



RESEARCH ARTICLE

DEVELOPMENT OF INDIGENOUS FIBER RICH BREAKFAST RECIPES FOR CARDIOVASCULAR PATIENTS

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ABSTRACT

To combat lifestyle diseases a balanced diet and healthy regime including exercise is the need of the hour. An interview schedule was formulated to elicit information on socio economic status and dietary pattern of the cardio vascular patients. Three different combinations of fibre rich mix were formulated, combination C1 consisting of whole wheat flour, defatted soy flour, green gram dal and lotus stem, combination C2 consisting of wheat flour, defatted soy flour, horse gram, and agathi leaves, combination C3 consisting of whole wheat flour, defatted soy, black gram and curry leaves. These mixes were incorporated into 10 breakfast recipes at proportions of 20 percent, 25 percent and 30 percent along with other ingredients. The recipes were standardized and the best recipes were chosen for nutrient analysis. The cost effectiveness of the formulated mix was calculated. Nutrition education was imparted to selected 30 cardiovascular patients using a booklet. The findings of the study indicated that majority of cardiovascular patients were male and non-vegetarians. In regard to consumption of fibre rich food 64 percent and 57 percent of the subjects consume vegetables and fruits daily. Forty three per cent of them have the habit of skipping meals and 18 of them skip their breakfast weekly twice. It was revealed that idly (97 percent) was the most frequently consumed breakfast food by the selected subjects. Among the 10 recipes and its 90 variations tried out, five recipes which obtained top score were pancake (C1V1), Broken wheat upma (C2V1), kolukattai (C1V1), Dosa (C3V3), Idiyappam (C2V2). And they are rich in fibre and low in fat and calorie. The formulated mix had a shelf life of 90 days and was cost effective at household level. Nutrition education imparted was effective and helped them in continued preparation of the mixes and recipes. A blend of commonly used hypolipemic foods in different combinations and variations incorporated into breakfast recipes were acceptable.

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INTRODUCTION

The important gift in life is good health and it can be achieved by making little changes in the life style. With the advent of processed and innovative fast foods and the influx of many technological innovations like television, computers, internet and multimedia the pattern of living has undergone transformation and these changes have had a detrimental effect on health. This has lead to the increase in the number of people suffering from lifestyle related diseases specifically cardiovascular disease and diabetes¹. There are three dietary patterns prevalent in the present scenario leading to various lifestyle disorders. The cosmopolitan pattern characterized by greater consumption of vegetable oils, garlic, fried vegetables, salad vegetables, rice, pasta, chicken, fish, wine, and lesser consumption of potatoes. The traditional pattern characterized by greater consumption of red meat, potatoes, highly saturated

added fat, coffee, beer, and lesser consumption of soy products, low-fat dairy, breakfast cereals, tea, and fruit. The refined-foods pattern characterized by greater consumption of French fries, high-sugar beverages, mayonnaise, salty snacks, white bread, and candy, and lesser consumption of whole-grain bread and boiled vegetables. Hence to combat lifestyle diseases a balanced diet and healthy regime including exercise is the need of the hour to help us to live longer and to be happy. People who ate more fruits and vegetables and whole cereals had a 30% lower risk of heart attack as compared to people who ate very little whole cereals or no fruits and vegetables. The study also concluded that people who ate the typical refined diet, heavy in fried foods, meat, and junk food had a 35% greater risk of heart attack when compared to people who ate very little of those foods². Bringing about changes in the diet by replacing with high fiber by increasing fiber intake around 20 to 30 gms per day of which at least six grams from soluble fiber, and this is accompanied by approximately 5% reduction in LDL. Soluble fiber is found in

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oats, soybeans, legumes, green leafy vegetables, whole cereals. There is a growing recognition that skipping breakfast belongs to a special category of risk factors because it markedly increased the risk of CVD. The effects of a skipped breakfast are short attention span, lack of alertness, longer reaction time, low blood sugar, decreased work productivity. A good breakfast is one that provides at least one third of the day's calories. (www.ayushveda.com/dietfitness/importance-of-breakfast). Against such a backdrop, the present study on "Development of an Indigenous Fiber Rich Breakfast Recipes for Cardiovascular Patients" has been undertaken with the following specific objectives to:

- Identify commonly used hypolipidemic ingredients for the formulation of mix
- Formulate and evaluate recipes using different combinations of formulated mix for acceptability
- Estimate the nutrient content of the selected recipes
- Estimate the shelf life study and cost effectiveness of the product
- Imparting nutrition education to selected cardiovascular patients.

