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Utilization of Basil seed gum and Basil seed powder in traditional recipes and evaluating their consumer acceptability

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Basil Seeds, being a healthier fat, replaces the fat content of the recipe and in turn enhances its taste, flavor, mouth feel as well as nutritive quality. In total, 4 numbers of recipes selected from different food groups were modified and standardized by incorporating Basil Seed Gum (BSG) and Basil Seed Powder (BSP) separately in different ratios. These modified recipes were evaluated by the panelists to select the most appropriate one, then standardized and later consumer feedback were noted on basis of sensory parameters. Modifications and standardization trial improved the sensorial quality gradually to acceptable level. The mean overall acceptability scores for the final standardization of mix vegetables cooked with 30% replacement of fat by using basil seed gum were 8.0, semolina dessert (30% BSG) were 9.0, chicken gravy (30% BSG) were 8.5 and chickpea lentils(30% BSG) were 8.0. While those made from BSP mix vegetables (30% BSP) got 8.7 and chicken gravy (10% BSP) got 8.4. Whereas, semolina dessert and chickpea lentils (20% BSP) secured 8.6 and 8.2, respectively. This research was performed to develop and standardize selected traditional recipes in which Basil Seed Gum and Basil Seed Powder had been incorporated as a healthy fat replacer in different ratios.

Keywords: Basil seed, Basil Seed Gum (BSG), Basil Seed Powder (BSP), fat-replacer, traditional recipes, consumer acceptability

INTRODUCTION

Seeds are known to be one of the healthiest foods. Seeds provide adequate amounts of fiber and it helps to maintain the health of digestive system and also prevents many heart diseases, weight gain and diabetes. It has been proved in a study that consumption of dietary fiber is inversely related to many diseases specifically cardiovascular diseases, obesity, cancer and type-2 diabetes (Lattimer and Haub, 2010). Basil (*Ocimumbasilicum L*.) is a plant usually found in tropical regions. It belongs to genus “Ocimum”. Originally basil is native to India, Iran and other tropical areas of sub-continent Asia and have been cultivated since more than 5,000 years (Sharma, 2019).This genus consists of approximately 50 and 150 species of herbs and shrubs respectively. Seeds of basil are of black color and have oval shape and are rich source of fiber. When basil seeds are soaked in water they

swell up and this swelling leads to the production of gelatinous mass because of the presence of layer of poly saccharide on outer epidermis wall of seed (Azoma and Sakamoto, 2003) Basil seeds are also used as a traditional medicine for the treatment of ulcer, dyspepsia, diarrhea and many other diseases. In many parts of Asia, seeds of basil are also used in the preparation of traditional beverages locally known as sharbat and many ice desserts i.e. falooda (Hosseini-Parvar et al. 2010). Seeds of basil are also used as antipyretic, antispasmodic, stomachic and diuretic.It is not only used as a pharmaceutical plant but can also be used as "culinary herb" (Naghibi et al. 2005). Seeds of basil are also utilized for pharmaceutical purposes. Adequate amounts of mucilage surround the basil seeds when they are soaked in water. This mucilage of basil seed consists of considerable amounts of hydrocolloids and have many other functional properties as well.Basil seed gum is composed of two important fractions that includes an acid stable core glucomannan and a-linked xylan which includes acidic side chains of the xylosyl residues at C-2 and C-3 in the acid-soluble portion. Basil seed gum also consists of a minor portion of glucan (Hosseini-Parvar et al. 2014). Gum of basil seeds has a significant potential to be used as gelling, binding, foaming, fat replacing, emulsifying, thickening and stabilizing agent in food as well as in pharmaceutical industries. In many studies, seeds of basil were also processed into essential oil products due to their increased polysaccharide content (Rafe et al. 2012). BSG can also be used as a good fiber source, suspending agent, dis-integrant, pharmaceutical excipient, anti-diabetic agent, biodegradeable edible film and seed-ling growth of plants. (Naji-Tabasi and Razavi et al. 2017). The two major fractions of poly saccharides from seeds of basil: glucomannan (43%) and (1-4)-linked xylan (24.29%) and it also contains a minor fraction of glucan (2.31%) (Hosseini-Parvar et al.2010). Basil Seed Mucilage (BSM) can be used as stabilizing, gelling and thickening agents which results in the improvement of textural properties and stability of foods and food products (Karazhiyan et al. 2011).Basil Seed Mucilage (BSM) can be used as a fat replacer in many food products including processed cheese and low-fat ice cream (Javidi et al. 2016). Consumer acceptability is an essential factor for the success of new functional food products. The knowledge of consumer depends on the individual health status of the consumer because this determines the consumers' involvement as regards information finding for a certain functional nutrition (Bornkessel et al. 2011). The purpose of this research is to modify the traditional recipes with Basil seed.

