Development of Aloe Vera Incorporated Buttermilk for Diabetic Patients

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Abstract:
Aloe Vera contains active compounds like polysaccharides which are used to increase the insulin levels and exhibit hypoglycemic properties. An attempt has been made in the present study for the development of product using Aloe Vera for Diabetic patients. The product developed was aloe vera incorporated buttermilk. Product was prepared in two variations namely variation I and variation II (15% &25%). Product with 25% substitution with aloe vera was found to be superior in its nutrient content. The total cost Analysis of basic and variations of buttermilk was Rs.14,15,16/- for basic and variations. A panel of 20 semi trained judges tested the sensory attributes of the products and scored them using a 5 - point scoring card, for appearance, taste, texture, flavor and overall acceptability. The nutrient analysis of aloe vera incorporated buttermilk revealed that the protein and fiber content of newly developed variation of buttermilk was higher compared to basic. ANNOVA was used to find if there is a significant difference between the means scores of the sensory properties of the basic and the two variations. Variation I of buttermilk was most accepted in terms of their sensory qualities. From the results of ANNOVA it was concluded that the variations produced are similar to the basic in terms of its sensory qualities and since it is not significantly different from the basic, variations may be easily accepted by the consumers. Hence, development of aloe vera incorporated buttermilk is an effective way of delivering the bioactive benefits of aloe vera in a tasty and refreshing way to the consumers.

Keywords: Aloe Vera, buttermilk, nutrient analysis.

1. Introduction

The latest global figures on diabetes, released by the International Diabetes Federation (IDF) shows that, India is presently with 62 million diabetics stands second after China (92.3 million diabetics), which showed nearly 2 million increases from the previous year. Diabetes is one among those categories of diseases which is mainly due to the changing health Habits of the people. Unhealthy food habits, Obesity, age, heredity, lack of exercise, smoking and alcoholism are considered as the risk factors of diabetes. Treating diabetes is a major concern among diabetics due to the increasing cost of medications, frequent monitoring of blood glucose level and follow up. As we keep on treating Diabetes only with the help of medicines; it turns to be a chronic metabolic disease with micro and macro vascular complications. In addition to it, the adverse effects of anti-diabetic drugs also make the life miserable. Thus, it is high time to think of the harmless alternative therapies as an adjunct therapy to treat the diabetes mellitus.

Aloe Vera (Aloe Barbadensis belongs to Liliaceae family) leaf gel is one among this which can produce a positive effect on blood glucose level in adult with type II diabetes. Aloe Vera plant or gel extracted from this plant contains a lot of beneficial nutrients, enzymes, and many bioactive compounds. And for many centuries it had also been utilized and used in medicine. Aloe Vera is one of the more than 400 species of aloe belonging to the family Liliaceae that originated in South Africa. Aloe Vera is a cactus-like plant that grows readily in dry, hot climates and currently is cultivated in large quantities because of its demand, which is increasing day by day.

Aloe vera has potential to use against different diseases because it is composed of several useful active components. The active compounds found in Aloe vera plant are sugar, amino acids, enzymes, methylchromones, flavonoids, vitamins, minerals, Aloesin, Aloeemodin, lignin, aloin, Aloemannan, acemannan Aloeride, saponins, Naftoquinones, sterols, anthraquinones and salicylic acid as well as other

compounds such as fat-soluble and water- soluble vitamins, minerals, enzymes, organic acid, simple/complex, phenolic compounds and sugars (Danish et al., 2020). Aloe vera exhibits various activities such as anti-bacterial, anti- viral, anti-cancer, anti-oxidant, anti-allergic, anti-inflammatory, anti-ulcer, anti-diabetic anti- aging, and wounds/burns healing and various skin infections (Sánchez-Machado et al., 2017; Arbab et al., 2021). Further, it has also been used in the treatment of constipation, gastrointestinal disorders, and for immune system deficiencies (Radha and Laxmipriya, 2015).

Numerous animal trials have reported positive effects of Aloe vera in in vivo models of diabetes, including lower fasting blood glucose levels in alloxan-induced diabetic mice, enhanced glucose tolerance in glucose-loaded rats compared to normal, decreased glucose levels in streptozotocin-induced diabetic rats; improved liver gluconeogenesis in streptozotocin-induced diabetic rats; decreased oxidative damage in the brains of streptozotocin-induced diabetic mice; decreased lipid peroxidation in diabetic rat kidney and liver and, in streptozotocin induced diabetic rats, decreased fasting glucose, normalized lipids and fatty acid compositions in liver and kidney with reduced liver transaminases, and improved plasma insulin levels.