Materials and Methods

A sample of 100 cardiovascular patients (65 male and 35 female) in the age group of 30 to 55 years were selected from the household survey and OPD carried out from prominent residential areas of Kottayam town and from Kottayam Medical College Hospital in Kerala state. Socio-economic and dietary survey was conducted and the ingredients for the formulation of the mix and recipes were selected. The survey revealed that breakfast recipes frequently consumed by the cardiovascular patients were high in calorie and fat and low in fibre. Hence a mix was formulated with a blend of whole cereals, pulses and green leafy vegetable. The ingredients selected were whole wheat flour, defatted soy flour, green gram dhal, horse gram dhal and black gram dhal, green leafy vegetables like agathi and curry leaves and lotus stem were all included in the mix. Popular breakfast cuisines of Kerala and the preference of the subjects were considered for the selection of breakfast recipes. Three wheat based recipes namely palak, chappathi, pan cake, broken wheat uppuma, four rice based recipes puttu, idiyappam, elai adai and kolukattai and three rice and pulse based recipes namely dhokhala, dosa and idli were selected for incorporation of the developed powder mix. The raw materials chosen for the preparation of the mix were cleaned with sprays of clean water to remove part of the sand and dirt.

The green leafy vegetables were then sorted and trimmed to remove roots, stem, and damaged and discoloured leaves. Great care was taken not to bruise the leaves because bruising accelerates the loss of vitamin C. After cleaning, the moisture was removed by wiping in cotton cloth. The moisture content of selected ingredients were reduced by drying in sun, drying using vacuum drier and microwave oven. The raw ingredients, 175g of whole wheat, 75g of defatted soy, 60g of each horse gram, black gram dal and green gram dal, 150g of curry leaves and agathi leaf and 75g of lotus stem were weighed and dried. The dried sample is made into a fine powder using a pulverizer. Then they were weighed and mixed to prepare three combinations in different ratio. Three different

combinations of fibre rich mix were formulated. Combination (C₁) consisting of whole wheat flour 55 g, defatted soy flour 20g, green gram dal 15g and lotus stem 10g, combination (C₂) consisting of whole wheat flour 55g, defatted soy flour 20g, horse gram 15g and agathi leaves 10g, combination (C₃) consisting of whole wheat flour 55g, defatted soy 20g, black gram 15g and curry leaves 10g. These three mixes in different proportion of 20 percent, 25 percent and 30 percent were incorporated along with other ingredients into selected ten breakfast recipes. The product developed was evaluated for its sensory properties. A four point score card was developed for the purpose of evaluation of the acceptance of colour, taste, texture and flavour and scores were given according to the acceptance of the recipes. For acceptability trials each combination of formulated mix were incorporated into selected ten recipes in three different proportions of 20 percent, 25 percent and 30 percent and a total of ninety variations were prepared. Out of ninety recipes prepared, five recipes which obtained the highest scores in sensory evaluation were selected for further evaluation of its sensory attributes. Three trials were carried out for maximum accuracy of the results.

The recipes which obtained the highest acceptability scores through sensory evaluation were considered the best acceptable recipes and were used for nutrient analysis. Table I shows the best five acceptable recipes and their variations. The recipes were analyzed for their moisture, protein, fat, carbohydrates, ash, moisture, and fibre. The dried powder, weighing 100 g of each were packed in polythene covers, sealed and stored at room temperature for a period of three months. Every month the products were evaluated for change in colour, appearance, flavour, texture and taste by the investigator. Every month the products were analyzed for micro organism's namely bacterial and fungal count. Initial nutritional knowledge of subjects on fibre and their health benefits was assessed using an interview schedule and after imparting education the same questions were asked to evaluate the effect of educational program. The impact of education imparted was assessed by comparing the results obtained before and after educational program. The selected cardiovascular patients were educated for the importance of low fat, low calorie and high fibre diet, preparation of the formulated mix and its storage, preparation of the recipes using the formulated mix and life style modification. A booklet was developed using software's namely Adobe photoshop 7.0, Adobe page maker 7.0 and Corel draw 11.0.