MATERIALS AND METHODS

Research design

Research design for this study was experimental. Experiments were conducted for incorporating basil seed's powder and gel in different recipes. These modified recipes were then assessed for their consumer acceptance. Research was conducted at Food Science Laboratory of Food Science and Human Nutrition Department, Kinnaird College for women, Lahore.

Raw material preparation:

Basil seeds were procured from local market. Cleaned and then powder was prepared by grinding and sieving. While for gum preparation, seeds were soaked and when they absorbed water and formed a gelling material, they were drained and used as gum.

Recipe Modification Procedure

Different recipes were modified by incorporating basil seeds in different proportions. Modified recipes were then standardized and tested for their consumer acceptance.

Selection of base recipes:

Initially base recipes were selected using the internet and cookbooks. The selected recipes needed to complement our purpose of basil seeds substitution as powder and gel thus the recipes in which basil seeds powder and gel can be incorporated were selected. From the recipes selected above, only a few were finalized by considering the preferences of general population. Questionnaires were circulated amongst the general population to assess the preferences, likes and dislikes of the population in order to select recipes according to the preferences. The selected recipes portrayed how basil seed's powder and gel can easily be substituted in our everyday cuisine.

Measurement of ingredients:

After the selection of recipes, ingredients were measured according to the selected recipes by using proper equipment like: Measuring cups, Measuring spoons, Electronic balance, Dry measuring cups. The use of specific measuring

equipment for measuring specific ingredient depends on the present state of the ingredients.

Modification of recipes:

After the selection of recipes and proper measurement of ingredients to be added, recipes went through the process of modification. The texture, flavor, color, nutritive value and other sensory attributes of the selected recipes were modified. These recipes were modified by the incorporation of basil seed's powder in place of flour while basil seed's gel as a fat replacer in varying ratios i.e., 10%, 20% and 30%.

Sensory Evaluation by the Expert Panel:

The sensory evaluation of each of the modified product was carried out by the experienced and well- educated staff of Food and Nutrition Department of Kinnaird College for women, Lahore. After the evaluation of recipes in different ratios i.e., 10%, 20% and 30%, the most appropriate of them was selected for each recipe by considering the results of the evaluation forms being filled by the expert panel and consumer acceptability.

Scale for Sensory Evaluation:

The sensory evaluation of each recipe was carried out by the expert panel of Food and Nutrition Department of Kinnaird College for women, Lahore by using 9 points Hedonic Scale**.** 9-points Hedonic Scale forms were given to each evaluator for each recipe. No discussion was allowed during the sensory evaluation. Each panelist evaluated the product and filled the form accordingly. Key for the 9-points Hedonic Scale is as follows: Dislike Extremely; Dislike Very Much; Dislike Moderately; Dislike; Neutral; Like; like moderately; Like Very Much; Like Extremely. The recipes were evaluated using 9-points Hedonic Scale for each of the following characteristics: Taste; Mouth-feel; Flavor; Texture; Chew Ability; Color; Overall Acceptability.

Standardization of recipes:

A standard recipe is that which has not been altered at any case and tends to produce the same result, in both taste and quality whenever similar methods are used in the light of parallel conditions. The recipes were modified by the incorporation of Basil seed's powder and gel in selected recipes in varying amounts by substitution of flour by powder and fat by gel in different ratios i.e., 10%, 20% and 30%. These recipes were evaluated by the expert panel and the most appropriate ratio was selected according to the results of the evaluation forms being filled by the panelists.

Evaluating the Consumer Acceptability of Modified Recipes:

The consumer acceptability of the recipes modified by using Basil seed's powder and gel was checked by the general public specifically students of Kinnaird College for women, Lahore. They evaluated the modified recipes on the basis of its taste, texture, flavor, mouth-feel, chew-ability, color and overall acceptability.