Aloe gel is presently used for manufacturing of different milk and fruit based functional foods like ice cream, yoghurt, probiotic dahi, jam, jelly, candy, ready to serve beverage etc. (Panesar, and Shinde, 2012; Sasi et al., 2013; Manoharan and Ramasamy, 2013; Palve et al., 2013; Rahman et al., 2015; Tiwari et al., 2015; Hussain et al., 2016). Aloe vera gel can be used as natural preservative and flavoring agent in some foods (Christaki and Florou-Paneri, 2010). The extracted Aloe gel shouldn't contain any other parts except gel such as leaf, skin and the yellow portion which may enhance its bitter taste.

With this view, in this study aloe vera was incorporated to buttermilk in varying proportions to identify the level of acceptance.

II. Materials and Method

Aim and Objectives:

1. Development of product using Aloe Vera for diabetic patients.
2. To standardize the ingredients involved in the development of the product.
3. To estimate the nutrient composition of the product.
4. To conduct Cost analysis
5. To evaluate the product in terms of sensory attributes and find the most accepted product.
6. To analyze the protein and crude fiber in Aloe vera incorporated buttermilk (basic and variation I).

Place of study

This study was carried out at the Department of Food and Nutrition, Telangana Mahila Viswavidyalayam, Koti.

Procurement of the sample

Ingredients were brought from the local market. This includes curd, Aloe Vera, along with other ingredients like black pepper, cumin powder, mint leaves, Ginger etc. The gathered ingredients were utilized to establish a standardized recipe, which was then used to formulate the products.

Standardization

Recipe standardization for buttermilk was done in three trials. Initial trials were done without blending Aloe Vera. Later it was done by making Aloe Vera into a blended form. And the recipe was finally standardized.

Formulation of Aloe Vera Incorporated Buttermilk

Buttermilk is incredibly refreshing and rapidly cools down our bodies. A glass of buttermilk garnished with cumin seeds, mint and salt, is perfect for quenching our thirst. The recipe is almost the same for basic and variations. The difference is only the addition of Aloe Vera to both the variations.

Table 1 Ingredients List of the Basic and Variations of Buttermilk

INGREDIENTS	BASIC	VARIATION I	VARIATION II
Curd	50gm	40gm	35gm
Mint leaves	5gm	5gm	5gm
Coriander leaves	5gm	5gm	5gm
Ginger	1.No (small)	1.No (small)	1.No (small)
Salt	1/4tsp	1/4 tsp	1/4 tsp
Cumin powder	1/4tsp	1/4 tsp	1/4 tsp
Black pepper powder	1/4tsp	1/4 tsp	1/4 tsp
Aloe Vera	-	10gm	15gm

Method of Preparation:

Basic Buttermilk Recipe:

1. In a blender, take mint leaves coriander leaves and ginger.
2. Also add a cup of curd.
3. Additionally add salt, cumin powder and black pepper.
4. Add 1 cup of water.
5. Blend it till all the ingredients are combined.
6. Transfer the buttermilk into a glass.
7. Add in ice cubes and serve chilled.

Aloe Vera Incorporated Buttermilk (Variations) Recipe:

1. Wash Aloe Vera leaf thoroughly.
2. Cut off the outer layer and any spiky edges and then gently scoop out the gel using a spoon.
3. Blend the Aloe Vera gel to smooth consistency and keep it aside.
4. From this step, follow the procedure same as that of basic to prepare Aloe Vera incorporated buttermilk.

Nutritive Value Calculations:

The nutritive value of the basic and the variation was calculated. Energy, Protein, Fat,

Carbohydrates, Fiber and vitamin C were determined. These nutrients were calculated using IFCT (Indian food composition tables) And USDA Tables (T. Longvah et. Al 2017).

Cost Analysis:

Food cost of the basic and the variations for the developed products was estimated. The cost of ingredients used for development of each product (basic and variation) was done individually.

Sensory Evaluation:

The sensory evaluation was done to evaluate the most accepted product. Sensory evaluation was carried out in the Food and Nutrition, Department, Koti.

Selection of Panelists:

20 semi-trained panelists were selected for evaluation of sensory attributes of prepared recipe.

The students belonged to department of Food and Nutrition, Koti.

Score Card-5 point Hedonic Scale:

The selected judges were requested to evaluate the products for various sensory characters by ranking the responses in 5-point hedonic scale (Amerine et al,1965)

The judges were requested to score the products for different sensory characteristics namely Appearance, Taste, Texture, Flavor and overall acceptability. The scoring ranged from 1 to 5 with 5 representing excellent, 4 as very good, 3 as good, 2 as fair and 1 as poor. To calculate the score of each product each descriptor was assigned a score value. The judges were requested to evaluate the products with the help of the given score card.

Nutrient Analysis:

The nutrient analysis of Fiber along with protein of the basic and the most accepted variation of Aloe Vera incorporated buttermilk was determined according to the standard analytical methods (AOAC).

Total Crude Fibre:
Total Crude Fiber was analyzed using enzymatic gravimetric method given by AOAC.

Total Milk Protein:
Total Milk Protein was Analyzed using Kjeldahl method given by AOAC.