RESULTS AND DISCUSSION

In the present study, 19 per cent of Cardiovascular patients belonged to the age group of 30-40 years, peak prevalence was found between the age group of 40 to 50 years with 39 per cent, 16 per cent among 50 to 60 years and around 26 per cent were above 60 years of age. Seventy nine per cent of families belong to high income group with a monthly income of more than Rs.7500/-. The complications present among cardiovascular patients, 79 of them were suffering from high cholesterol, 39 from hypertension, 34 of them had diabetes mellitus and 18 of them were obese. The selected patients were suffering from one or more of cardiovascular related complications. Blood lipid profile revealed that 29.5 per cent of patients had blood lipid level of ≥ 300 mg/dL of total cholesterol, followed by 43.5 per cent with cholesterol level of 250 to 300 mg/dL and remaining 26 per cent and one per cent

had 200 to 250 mg/dL and ≤ 200 mg/dL of total cholesterol respectively. Forty six per cent of the patients had been suffering from Cardiovascular diseases for the past 1 to 3 years, 23 per cent of them had been suffering for more than 3 years and the remaining 21 per cent and 10 per cent for 6 months to 1 year and less than six months respectively. Tobacco use, whether it is smoking or chewing tobacco, increases risks of cardiovascular disease. Heavy alcohol consumption increases risk for hypertension, which is in itself a strong risk factor for cardiovascular disease, knowing all these factors have not deterred male subjects from consuming alcohol or smoking. Out of the sixty five male subjects, 66 percent of them had the habit of alcohol consumption, 17 percent of them smoked and 12 percent of them had the habit of chewing pan. Among the 100 subjects majority of 61 percent of them had the regular habit of exercising, while the remaining 39 per cent lacked the habit of regular exercising due to lack of time and awareness on the importance of exercise. The present study points out that walking was the type of exercise adopted among the majority of the subjects with varying time duration since it is the most practical and inexpensive method of exercising.

Table II depicts details regarding the frequency of consumption of breakfast recipes among the selected cardiovascular patients. From the response of the subjects it was revealed that idly was the most frequently consumed breakfast recipe by the selected subjects followed by puttu (96 percent), dosa (92 percent) and idiyappam (92 percent) weekly once and very few consumed oats porridge rarely (11) and other less popular breakfast recipes like kolukattai, pancake, bread omelet, and ready to eat cereal mixes. Ninety seven percent of selected subjects consumed idly weekly at least once and puttu was another most popular and frequently consumed breakfast recipe by 96 percent of them consuming weekly once. Other two equally popular recipes consumed were dosa and idiyappam. Ninety two percent of selected subjects prefer having dosa and idiyappam weekly once. Wheat based recipes like phulkha, broken wheat upma and poori were also consumed by the selected cardiovascular patients. Recipes like adai and oats porridge were less popular among the selected cardiovascular patients.

Development of fibre rich breakfast recipes

Mean acceptability scores of wheat based breakfast recipes

Sensory evaluation of different breakfast recipes was conducted in different trials by a panel of judges and the scores were recorded. Table III indicates the mean acceptability scores of wheat based breakfast recipes with its different combinations and variations. Among the wheat based recipes, pancake (C_1V_1) and broken wheat upma (C_2V_1) both obtained the highest score of 3.8. In regard to the appearance and flavour broken wheat upma (C_2V_1) obtained the highest score of 3.9 and 3.8 respectively. Pancake (C_1V_1) obtained the highest score of 4.0 for colour and 4.0 for texture. In concern to taste both broken wheat upma (C_2V_1) and pancake (C_1V_1) obtained the highest score of 3.8. Since the formulated mix did not blend with chappathi, it was not accepted. Table IV indicates the mean acceptability scores of rice based breakfast recipes with its different combinations and variations. Among the rice based recipes, kolukattai (C_1V_2) and idiyappam (C_2V_2) obtained the highest mean acceptability score of 3.9 and 3.8 respectively whereas,

