

Value addition of green apple ginger smoothie by enrichment with *Chlorella vulgaris*: Sensory evaluation

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ABSTRACT

Chlorella has a number of nutrients in great quantities that is why it can be incorporated in normal dishes. It has biological and pharmacological properties important to human health. *Chlorella* has vitamin A, folic acid, biotin, iodine, magnesium, iron and zinc along with nutritionally complete protein. *Chlorella* can improve the condition of hyperlipidemia and hyperglycemia. In the present study we prepared four varieties of smoothies having different quantities of *chlorella*. Results of our study indicate that on a hedonic scale S30 and S40 scored highest in color and appearance with a mean value of 7.71 ± 1.11 and 7.71 ± 1.25 . Variant S40 scored highest for aroma with a mean value of 8.14 ± 1.21 . S10 scored highest for taste and texture (7.85 ± 0.69) as well as for overall acceptability (8 ± 0.57).

Key Words : *Chlorella vulgaris*, Sensory evaluation, Enrichment and smoothie

INTRODUCTION

Chlorella is unicellular, micro green algae. It has biological and pharmacological properties important for human health. *Chlorella vulgaris* has a long history of use as a food source which has an exceptional constitution comprising of a number of functional macro- and micro-nutrients including complete proteins (about 60% of dry weight), omega-3 polyunsaturated fatty acids, polysaccharides, vitamins (notably vitamin A, folic acid and biotin etc.) and minerals (including iodine, magnesium, iron and zinc etc.). Clinical trials have indicated that supplementation with *Chlorella vulgaris* can improve the conditions of hyperlipidemia and hyperglycemia, and guard against oxidative stress, cancer and chronic obstructive pulmonary disease (Panahiet al, 2016). Moreover, it is one of the few vegetarian sources having bioavailable iron and vitamin B₁₂ thus it can ameliorate anemia. Likewise, consumption of *chlorella* can act as a one rich source of many nutrients for the people of the countries like India (Becker 2007). Furthermore, given the nutrient profile of *chlorella* it is an obvious choice for fortification of various recipes (Belasco, 1997). Such a recipe is a healthier choice and can replace junk food having empty calories only and hence possibly defending

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against numerous deficiency diseases. In the light of above discussion, a unique recipe of smoothie is formulated. It is then subjected to sensory evaluation.

Objectives :

The objectives of my study are:

- To evaluate the nutritional potential of chlorella enriched green apple ginger smoothie.
- To study the variations in the smoothie's organoleptic features and
- To assess the suitability of smoothie concocted by incorporating chlorella.

METHODOLOGY

Variants of green apple ginger smoothie with different amounts of chlorella (10g, 20g, 30g and 40g) were formulated. A 9-Point Hedonic Scale was used for sensory evaluation of the smoothies. A panel of seven judges was recruited to evaluate the organoleptic characteristics of smoothies concocted by adding varying quantities of chlorella. SPSS version 16 was used for the analysis of sensory evaluation data thus obtained.

Smoothie variants :

S1- Smoothie formulated using 10 g of broken cell wall chlorella powder.

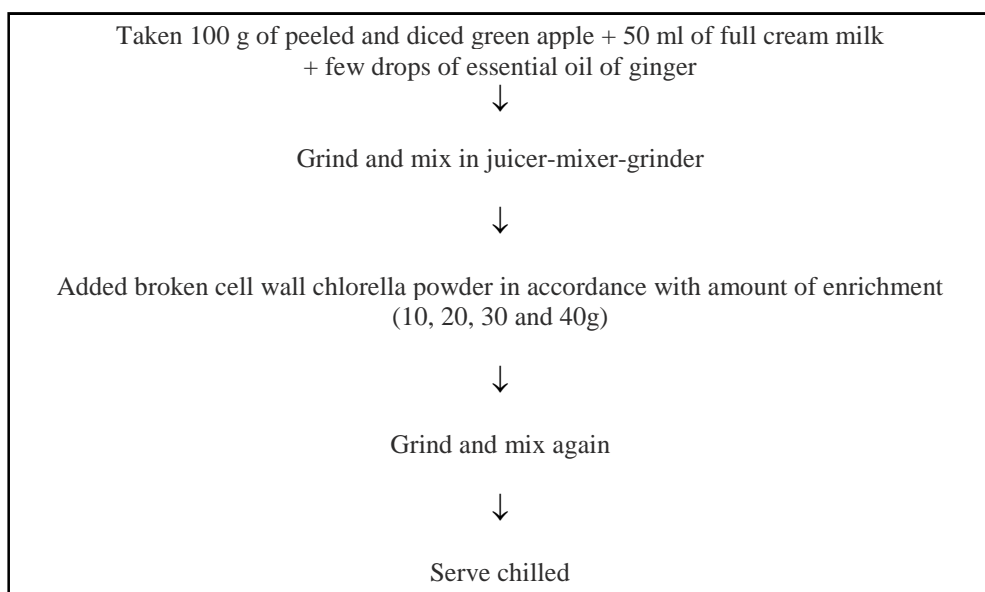
S2- Smoothie formulated using 20 g of broken cell wall chlorella powder.

