1.67 mg & 47.44 mg in T_1, 435.56 µg, 2.06 mg & 50.48 mg in T_2, 460.94 µg, 2.36 mg & 53.52 mg in T_3 and 486.32 µg, 2.66 mg and 56.56 mg in T_4 respectively.

11. PHYSICO-CHEMICAL PROPERTIES OF PREPARED BEVERAGES:-

Products / **Properties**	**Orange and celery juice with mint**	**Gooseberry and celery juice with mint**	**Cherry tomato and celery juice with mint**
pH	5.2	4.7	4
Viscosity (cP)	56	57.2	**60.12**
Total soluble solids	10.23	12.12	**13.131**

The products show an acceptable range in physico chemical characteristics. The pH is mainly towards the acidic side due to the addition of fruit juices. The beverages are fairly viscous as evident from the above table. This allows the beverages to be adequately acceptable to the people. It has not much amount of total soluble solids which makes it suitable as a beverage. The cherry tomato and celery juice is the most acidic as compared to the other two. It is also more viscous and has more amount of total soluble solids as compared to the other two.

CONCLUSION

From the result summarized it is concluded that celery juice with fruit pulp can be successfully incorporated regularly in everyday fruit beverages according to their recipes. The prepared drinks were accepted with regard to sensory characteristics. Nutritional composition of prepared health drinks regarding carbohydrates and energy was found to be satisfactory. On the other hand, the qualities of the drinks were improved rapidly on addition of celery and mint and by replacing sugar with Stevia. The amount of iron, carotene, calcium and vitamin-C was greatly improved in the treated samples of the products.

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