variations of elai adai and puttu obtained the minimum score hence they were not accepted. In regard to the appearance, colour, flavour, taste and texture kolukattai obtained the highest score of 3.9. Table V shows the mean acceptability score of rice and pulse based recipes. Among the rice and pulse based recipes dosa (C_3V_3) obtained the highest mean acceptability score of 3.9. Dosa (C_3V_3) obtained the highest score for all the attributes namely appearance, colour, flavour, taste and texture with highest mean acceptability score of 3.9. Since dhokhala and idly obtained minimum score they were rejected. Table VI shows the mean acceptability score of selected ten fibre rich breakfast recipes. The acceptance response was derived mainly from quantity of consumption and expression of taste panel members. Among the 10 recipes and its 90 variations developed, five recipes which obtained top score were selected as follows pancake (C_1V_1), broken wheat upma (C_2V_1), kolukattai (C_1V_2), Dosa (C_3V_3), Idiyappam (C_2V_2).

Mean acceptability scores of selected five recipes

Table VII presents the mean acceptability scores of selected five recipes. There is no significant difference between the five samples of recipes at 5 per cent level of significance. From the table VIII it is clear that, all the five recipes obtained maximum acceptability scores.

Nutrient analysis of the recipes

According to Rody (2007), nutritional quality is a major factor affecting food selection. Table VIII presents the nutrient content of the selected five recipes. The table gives the analyzed nutrient content of selected five recipes per 100g. Kolukattai (C_1V_2) has high amounts of dietary fibre (6.02 g), broken wheat has high amounts of carbohydrate (50.34 g) and fat (4.0g) and pancake has lowest amount of fat (2.0 g) and highest amount of protein (9.74g), whereas all the other recipes contained optimum amount of carbohydrate, fat, protein and dietary fibre. In regard to moisture content, kolukattai being a steamed food had the highest moisture content of 62.6 percent and ash content of 14.54 percent.

Shelf life and Cost effectiveness of the Mix

Microbial analysis is important to determine the safety and quality of food. The formulated mix was analyzed for its total bacterial and fungal count for every 30 days. The shelf life of formulated mix prepared using different methods of drying namely microwave dried, sun dried and vacuum dried for a period of 90 days was compared. Analysis revealed that all the three combinations of mix dried using different methods had shelf life of 90 days even though vacuum dried combination C_2 showed 0.04 % fungal growth which is very negligible. The mix was also periodically analyzed for any changes that occur in flavour, texture, colour, appearance and taste and no undesirable changes were noticed. The above Table IX indicates the cost of formulated mix per 100 g according to the current market price of the ingredients. Combination C_1 was estimated to have lowest cost Rs 6.30 and combinations C_2 and C_3 costs Rs 9.90 and Rs.9.95 respectively.

Effect of nutrition education on selected cardiovascular patients

The below Table X depicts the evaluation of impact of nutrition education on selected cardiovascular patients.

Table I. Best five recipes and variation selected for the analysis

S.NO	RECIPES	VARIATIONS
1.	Pancake	C ₁ V ₁
2.	Broken wheat upma	C ₂ V ₁
3.	kolukattai	C ₁ V ₂
4.	Dosa	C ₃ V ₃
5.	Idiyappam	C ₂ V ₂

C- Combination, V- Variation, V₁-20%, V₂-25%, V₃-30% of the formulated mix.

