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ANTIOXIDANT ACTIVITY OF YOGHURT INCORPORATED WITH TENDER COCONUT WATER AND TENDER COCONUT MEAT

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Abstract: Yoghurt is a popular fermented dairy product consumed due to its unique sensory and nutritive properties. Yoghurt is obtained from lactic acid fermentation by the action of starter culture containing *Lactobacillus bulgaricus* and *Thermophilus.* Moreover, the presence of live active bacteria in yoghurt contributes to the nutritional and therapeutic properties. Cow's milk and dairy are commonly consumed foods in the human diet and contribute to maintaining a healthy nutritional state, providing unique sources of energy, calcium, protein, and vitamins, especially during early childhood. The tender coconut yoghurt was evaluated for its sensory properties, nutritional composition and storage properties. The developed yoghurt was formulated from tender coconut water and tender coconut meat in different ratios. High mean values (4.93±0.25) were obtained for the formulated yoghurt (YV2) compared to the control in terms of sensory attributes. The sensory evaluation was conducted and done by 15 panel members. The product was subjected to analysis the shelf life and packaging methods.

Index Terms **– Yoghurt; Cow's milk; lauric acid; *Lactobacillus bulgaricus*; Tender coconut water; Tender coconut meat**

I. INTRODUCTION

Yoghurt has been considered as a functional food. Functional foods are generally considered processed foods containing ingredients that aid specific body functions, in addition to being nutritious. Yoghurt has an important role in human nutrition due to its nutritional value from proteins, lactose, calcium, and water-soluble vitamins. Yoghurt is defined as fermented milk obtained by lactic acid fermentation due to the presence of *Lactobacillus delbrueckii ssp. Bulgaricus* and *Streptococcus salvarius ssp. thermophilus* in milk. Yoghurt is an excellent source of protein, calcium, phosphorous, riboflavin (vitamin B2), thiamine (vitamin B1) and vitamin B12, and a valuable source of folate, niacin, magnesium and zinc. Yoghurt diversification is reflected by various textures (set-type or firm, stirred, drinking, frozen, concentrated, or powder yoghurts), numerous flavours (natural, sweetened, flavoured, or with added pieces of fruits or honey), and diverse shelf life and nutritional (fat content and residual lactose content) properties.

II. METHODOLOGY

The methodology pertaining to study entitled on "Antioxidant activity of yoghurt incorporated with tender coconut water and tender coconut meat" is presented.

Selection and procurement of raw materials:

The ingredients were procured from the local market in Nehru Nagar Coimbatore, Tamilnadu. The listed ingredients were followed as:

- Cow milk
- Tender coconut water
- Tender coconut meat
- Yoghurt culture

FORMULATION OF YOGHURT

Filter and remove the residues in tender coconut water. Grind the tender coconut meat into paste. Add both into milk and keep stirring until it boils. Once the milk is start boiling let it boil for another 10 minutes (100°C for 10 minutes). After boiling the mixture of milk cool it to 43-46°C. 2tsp of yoghurt culture was mixed with 5 ml of cooled milk. After adding culture, don't over beat the milk.The yoghurt culture must be at room temperature. Covered the yoghurt and keep it for fermentation at least for 5-6 hours. Then uncovered for 30 minutes at room temperature. Yoghurt is set completely. It is now refrigerated for 8 hours.

FORMULATION OF YOGHURT BY USING STARTER CULTURE (*Lactobacillus bulgaricus)*

Isolation of yoghurt: Yoghurt was taken in a sterilized flask. Under the aseptic conditions yoghurt was serially diluted from 10^{-5} to 10^{-6}. Pour plate technique was done on MRS medium. The plates were incubated at 37°C for 24 hours. After incubation growth was observed.

Inoculation of starter culture into milk: *Lactobacillus bulgaricus* were directly inoculated to 20 ml of pasteurized milk and incubated at 37°C for hours in the incubator. After that coagulation was observed and cooled immediately.

Preparation of yoghurt from cultured milk: Add tender coconut water and tender coconut meat paste into the milk. Cow milk is boiled well in a pan and cool it to the temperature at 40-46°C. 1tsp of cultured milk added to the cooled milk. After adding culture, don't over beat the milk. It is then fermented for 5-6 hours. Then it refrigerated for 8 hours. Yoghurt is set completely. It is now refrigerated for 8 hours.