Statistical Analysis of Data:
The data collected from the palatability and acceptability will be compiled and classified. Mean from the sensory attributed of basic and variations will be found. ANNOVA (one way classification) will be applied to find out the significance of difference between mean scores of the sensory properties of the basic and the two variations.

ANNOVA (one way) is a versatile and powerful statistical technique which helps to know whether or not there is significant difference between the means of your independent variables.

III.RESULTS AND DISCUSSION

Nutritive value calculation:

The nutritive Value of the Basic buttermilk and variations are presented below. The nutrients for the raw ingredients of the recipe were Energy, Protein, Fat, Carbohydrates, Fiber and vitamin C.

Results of nutrient calculations revealed that there is an increase in the calorific value of variation I and variation II when compared to that of the basic. Highest energy content was seen in variation II (41.3) followed by variation I (38.6), While lowest was seen in basic (33.3).

It is seen that the protein content was slightly higher in both the variation (1.93, 1.95) compared to basic (1.9). There is a slight increase in the Fat, Fiber, vitamin C content of variation I and variation II when compared to basic. carbohydrate content was higher in both the variations (2.9,3.63) compared to basic (1.7).

Table 2 Nutritive Value Calculation for Buttermilk (Basic, Variations)

NUTRIENTS	BASIC	VARIATION I	VARIATION II
Energy (k.cal)	33.3	38.6	41.3
Protein (gm)	1.9	1.93	1.95
Fat (gm)	2.06	2.07	2.07
CHO (gm)	1.7	2.9	3.63

Fiber(gm)	0.52	0.54	0.55
Vitamin C(mg)	2.04	2.42	2.61

Cost Analysis

The cost of ingredients for producing basic buttermilk was Rs.14/-, for variation I and variation II it was calculated to be Rs.15/- and 16/-. Thus, maintaining a daily intake of diabetic friendly buttermilk was found to be cost effective.

Table 3 Cost Analysis of Basic and Variations of Buttermilk

PRODUCT	COST OF INGREDIENTS (Rs)
Basic	14/-
Variation I	15/-
Variation II	16/-

Sensory Evaluation of Aloe Vera Incorporated Buttermilk:

Appearance:

From the table it is evident that the mean score of the appearance for the basic and both the variations is same i.e, 4.95. These findings are in the line with the study of mirza Arslan Abid et al 2016, that demonstrate that the sensory value of appearance of aloe Vera is almost similar with different ready to serve (RTS) blends of aloe Vera.

FIGURE 1 below illustrates the average scores for Appearance of the basic and variations.

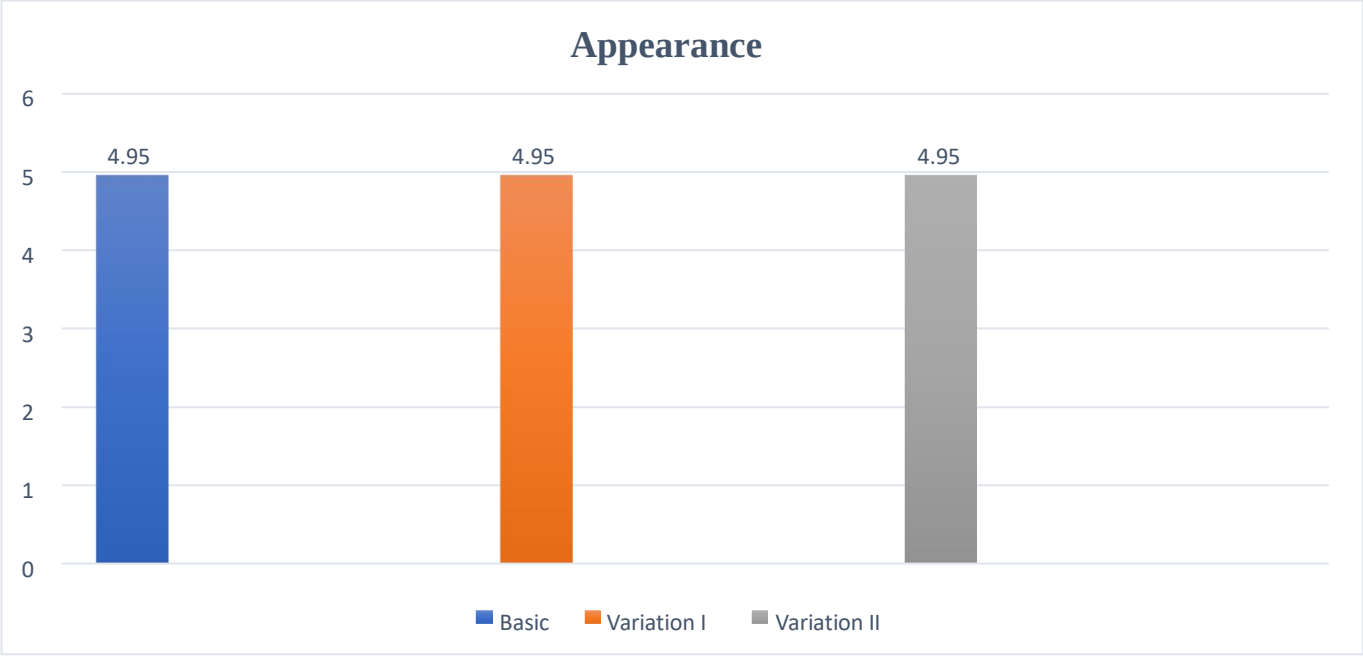

Figure 1 Mean scores of Appearance for Buttermilk (basic, variations)