Data Analysis

Seeds are known to be one of the healthiest foods. Seeds provide adequate amounts of fiber and it helps to maintain the health of digestive system and also prevents many heart diseases, weight gain and diabetes. It has been proved in a study that consumption of dietary fiber is inversely related to many diseases specifically cardiovascular diseases, obesity, cancer and type-2 diabetes (Lattimer and Haub, 2010). Basil (*Ocimumbasilicum L*.) is a plant usually found in tropical regions. It belongs to genus "Ocimum". Originally basil is native to India, Iran and other tropical areas of sub-continent Asia and have been cultivated since more than 5,000 years (Sharma. 2019). This genus consists of approximately 50 and 150 species of herbs and shrubs respectively. Seeds of basil are of black color and have oval shape and are rich source of fiber. When basil seeds are soaked in water they swell up and this swelling leads to the production of gelatinous mass because of the presence of layer of poly saccharide on outer epidermis wall of seed (Azoma and Sakamoto, 2003) Basil seeds are also used as a traditional medicine for the treatment of ulcer, dyspepsia, diarrhea and many other diseases. In many parts of Asia, seeds of basil are also used in the preparation of traditional beverages locally known as sharbat and many ice desserts i.e. falooda (Hosseini-Parvar et al.2010). Seeds of basil are also used as antipyretic, antispasmodic, stomachic and diuretic.It is not only used as a pharmaceutical plant but can also be used as "culinary herb" (Naghibi et al. 2005). Seeds of basil are also utilized for pharmaceutical purposes. Adequate amounts of mucilage surround the basil seeds when they are soaked in water. This mucilage of basil seed consists of considerable amounts of hydrocolloids and have many other functional properties as well. Basil seed gum is composed of two important fractions

that includes an acid stable core glucomannan and a-linked xylan which includes acidic side chains of the xylosyl residues at C-2 and C-3 in the acid-soluble portion. Basil seed gum also consists of a minor portion of glucan (Hosseini-Parvar et al. 2014). Gum of basil seeds has a significant potential to be used as gelling, binding, foaming, fat replacing, emulsifying, thickening and stabilizing agent in food as well as in pharmaceutical industries. In many studies, seeds of basil were also processed into essential oil products due to their increased polysaccharide content (Rafe et al. 2012). BSG can also be used as a good fiber source, suspending agent, dis-integrant, pharmaceutical excipient, anti-diabetic agent, bio-degrade able edible film and seed-ling growth of plants. (Naji-Tabasi and Razavi et al.2017). The two major fractions of poly saccharides from seeds of basil: gluco-mannan (43%) and (1-4)-linked xylan (24.29%) and it also contains a minor fraction of glucan (2.31%) (Hosseini-Parvar et al.2010). Basil Seed Mucilage (BSM) can be used as stabilizing, gelling and thickening agents which results in the improvement of textural properties and stability of foods and food products (Karazhiyan et al. 2011).Basil Seed Mucilage (BSM) can be used as a fat replacer in many food products including processed cheese and low-fat ice cream (Javidi et al. 2016). Consumer acceptability is an essential factor for the success of new functional food products. The knowledge of consumer depends on the individual health status of the consumer because this determines the consumers' involvement as regards information finding for a certain functional nutrition (Bornkessel et al. 2011). The purpose of this research is to modify the traditional recipes with Basil seed.

RESULTS

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Evaluating the Consumer Acceptability of Modified Recipes:

The consumer acceptability of the recipes modified by using Basil seed's powder and gel was checked by the general public specifically students of Kinnaird College for women, Lahore. They evaluated the modified recipes on the basis of its taste, texture, flavor, mouth-feel, chew-ability, color and overall acceptability.

Standardization of Mix Vegetables cooked with Basil Seed Gum and powder

The expert panelists evaluated the modified recipe of Mix Vegetables in different ratios of Basil Seed Gum i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9-point Hedonic Scale to reassure its standardization. The sensory attributes that were evaluated by the experts included taste, mouthfeel, flavor, texture, chew ability, color and overall acceptability.

The expert panelists evaluated the modified recipe of Mix Vegetables in different ratios of Basil Seed Powder i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9- point Hedonic Scale to reassure its standardization.

The sensory attributes that were evaluated by the experts included taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The mean scores for the overall acceptability of the modified recipe of Mix Vegetables incorporated with 30% Basil Seed Powder for Test 1 was 6.7, Test 2 was 7.5 and Test 3 was 8.4 respectively.

Consumer Acceptability for Mix Vegetables cooked

The students of Kinnaird College evaluated the selected percentage of Basil Seed Powder in Mix Vegetables using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe. The bar chart showed the evaluation results of the Mix Vegetables in which 30% of Basil Seed Powder was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for overall acceptability i.e., 8.0.