III. FIGURES AND TABLES

TABLE 1: STANDARDIZATION OF FORMULATED YOGHURT

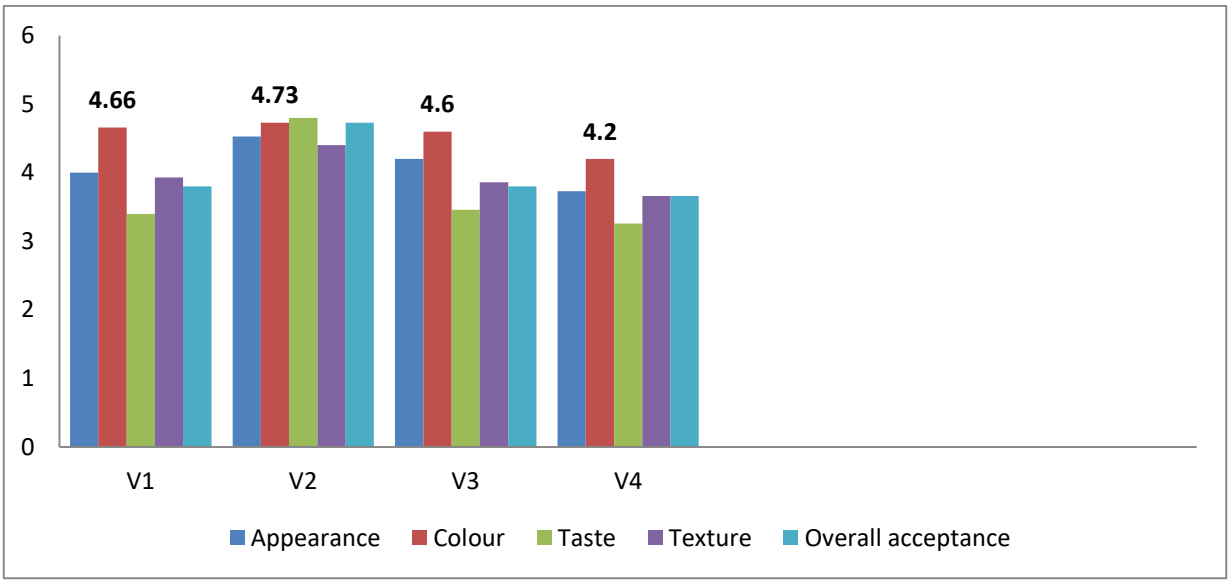
Ingredients	Variation 1	Variation 2	Variation 3	Variation 4
Milk	150ml	150ml	150ml	150ml
Tender coconut water	50ml	60ml	70ml	80ml
Tender coconut meat	50g	40g	30g	20g
Yoghurt culture	2tsp	2tsp	2tsp	2tsp

TABLE 1: The standardized products were standardized in terms of amount of ingredients, procedure and serving size. For the purpose of standardized products, a number of preliminary trials were conducted. It was formulated into four different variations. Different variations of yoghurt incorporated with Tender coconut water and tender coconut meat were prepared by altering the proportion of all the ingredients for standardization.

TABLE 2: ORGANOLEPTIC EVALUATION OF FORMULATED YOGHURT

CRITERIA	**YVI**	**YVII**	**YVIII**	**YVIV**
APPEARANCE	4±0.53	**4.53±0.51**	4.2±0.67	3.73±0.70
COLOUR	4.66±0.61	**4.73±0.45**	4.6±0.50	4.2±0.50
TASTE	3.4±0.50	**4.8±0.50**	3.46±0.63	3.26±0.45
TEXTURE	3.93±0.45	**4.4±0.50**	3.86±0.51	3.66±0.61
OVERALL ACCEPTABILITY	3.8±0.41	**4.73±0.45**	3.8±0.56	3.66±0.61

FIGURE 1: FIGURE OF ORGANOLEPTIC EVALUATION OF FORMULATED YOGHURT



Organoleptic evaluation of formulated yoghurt incorporated with tender coconut water and tender coconut meat has given to 15 semi trained panel members using the score card with a five sensory scale. In evaluation, the qualities of the product were asked to judge by 15 semi trained panel members with respect to appearance, colour, consistency, texture, taste and overall acceptability. The individual mean sensory scores for control, variation I, variation II, variation III and variation IV are noted.