Taste:

From the sensory evaluation it was seen that the mean score of basic was 4.82 which is slightly higher than variation I i.e 4.8 and the mean score for variation II was 4.67.These findings are in line with the study done by Jayabalan et al,2013 that demonstrates that the sensory value of taste increased with increase in aloe vera juice and sugar concentration in preparation of aloe vera jam and thereafter sensory score decreases with further increase in Aloe Vera juice and sugar.

FIGURE 2 below illustrates the average scores for taste of the basic and variations.

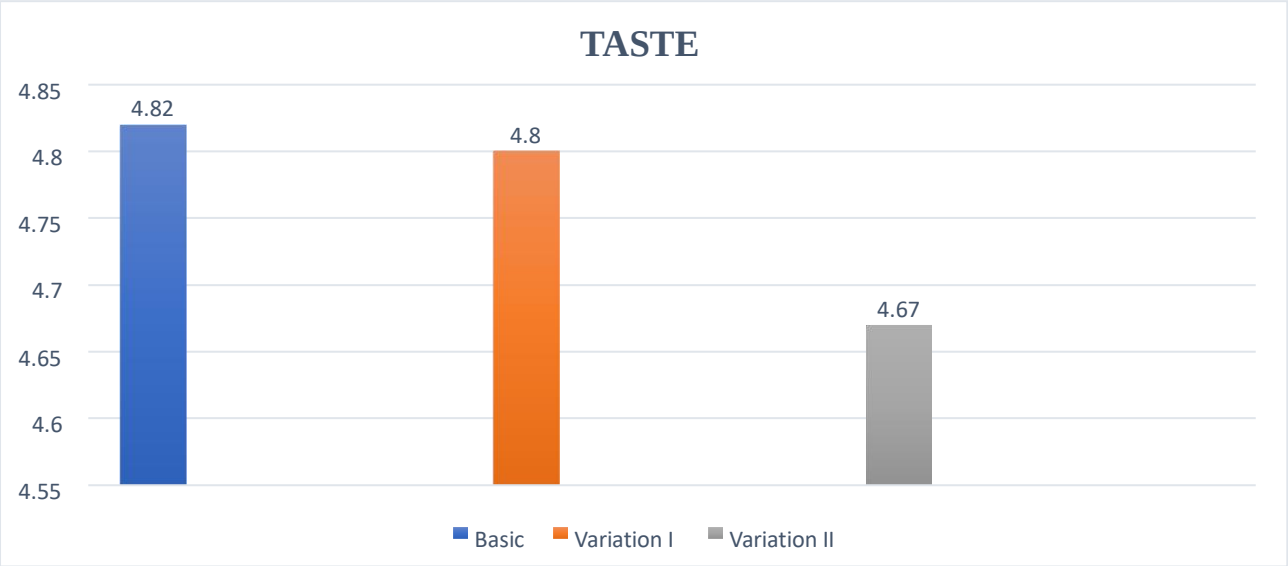

Figure 2 Mean scores of Taste for Buttermilk (basic, variations)

Texture

From the sensory evaluation it was found the mean score of variation I and variation II was found to be same i.e 4.97 which is higher than the basic i.e 4.87. These findings are in the line with the study done by Raghul M 2023, that demonstrates that the texture of the milkshake also increases with an increase in concentration, and this is mainly because of the viscous property of aloe vera.

FIGURE 3 below illustrates the average scores for texture of the basic and variations.