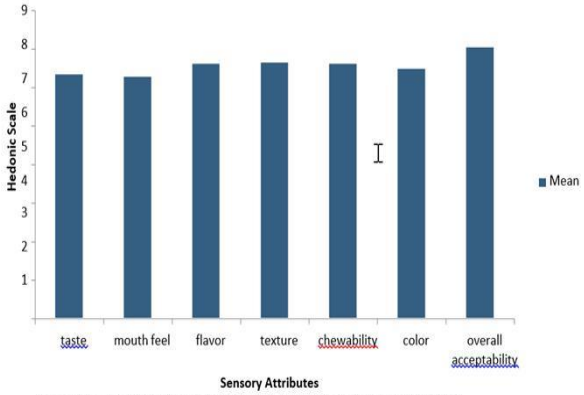

Figure 1: Consumer acceptability of mix vegetables with 30% BSP

The students of Kinnaird College evaluated the selected percentage of Basil Seed Gum in Mix Vegetables using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe. The bar chart showed the evaluation results of the Mix Vegetables in which

30% of Basil Seed Gum was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for taste i.e., 8.3.

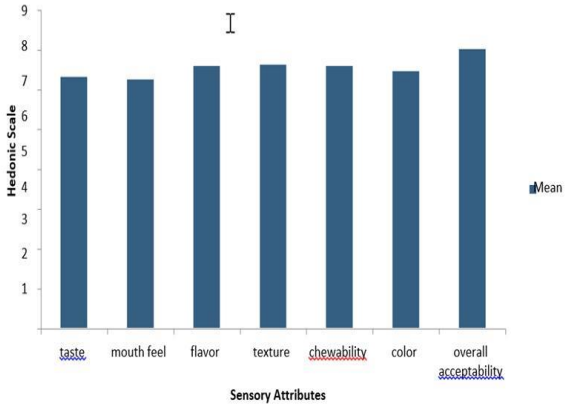

Figure 2: Consumer acceptability of mix vegetables with 30% BSG

Sensory Evaluation of Semolina dessert cooked with Basil Seed Gum and powder

The expert panel did the sensory evaluation of Semolina dessert with Basil Seed Gum incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Bar chart showed the results of sensory evaluation of Semolina dessert that was cooked by using Basil Seed Gum at different ratios. Results concluded that Semolina dessert cooked with 30% Basil Seed Gum was most preferred by the expert panel as shown in Table 3. ANOVA result in table 4 represent that there was a significance difference among three different ratios of Basil Seed Powder incorporated in Semolina dessert. The expert panel did the sensory evaluation of Semolina dessert with Basil Seed Powder incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. The bar chart showed the results of sensory evaluation of Semolina dessert that was cooked by using Basil Seed Powder at different ratios. Three samples of Semolina dessert with three different ratios of Basil Seed Powder i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Semolina dessert cooked with 20% Basil Seed Powder was most preferred by the expert panel.

Standardization of Semolina dessert cooked with Basil Seed Gum and powder

The expert panelists evaluated the modified recipe of Semolina dessert in different ratios of Basil Seed Gum i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9-point Hedonic Scale to reassure its standardization. The sensory attributes that were evaluated by the experts included taste, mouthfeel, flavor, texture, chewability, color and overall acceptability. The mean scores for the overall acceptability of the modified recipe of Semolina dessert incorporated with 30% Basil Seed Gum for Test 1 was 6.0, Test 2 was 7.0 and Test 3 was 9.0 respectively.

The expert panelists evaluated the modified recipe of Semolina dessert in different ratios of Basil Seed Powder i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9- point Hedonic Scale to reassure its standardization.

The sensory attributes that were evaluated by the experts included taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The mean scores for the overall acceptability of the modified recipe of Semolina dessert incorporated with 20% Basil Seed Powder for Test 1 was 6.7, Test 2 was 7.5 and Test 3 was 8.4 respectively.

Consumer Acceptability for Semolina dessert cooked with Basil Seed Gum and powder

The students of Kinnaird College evaluated the selected percentage of Basil Seed Gum in Semolina dessert using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe.

The bar chart showed the evaluation results of the Semolina dessert in which 30% of Basil Seed Gum was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for overall acceptability i.e., 8.7.

The students of Kinnaird College evaluated the selected percentage of Basil Seed Powder in Semolina dessert using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe. The bar chart showed the evaluation results of the Semolina dessert in which 20% of Basil Seed Powder was

incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for flavor i.e., 8.1.