TABLE 3: STANDARDIZATION OF YOGHURT BY USING STARTER CULTURE (*Lactobacillus bulgaricus*)

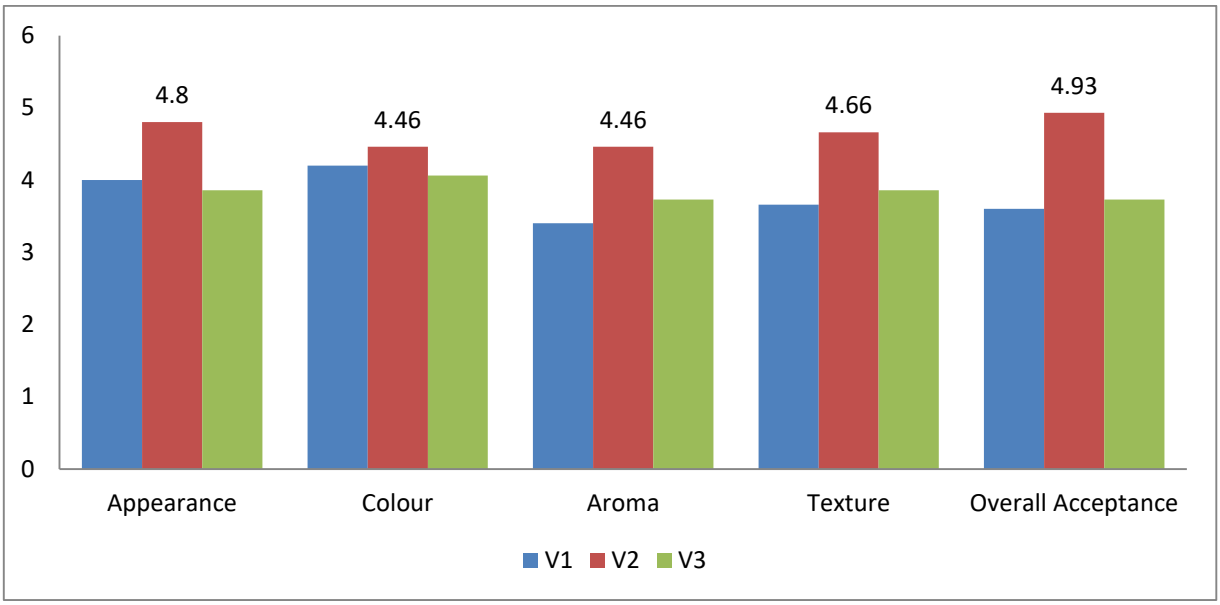
Ingredients	Variation 1	Variation 2	Variation 3
Milk	100ml	100ml	100ml
Tender coconut water	30ml	35ml	40ml
Tender coconut meat	20g	15g	10g
Cultured milk	1tsp	1tsp	1tsp

The standardized products were standardized in terms of amount of ingredients, procedure and serving size. For the purpose of standardized products, a number of preliminary trials were conducted. It was formulated into four different variations. Different variations of yoghurt incorporated with tender coconut water and tender coconut meat were prepared by altering the proportion of all the ingredients for standardization.

TABLE 4: ORGANOLEPTIC EVALUATION OF YOGHURT BY USING STARTER CULTURE (*Lactobacillus bulgaricus*)

CRITERIA	V1	V2	V3
APPEARANCE	4±0.53	**4.8±0.41**	3.86±0.63
COLOUR	4.2±0.77	**4.46±0.51**	4.06±0.59
AROMA	3.4±0.50	**4.46±0.51**	3.73±0.45
TEXTURE	3.66±0.61	**4.66±0.48**	3.86±0.51
OVERALL ACCEPTANCE	3.6±0.50	**4.93±0.25**	3.73±0.45

FIGURE 2: FIGURE OF ORGANOLEPTIC EVALUATION OF YOGHURT BY USING STARTER CULTURE



Organoleptic evaluation of yoghurt by using starter culture **(***Lactobacillus bulgaricus)* incorporated with tender coconut water and tender coconut meat has given to 15 semi trained panel members using the score card with a five sensory scale. In evaluation, the qualities of the product were asked to judge by 15 semi trained panel members with respect to appearance, colour, aroma, texture, and overall acceptability. The individual mean sensory scores for control, variation I, variation II and variation III are noted.