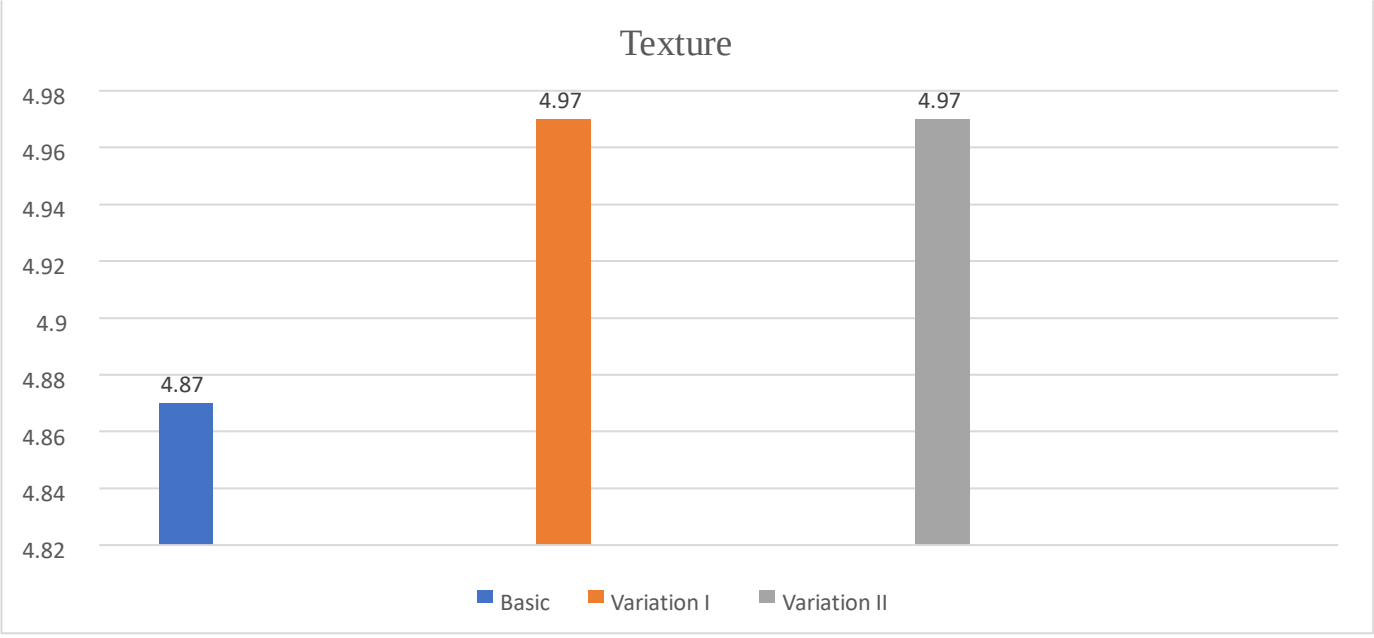

Figure 3 Mean Scores of Texture for Buttermilk (basic, variations

Flavor

From the sensory evaluation it is evident that the mean score for the flavor of basic was 5 which is slightly higher than variation I which is 4.82 and variation II which is 4.62 respectively. This was similarly seen in the study conducted by Raghul M 2023, that demonstrates that the flavor profile is undesirable with an increase in the concentration of Aloe Vera. FIGURE 4 below illustrates the average scores for taste of the basic and variations.

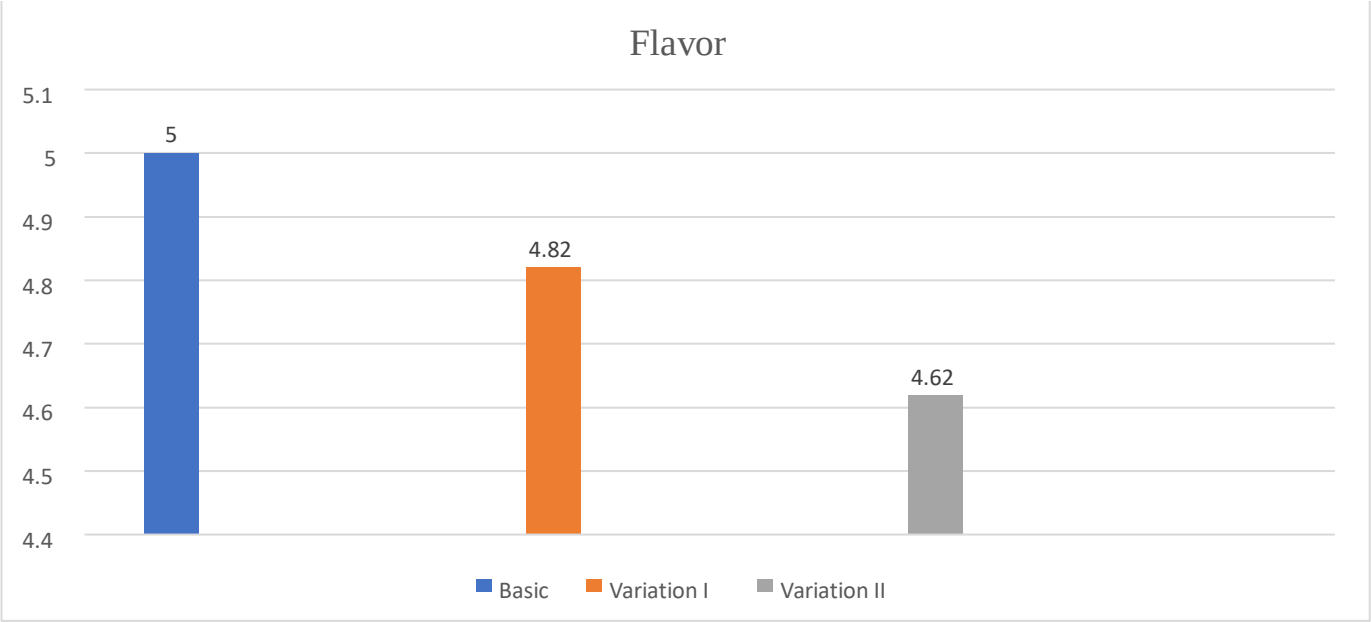

Figure 4 Mean Scores of Flavor for Buttermilk (basic, variations)