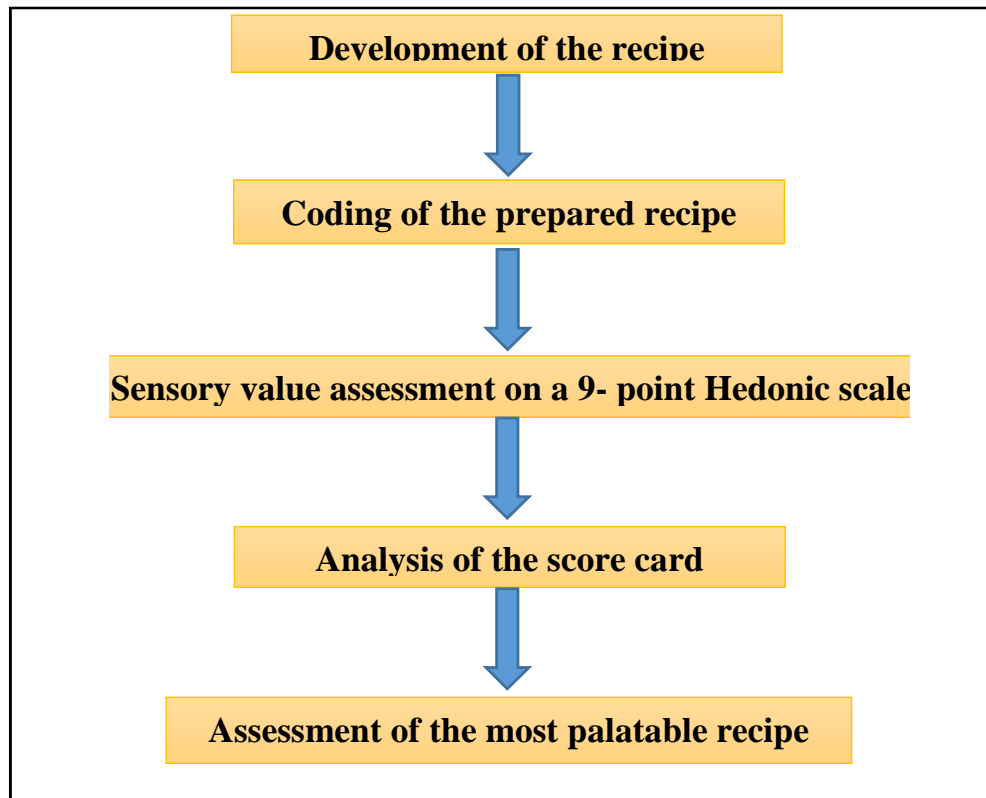
S3- Smoothie formulated using 30 g of broken cell wall chlorella powder.

S4- Smoothie formulated using 40 g of broken cell wall chlorella powder.

Thus treated smoothies were subjected to sensory evaluation, by the panel of judges, to find out the most palatable product.

Recipe preparation :





RESULTS AND DISCUSSION

Chlorella is an incredibly nutrient rich food. It is generally recognized as safe (GRAS) by United States Food and Drug Administration (USFDA, 2016). It has a high protein and high lipid content along with essential vitamins and minerals. Hence it can be deduced that addition of *chlorella* to the diet can protect against a number of deficiency disorders.