TABLE 5: MEAN SENSORY SCORE OF CONTROL AND FORMULATED YOGHURT

	CONTROL	**VARIATION II**
APPEARANCE	4.46	**4.53**
COLOUR	4.86	**4.73**
TASTE	4	**4.8**
TEXTURE	4.46	**4.4**
OVERALL ACCEPTANCE	4	**4.73**

From the above table, it was clear that the formulated yoghurt has better score than control and based on organoleptic evaluation the variation II has the highest score among the variations. Hence the highest scored overall acceptability variation II has been used for the further analysis.

FIGURE 3: FIGURE OF MEAN SENSORY SCORE OF CONTROL AND FORMULATED YOGHURT

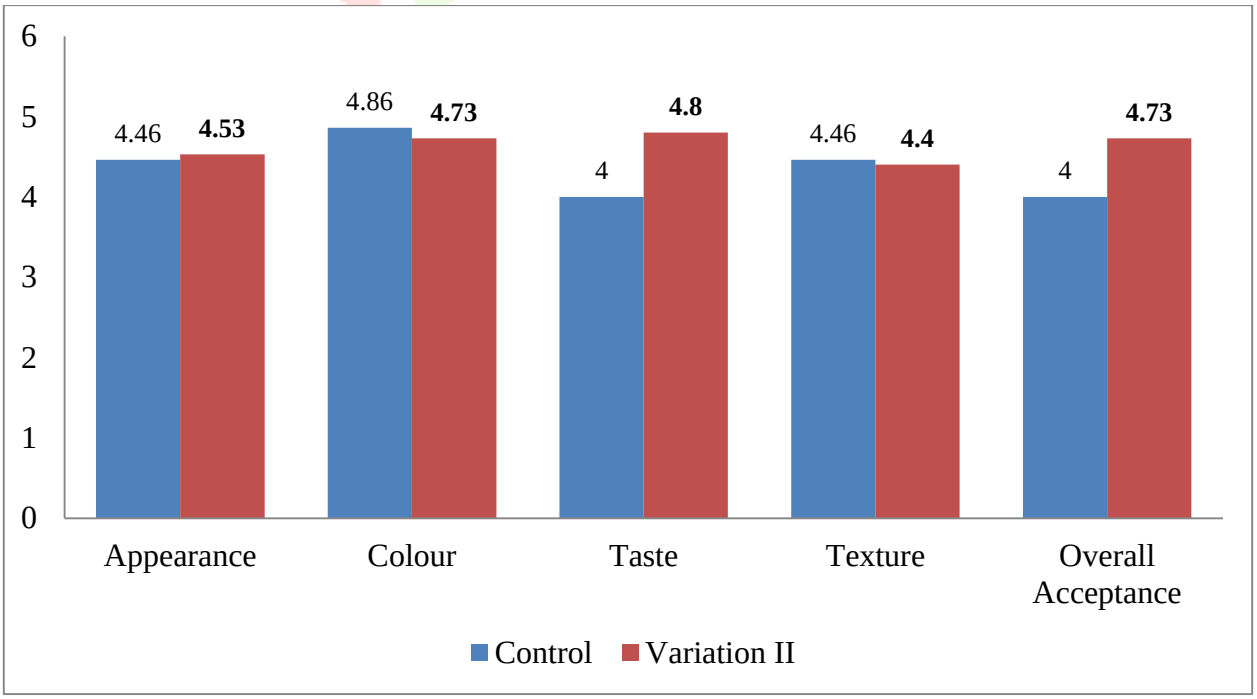


TABLE 6: MEAN SENSORY SCORE OF CONTROL AND YOGHURT BY USING STARTER CULTURE (*Lactobacillus bulgaricus)*

	CONTROL	VARIATION II
APPEARANCE	4.53	**4.8**
COLOUR	4.66	**4.46**
AROMA	4.73	**4.46**
TEXTURE	3.93	**4.66**
OVERALL ACCEPTANCE	4.26	**4.93**

From the above table, it was clear that the yoghurt by using starter culture has better score than control and based on organoleptic evaluation the variation II has the highest score among the variations. Hence the highest scored overall acceptability variation II has been used for the further analysis.