Table II. Frequency of consumption of breakfast recipes among selected cardiovascular patients

S.No.	Breakfast Recipes	Frequency							
		Weekly once		Weekly twice		Weekly Thrice		Rarely	
		No.	%	No.	%	No.	%	No.	%
1.	Idly	97	97	2	2	0	0	1	1
2.	Dosa	92	92	4	4	4	4	0	0
3.	Poori	71	71	16	16	3	3	10	10
4.	Phulkha	33	33	2	2	0	0	65	65
5.	Upma	61	61	2	2	0	0	37	37
6.	Puttu	96	96	1	1	0	0	3	3
7.	Idiyappam	92	92	0	0	0	0	8	8
8.	Adai	18	18	0	0	0	0	82	82
9.	Oats porridge	11	11	3	3	0	0	86	86
10	Others	2	2	1	1	0	0	97	97

Table III. Mean acceptability scores of wheat based recipes

Recipes	Attributes	Combination1			Combination2			Combination 3		
		V ₁	V ₂	V ₃	V ₁	V ₂	V ₃	V ₁	V ₂	V ₃
		BROKEN WHEAT UPMA	Appearance	3.9	3.06	2.9	3.9	3.06	2.8	2.5
	Colour	3.9	3.9	3.9	3.9	3.1	3.2	2.7	2.7	2.6
	Flavour	2.6	3.06	2.9	3.8	3.0	2.3	2.5	2.6	2.7
	Texture	2.6	3.3	2.9	3.8	3.06	2.3	2.3	2.4	3.1
	Taste	3.8	3.1	2.6	3.7	3.0	2.3	2.5	2.5	3.0
	M A S*	3.4	3.3	3.0	3.8	3.02	2.6	2.5	2.6	2.9
CHAPATHI	Appearance	3.3	3.0	2.8	3.1	2.7	3.0	2.7	2.2	2.9
	Colour	3.5	3.4	3.3	3.5	3.3	3.4	3.3	3.3	3.2
	Flavour	3.06	2.9	2.7	3.0	2.7	3.4	2.9	3.3	3.2
	Texture	3.3	2.3	3.2	3.3	3.0	3.0	3.6	2.7	2.8
	Taste	2.9	2.8	3.0	3.5	2.4	2.7	2.7	2.8	2.4
	M A S*	3.1	2.9	3.0	3.3	2.9	3.1	3.0	2.7	2.9
PANCAKE	Appearance	3.6	3.06	3.0	2.6	3.0	3.1	3.0	3.0	2.9
	Colour	4.0	3.7	3.5	3.3	3.1	3.0	3.2	3.1	3.0
	Flavour	3.6	3.06	3.0	2.8	2.7	3.0	3.2	2.7	2.9
	Texture	4.0	3.5	3.2	3.5	3.5	3.1	3.4	3.2	3.6
	Taste	3.7	3.0	3.0	3.0	2.9	3.0	3.0	2.9	3.0
	M A S*	3.8	3.2	3.1	3.0	3.04	3.0	3.1	2.9	3.0