Table 1 : Nutritive value of <i>Chlorella vulgaris</i>		
Principle	Nutritional content per 100 g.	
	Nutritive value	Percentage of RDA
Energy	421 Kcal	15.42
Carbohydrates	20g	05.83
Protein	60.5g	100.00
Fat	11g	36.66
Vitamin A activity	55,500 IU	2775.00
Vitamin B12	125.9µg	125.90
Biotin	191.6µg	638.66
Iodine	600µg	400.00
Magnesium	315mg	92.64
Iron	167mg	982.35
Zinc	71mg	591.66

Nutritional assessment :

Product	Calories (Kcal)	CHOs (g)	Protein (g)	Fat (g)	Vit. A (IU)	Vit. B12(µg)	Biotin (µg)	Iodine (µg)	Magnesium (mg)	Iorn (mg)	Zinc (mg)
S10	159.6	17.90	8.40	4.85	5550	12.59	19.16	60	38.50	17.50	7.16
S20	201.7	19.90	14.45	5.95	11100	25.18	38.32	120	70	34.20	14.26
S30	243.8	21.90	20.50	7.05	16650	37.77	57.48	180	101.50	50.90	21.36
S40	285.9	23.90	26.55	8.15	22200	50.36	76.64	240	133	67.60	28.46

Organoleptic assessment :

Sensory evaluation of smoothie variants was carried out by a panel of seven judges. Following parameters were scored on a 9-point hedonic scale:

- Color and appearance
- Aroma
- Taste and texture
- Overall acceptability

The results of organoleptic evaluation are shown in Table 3 and Fig. 1. All recipes scored well for all parameters. S10 scored highest for taste and texture (7.85 ± 0.69) as well

Product	Color and appearance	Aroma	Taste and Texture	Overall acceptability
S10	7.14 ± 1.06	7.14 ± 1.95	7.85 ± 0.69	8 ± 0.57
S20	7.57 ± 0.53	7.28 ± 1.11	7.57 ± 0.97	7.71 ± 1.11
S30	7.71 ± 1.11	7.85 ± 0.89	7.28 ± 1.70	7.85 ± 0.89
S40	7.71 ± 1.25	8.14 ± 1.21	7.28 ± 1.25	7.57 ± 1.27

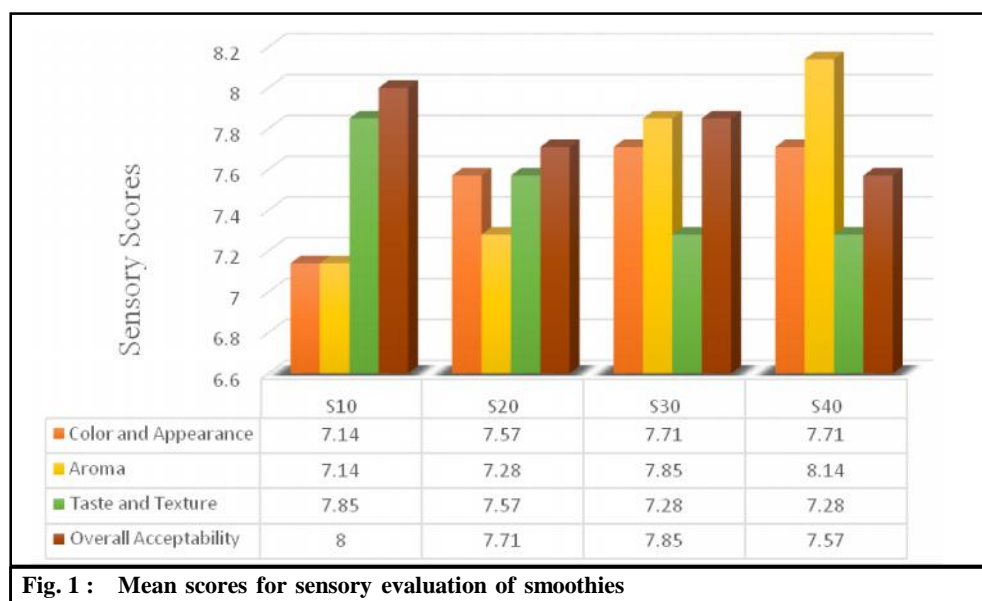


Fig. 1 : Mean scores for sensory evaluation of smoothies

as for overall acceptability (8 ± 0.57). color and appearance score was highest for the S30 and S40 variants (7.71 ± 1.11 and 7.71 ± 1.25 , respectively). Variant S40 scored highest for aroma with a mean value of 8.14 ± 1.21 . our study is in agreement with the previous studies.

Conclusion :

The enriched smoothies had higher nutritive value especially with reference to protein, vitamin A, Vitamin B12, biotin, iodine, magnesium, iron and zinc. Our study evidently indicated that fortified variants of smoothie formulated by integrating broken cell wall *Chlorella vulgaris* had higher nutritional potential. Chlorella based recipes thus developed can contribute to overall nourishing diet and can also ensure the food security in this part of the world.

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