FIGURE 4: FIGURE OF MEAN SENSORY SCORE OF CONTROL AND YOGHURT BY USING STARTER CULTURE (*Lactobacillus bulgaricus)*

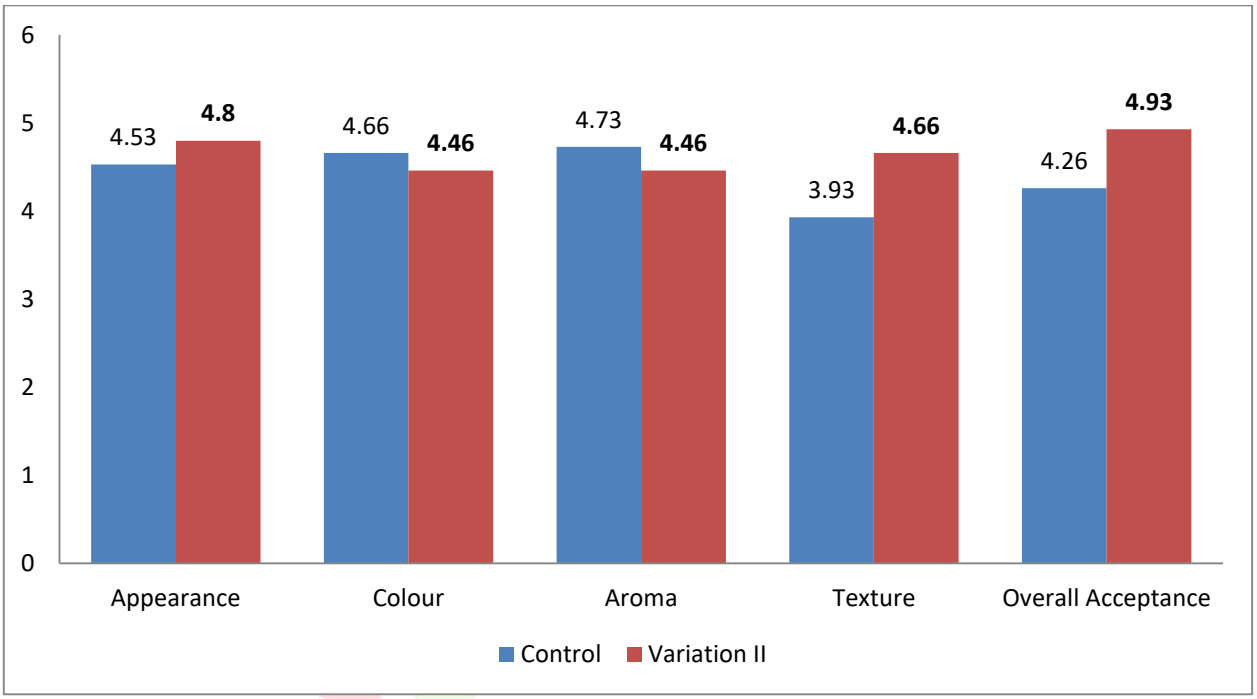
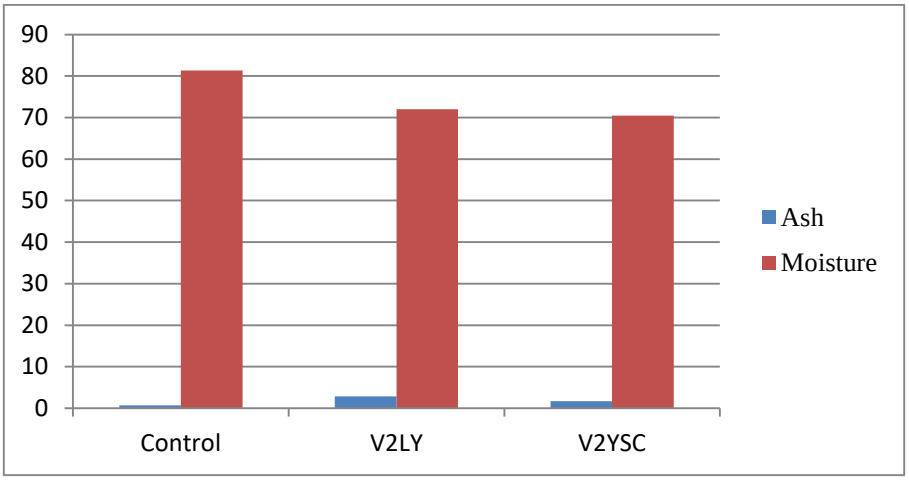