Overall Acceptability

From the data obtained by sensory analysis it was found that the mean scores for overall acceptability were higher for basic and variation I which is 4.8 and the overall acceptability for variation II was slightly lower i.e 4.7. These findings are in the line with the study done by Tusneem Kausar et.al, 2020, that demonstrates that the addition of aloe vera gel at concentration of 5% improves overall acceptability of ready to serve (RTS) while further increase results in drastic reduction of overall acceptability. FIGURE 5 below illustrates the average scores for Overall Acceptability of the basic and variations.

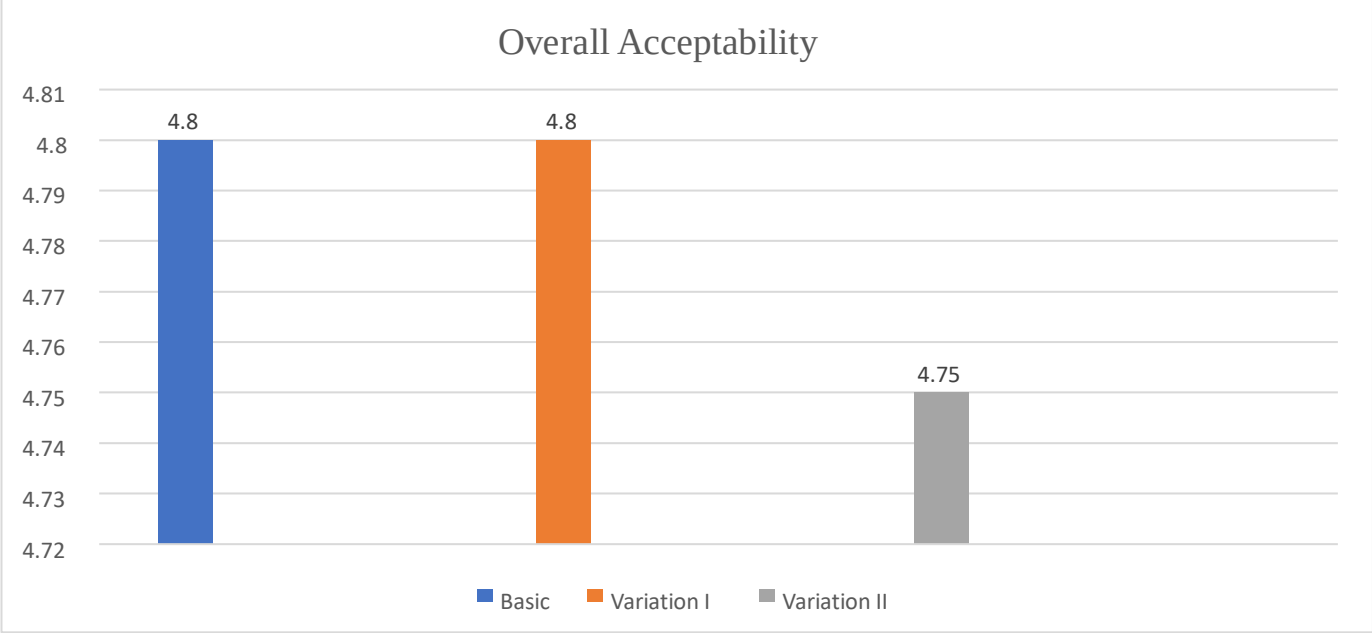

Figure 5 Mean Scores of Overall Acceptability for Buttermilk (basic, variations)

Statistical Analysis:

ANNOVA was done to find out the significant difference between the three samples.

From the results of ANNOVA for the mean scores of basic, variation I and variation

II it was seen that the calculated F calculated value didn't exceed F table value at 0.05% significance level, conclusion made was that there is insufficient evidence for difference. In other words, all the three samples were rather closed compared to the level of error among panelists.

This may be interpreted as the variations produced are similar to the basic in terms of it's sensory qualities and since it is not significantly different from basic, variations may be easily accepted by the consumers.