MAS*: Mean acceptability score

Table IV. Mean acceptability scores of rice based recipes

Recipe	Attributes	Combination 1			Combination 2			Combination 3		
		V ₁	V ₂	V ₃	V ₁	V ₂	V ₃	V ₁	V ₂	V ₃
ELAIADAI	Appearance	3.0	2.4	2.3	2.6	2.6	2.5	3.0	4.0	3.0
	Colour	4.0	4.0	3.8	3.06	3.0	3.0	3.0	3.0	3.0
	Flavour	3.5	3.06	2.6	2.9	2.9	2.9	3.0	3.7	3.1
	Texture	3.3	3.1	2.8	2.9	3.0	3.0	3.0	3.9	3.0
	Taste	3.4	3.2	3.0	2.8	3.3	3.1	3.1	3.9	2.9
	M A S*	3.4	3.1	2.9	2.8	2.96	2.9	3.0	3.7	3.0
IDIYAPPAM	Appearance	3.0	3.0	2.7	2.3	3.9	3.06	3.2	3.1	3.0
	Colour	4.0	4.0	4.0	3.4	3.3	3.1	3.1	3.0	3.0
	Flavour	3.8	3.2	3.0	3.06	3.9	3.06	3.0	2.6	3.1
	Texture	3.5	3.0	3.1	3.3	3.8	3.1	3.2	3.1	3.0
	Taste	3.6	3.06	3.2	3.0	4.0	3.0	3.2	3.1	3.0
	M A S*	3.6	3.2	3.2	3.0	3.8	3.04	3.1	2.9	3.0
KOLUKATTAI	Appearance	3.0	3.9	3.06	2.8	2.2	2.3	2.4	2.6	2.5
	Colour	4.0	3.9	2.6	2.9	3.0	3.0	3.0	3.0	2.8
	Flavour	3.5	3.9	3.06	2.6	3.06	2.8	2.8	3.0	2.9
	Texture	3.3	3.9	3.1	2.6	2.9	2.9	2.9	2.7	2.7
	Taste	3.3	3.9	3	3.1	2	2.9	2.9	3.4	2.7
	M A S*	3.4	3.9	2.9	2.8	2.7	2.8	2.8	3.5	2.7
PUTTU	Appearance	3.3	2.4	3.0	3.2	3.2	3.5	3.0	3.0	3.4
	Colour	3.4	4.0	3.9	3.4	3.2	3.2	3.8	3.9	3.2
	Flavour	3.0	2.9	3.0	3.0	3.0	2.9	3.0	2.9	2.9
	Texture	3.5	3.6	3.4	2.9	3.5	3.5	3.3	3.5	3.2
	Taste	3.0	3.2	3.0	2.8	2.7	2.6	3.0	3.1	3.6
	M A S*	3.2	3.2	3.3	3.06	3.1	3.1	3.2	3.3	3.3

MAS*: Mean acceptability score

Table V. Mean acceptability scores of rice and pulse based recipes

Recipe	Attributes	COMBINATION 1			COMBINATION 2			COMBINATION 3		
		V1	V2	V3	V1	V2	V3	V1	V2	V3
CARROT DOSA	Appearance	3.4	3.4	3.5	3.3	3.6	3.9	3.3	3.0	3.8
	Colour	3.9	3.7	3.7	3.5	2.9	3.5	3.6	3.5	3.7
	Flavour	3.5	3.4	3.3	3.0	3.3	3.7	3.4	3.5	3.7
	Texture	3.7	3.9	3.7	3.4	3.3	4.0	3.9	3.6	3.7
	Taste	3.6	3.3	3.3	3.3	3.5	3.7	2.9	3.6	3.5
	M A S*	3.6	3.5	3.5	3.3	3.3	3.8	3.4	3.4	3.9
DHOKHALA	Appearance	3.4	3.3	2.7	2.9	2.6	2.8	2.8	2.8	2.6
	Colour	3.7	3.06	3.2	3.0	3.0	2.9	3.0	3.0	3.0
	Flavour	3.8	3.0	2.8	2.8	2.6	2.9	2.6	2.7	2.6
	Texture	3.6	3.2	2.6	3.1	2.9	3.0	2.9	3.0	2.9
	Taste	3.6	3.1	2.9	2.9	3.1	2.0	2.9	3.0	2.9
	M A S*	3.6	3.1	2.8	2.9	2.9	2.9	2.8	2.9	2.8
IDLI	Appearance	3.7	3.8	2.8	3.0	3.3	2.3	3.6	3.3	2.9
	Colour	3.6	3.4	3.2	2.9	2.6	2.8	3.5	3.5	2.9
	Flavour	3.3	3.2	2.7	3.1	2.4	2.5	3.3	3.1	2.9
	Texture	3.9	3.2	2.5	3.5	2.8	3.7	3.0	3.2	3.3
	Taste	3.5	3.2	3.1	3.1	3.0	2.5	2.9	2.9	3.0
	M A S*	3.6	3.4	2.9	3.1	2.8	2.8	3.3	3.2	3.0