TABLE 7: PHYSIO-CHEMICAL ANALYSIS OF CONTROL, FORMULATED YOGHURT AND YOGHURT BY USING STARTER CULTURE(*Lactobacillus bulgaricus)*

S.NO	NUTRIENTS	CONTROL	V2LY	V2YSC
1	Ash(gm)	0.68	2.86	1.72
2	Moisture(gm)	81.30	72.0	70.45

FIGURE 5: FIGURE OF PHYSIO-CHEMICAL ANALYSIS OF YOGHURT

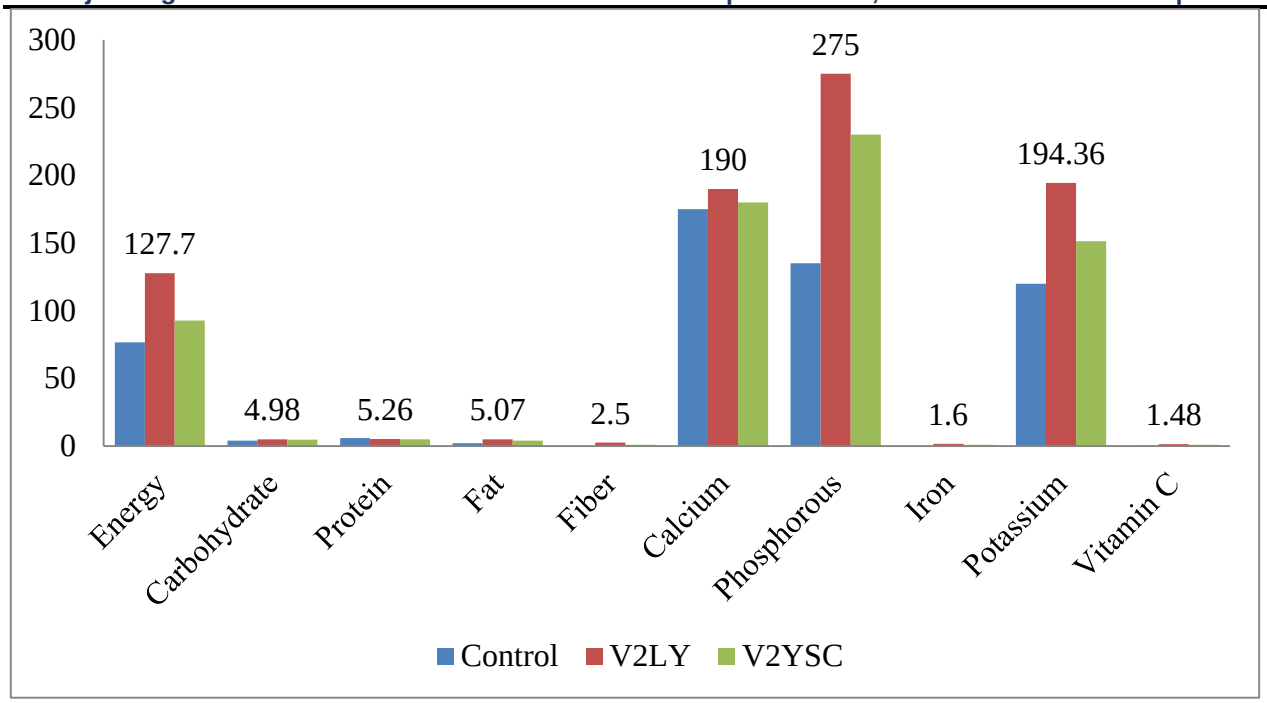


The physiochemical value of control was compared with formulated yoghurt (variation II) and yoghurt by using starter culture (variation II). It is noted that the ash content of control was 0.68gm, ash content of formulated yoghurt was 2.86gm and ash content of yoghurt by using starter culture was 1.72gm. The ash content level of the formulated product was increased. The moisture content in control was 81.30gm, moisture content in formulated yoghurt was 72.0gm and moisture content in yoghurt by using starter culture was 70.45gm. The moisture content level of the control was increased.

TABLE 8: NUTRITIONAL ANALYSIS OF THE CONTROL, FORMULATED YOGHURT AND YOGHURT BY USING STARTER CULTURE

Sl.no	Parameters	Nutritive value of control	Nutritive value of formulated yoghurt	Nutritive value of yoghurt by using starter culture
1	Energy(Kcal)	76.6	127.7	92.66
2	Carbohydrates(g)	3.98	4.98	4.66
3	Protein(g)	6	5.26	4.92
4	Fat(g)	2.2	5.07	4.15
5	Fibre(g)	0.00	2.5	1.04
6	Calcium(mg)	175	190	180
7	Phosphorus(mg)	135	275	230
8	Iron(mg)	0.00	1.6	1.0
9	Potassium(mg)	120	194.36	151.42
10	Vitamin C(mg)	0.10	1.48	0.94
11	Lauric acid(mg)	0	2540.82	1620.52

FIGURE 6: FIGURE OF NUTRIENT ANALYSIS OF TENDER COCONUT YOGHURT



From the above table and figure, it was clear that formulated yoghurt contains high nutritional values like Energy(127.7Kcal), Carbohydrate(4.98g), Fat(5.07g), Fibre(2.5g), Calcium(190mg), Phosphorus(275mg), Iron(1.6mg), Potassium(194.36mg), vitamin C(1.48mg) when compared to control and yoghurt by using starter culture.

TABLE 9: COST CALCULATION OF FORMULATED YOGHURT

S.NO	INGREDIENTS	QUANTITY	COST
1	Milk	150ml	10Rs
2	Tender coconut water and meat	60ml, 40g	40Rs
Total			50Rs

Raw material cost= 50Rs

Over head cost (15%)= 50×15/100=7.5