The data from ANNOVA testing between the means of sensory attributes of all the three samples are presented in Table 4

Table 4 ANNOVA for Aloe Vera incorporated Buttermilk:

S.NO	Sensory attributes	Mean values of basic	Mean values of variation I	Mean values of variation II	F-Calculated	Result
1.	Appearance	4.95	4.95	4.95	2.5	Insignificant
2.	Texture	4.87	4.97	4.97		
3.	Flavor	5	4.82	4.62		
4.	Taste	4.82	4.8	4.67		
5.	Overall acceptability	4.8	4.8	4.75		

Nutrient Analysis

TOTAL FIBRE CONTENT:

Data from Nutrient Analysis indicated that Aloe vera incorporated buttermilk (variation I) has 4.53gm of fiber and Basic Buttermilk was seen to have <0.1gm of fibre as represented in Figure 6. These findings are similar to the study conducted by Agostoni et.al, 2001, where Crude Fiber content increased with increased in the proportion of aloe vera gel. Average crude fiber (7.84%) was the third parameter noted, this implies that they can serve as a source of fiber.

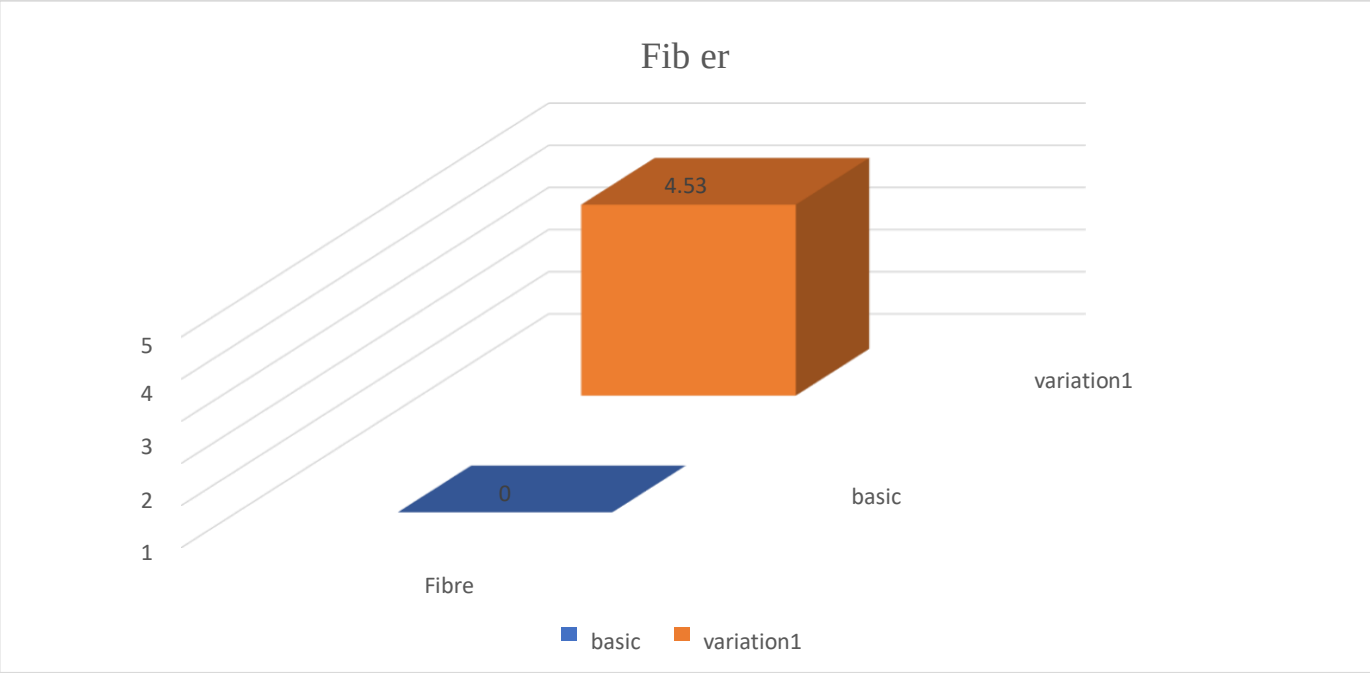

Figure 6 Total Fibre content of buttermilk (basic, variation I)

TOTAL PROTEIN CONTENT

Data from the nutrient analysis shows that the protein content of Aloe Vera incorporated buttermilk was 2.88gm and basic buttermilk was seen to have 2.30gm of protein as represented in Figure7. These findings are similar to study conducted by Nick John, 2021, where the crude protein content increased with increase in the proportion of Aloe Vera gel in Butterscotch cookies mixture.