MAS*: Mean acceptability score

Table VI. Mean acceptability scores of ten breakfast recipes

Recipe	Mean acceptability								
	C ₁			C ₂			C ₃		
	V ₁	V ₂	V ₃	V ₁	V ₂	V ₃	V ₁	V ₂	V ₃
Adai	3.4	3.1	2.9	2.8	2.96	2.9	3.0	3.7	3.0
Broken wheat upma	3.4	3.3	3.04	3.8	3.02	2.6	2.5	2.6	2.9
Dosa	3.6	3.5	3.5	3.3	3.3	3.8	3.4	3.4	3.9
Dhokhala	3.6	3.1	3.1	2.9	2.9	2.9	2.8	2.9	2.8
Idiy	3.6	3.4	3.4	3.1	2.8	2.8	3.3	3.2	3.0
Idiyappam	3.6	3.2	3.2	3.0	3.8	3.04	3.1	2.9	3.0
Kolukattai	3.4	3.9	2.9	2.8	2.7	2.8	2.8	3.5	2.7
Chapathi	3.1	2.9	3.0	3.3	2.9	3.1	3.0	2.7	2.9
Pancake	3.8	3.2	3.1	3.04	3.04	3.04	3.1	2.9	3.0
Puttu	3.2	3.2	3.3	3.06	3.1	3.1	3.2	3.3	3.3

Table VII. Mean acceptability scores of selected five recipes

Attributes	Pancake C ₁ V ₁	Broken wheat upma C ₂ V ₁	Kolukattai C ₁ V ₂	Dosa C ₃ V ₃	Idiyappam C ₂ V ₂
Appearance	3.6	3.9	3.9	3.8	3.9
Colour	4.0	3.9	3.9	3.7	3.3
Flavour	3.6	3.8	3.9	3.7	3.9
Texture	4.0	3.8	3.8	3.7	3.8
Taste	3.7	3.7	3.9	3.5	4.0
Mean acceptability Score	3.8	3.8	3.9	3.9	3.8
F- ratio	0.32				

Table VIII. Analyzed nutrient content of selected five recipes

Nutrients	Pancake C ₁ V ₁	Broken wheat upma C ₂ V ₁	Kolukattai C ₁ V ₂	Dosa C ₃ V ₃	Idiyappam C ₂ V ₂
Carbohydrates (g)	20.35	50.34	30.02	50.6	34.91
Fat (g)	2.0	4.0	3.02	2.8	2.09
Protein (g)	9.74	5.4	8.04	7.66	7.40
Dietary fiber (g)	4.6	5.6	6.02	4.9	4.0
Moisture (%)	26.43	30.68	62.6	60.25	53.67
Ash (%)	1.90	6.43	14.54	3.54	3.66

Table IX. Cost of the formulated mix

S.No.	Formulated mix (100g)	Cost (Rs.)
1.	C ₁	6.3
2.	C ₂	9.9
3.	C ₃	9.95

Table X. Evaluation of effect of nutrition education on selected cardiovascular patients

Details	Initial Mean \pm SD	Final Mean \pm SD	Difference	t value
Knowledge about diet	3.03 \pm 1.2	6.03 \pm 0.9	+29	12.27*
Knowledge about disease	1.7 \pm 0.98	3.6 \pm 1.06	+29	7.91*
Knowledge about lifestyle risk	0.70 \pm 0.74	1.8 \pm 1.06	+29	4.74*
Overall	5.46 \pm 2.11	11.6 \pm 1.88	+6.3	13.28*

* Significant at five per cent level

Nutrition education was imparted to 30 interested cardiovascular patients through nutrition counseling with aid of booklet. From the above table it is evident that the initial score obtained by 30 cardiovascular patients was 5.47 and final mean of 11.6 with a difference of +6.3. The t – value obtained showed a significance at five per cent level indicating remarkable increase in nutritional knowledge in selected cardiovascular patients after imparting nutrition education.

Conclusion

Among the 10 recipes and its 90 variations tried out, five recipes which obtained top score were pancake (c1v1), broken

wheat upma (c2v1), kolukattai (c1v1), dosa (c3v3) and idiyappam (c2v2). Nutrient analysis of recipes revealed that kolukattai (c1v2) contained high amount of dietary fibre (6.02g), fat (2.0g). Shelf life study revealed that all the three combinations of mix dried using different methods like sun, vacuum and microwave dried had shelf life of 90 days.

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