Total cost= 50+7.5= 57.5Rs

The cost calculation of the product includes raw materials cost, processing cost and other expensive. The cost of the product is based on cost of raw material that it would be economically suitable. Table shows the cost of formulated tender coconut yoghurt. The total cost of formulated yoghurt per 100ml was found to be Rs.57.5.

IV. DISCUSSION

Yoghurt is a diary product made by fermenting milk with a yoghurt culture. It provides protein and calcium, and it may enhance healthy gut bacteria. Yoghurt starts as fresh milk or cream. It is often first pasteurized, then fermented with various live bacteria cultures, and incubated at a specific temperature to encourage bacteria growth. The culture ferments the lactose, the natural sugar found in milk. This produces lactic acid, which gives yoghurt its distinctive flavour.

Whether yoghurt is a healthful choice depends on the person consuming it and the type of yoghurt. Yoghurt can be high in protein, calcium, vitamins, and live culture, or probiotics, which can enhance the gut microbiota. These can offer protection for bones and teeth and prevent digestive problems. Low fat yoghurt can be useful source of protein on a weight-loss diet. In conclusion, an attempt was made in the present study to formulate yoghurt incorporated with tender coconut water and tender coconut meat to enhance its colour, improve its taste, aroma and nutritional characteristics. The sensory attributes, physio-chemical characteristics, nutritive value, microbial count, shelf life was analysed and cost was calculated for the developed product.

V. CONCLUSION

Yoghurt has a low lactose content, so a person with lactose intolerance will likely find it more tolerable than milk. It also contains bacteria that aid digestion. As a result, people who experience discomfort, bloating or gas after consuming liquid milk or ice cream can often tolerate yoghurt without symptoms. People with a lactose intolerance often lack calcium, so yoghurt can be important component of their diet.

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