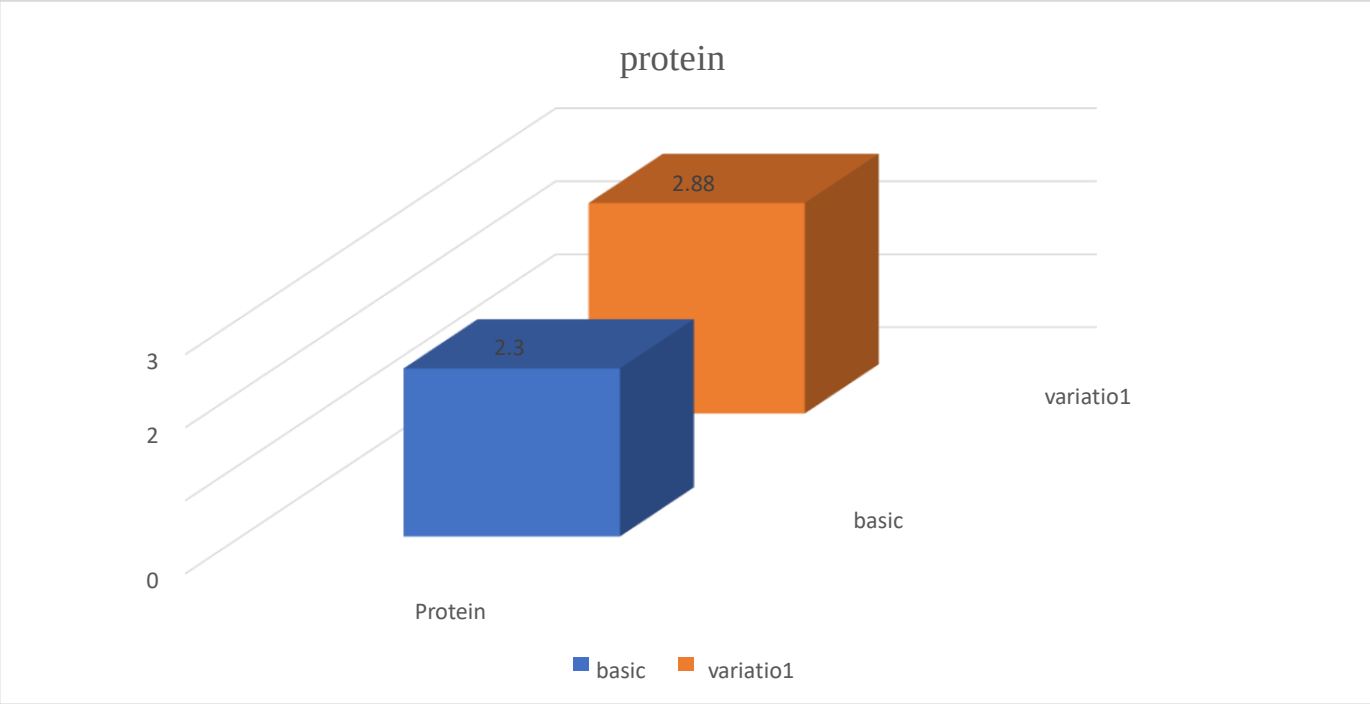

Figure 7 Total Protein content of buttermilk (basic, variation I)

IV CONCLUSION:

Aloe Vera contains active compounds like polysaccharides which are used to increase the insulin levels and exhibit Hypoglycemic properties. An attempt has been made in the present study for the development of product using Aloe Vera for diabetic patients. The product developed was aloe vera incorporated buttermilk. Several trials for testing the recipe of buttermilk were done. The recipe was then standardised after the results were found to be satisfactory. The value addition was done to basic standardized recipe to produce variations. Buttermilk was prepared in two variations namely variation I and variation II (15% and 25%).

Nutritive value calculations of the basic and newly added variations was done using IFCT and USDA tables to analyze and contrast the nutritional content among them. Food cost of the basic and the variations for the developed products was estimated. It is essential that the product so formulated be well accepted in terms of their sensory characteristics. A panel of 20 semi trained judges tested the sensory attributes of the product and scored them using a 5point scoring card, for appearance, taste, texture, flavor and overall acceptability. ANNOVA is a form of statistical analysis used to find if there is a significant difference between the means scores of the sensory properties of the basic and the two variations. The basic buttermilk and the most accepted variation were then subjected to nutrient analysis for protein and fiber.

From examining the data of results and discussion it was concluded that variations from a basic buttermilk using aloe vera can be developed at 15% and 25%. Aloe Vera incorporated buttermilk with 25% substitution with aloe vera was found to be superior in its nutrient content. The total cost analysis of basic and variations of buttermilk was Rs.14,15,16/- Respectively. Variation I of buttermilk was most accepted in terms of their sensory qualities. From the results of ANNOVA it was concluded that the variations produced are similar to the basic in terms of its sensory qualities and since it is not significantly different from the basic, variations may be easily accepted by the consumers. The nutrient analysis of aloe vera incorporated buttermilk revealed that the protein and fiber content of basic and variation I of buttermilk was 2.33g, <0.1g and 4.53g, 2.88g respectively. Thus, when compared to the basic the newly developed variation of buttermilk had more fiber and protein. Hence, development of aloe vera incorporated buttermilk is an effective way of delivering the bioactive benefits of aloe vera in a tasty and refreshing way to the consumers.

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