Sensory Evaluation of Chicken Gravy cooked with Basil Seed Gum and powder

ANOVA result in table 5 represent that there was a significance difference among three different ratios of BSG incorporated in Chicken Gravy. The expert panel did the sensory evaluation of Chicken Gravy with Basil Seed Gum incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Three samples of Chicken Gravy with three different ratios of Basil Seed Gum i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Chicken Gravy cooked with 30% Basil Seed Gum was most preferred by the expert panel. ANOVA result in table 6 represent that there was a significance difference among three different ratios of Basil Seed Powder incorporated in Chicken Gravy. The expert panel did the sensory evaluation of Chicken Gravy with Basil Seed Powder incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Three samples of Chicken Gravy with three different ratios of Basil Seed Powder i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chewability, color and overall acceptability. The results concluded that Chicken Gravy cooked with 10% Basil Seed Powder was most preferred by the expert panel. ANOVA result in table 5 represent that there was a significance difference among three different ratios of BSG incorporated in Chicken Gravy. The expert panel did the sensory evaluation of Chicken Gravy with Basil Seed Gum incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Three samples of Chicken Gravy with three different ratios of Basil Seed Gum i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Chicken Gravy cooked with 30% Basil Seed Gum was most preferred by the expert panel.

ANOVA result in table 6 represent that there was a significance difference among three different ratios of Basil Seed Powder incorporated in Chicken Gravy. The expert panel did the sensory evaluation of Chicken Gravy with Basil Seed Powder incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Three samples of Chicken Gravy with three different ratios of Basil Seed Powder i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Chicken Gravy cooked with 10% Basil Seed Powder was most preferred by the expert panel.

Consumer Acceptability for Chicken Gravy cooked with Basil Seed Gum and powder

The students of Kinnaird College evaluated the selected percentage of Basil Seed Gum in Chicken Gravy using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe. The bar chart showed the evaluation results of the Chicken Gravy in which 30% of Basil Seed Gum was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for taste i.e., 8.6, evaluated the selected percentage of Basil Seed Powder in Chicken Gravy using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe. The bar chart showed the evaluation results of the Chicken Gravy in which 10% of Basil Seed Powder was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for texture i.e., 8.5.

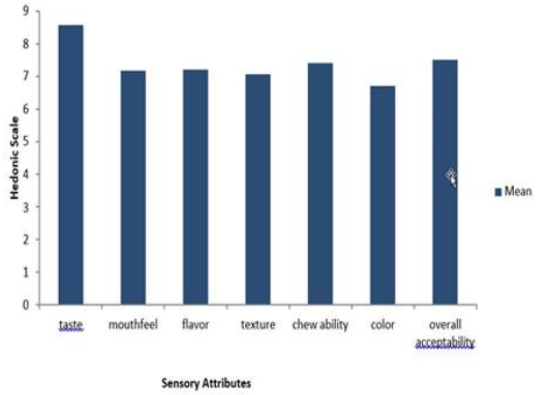

Figure 3: Consumer acceptability of chicken gravy with 10% BSP

Sensory Evaluation of Chickpea lentils cooked with Basil Seed Gum and powder

ANOVA result in table 7 represent that there was a significance difference among three different ratios of BSG incorporated in Chickpea lentils. The expert panel did the sensory evaluation of Chickpea lentils with Basil Seed Gum incorporated in different percentages as a fat replacer by using 9-point Hedonic Scale. Three samples of Chickpea lentils with three different ratios of Basil Seed Gum i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Chickpea lentils cooked with 30% Basil Seed Gum was most preferred by the expert panel. ANOVA result in table 8 represent that there was a significance difference among three different ratios of Basil Seed Powder incorporated in Chickpea lentils. The expert panel did the sensory evaluation of Chickpea lentils with Basil Seed Powder incorporated in different percentages as a fat replacer by using 9- point Hedonic Scale. Three samples of Chickpea lentils with three different ratios of Basil Seed Powder i.e., 10%, 20% and 30% were evaluated by the expert panelists on the basis of their sensory attributes including taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The results concluded that Chickpea lentils cooked with 20% Basil Seed Powder was most preferred by the expert panel.

Standardization of Chickpea lentils cooked with Basil Seed Gum and powder

The expert panelists evaluated the modified recipe of Chickpea lentils in different ratios of Basil Seed Gum i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9-point Hedonic Scale to reassure its standardization.

The sensory attributes that were evaluated by the experts included taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The mean scores for the overall acceptability of the modified recipe of Chickpea lentils incorporated with 30% Basil Seed Gum for Test 1 was 5.7, Test 2 was 6.9 and Test 3 was 8.0 respectively. The expert panelists evaluated the modified recipe of Chickpea lentils in different ratios of Basil Seed Powder i.e., 10%, 20% and 30% using 9-point Hedonic Scale. The recipe with highest favored results was selected by the expert panelists and was evaluated three times again using 9-point Hedonic Scale to reassure its standardization. The sensory attributes that were evaluated by the experts included taste, mouth feel, flavor, texture, chew ability, color and overall acceptability. The mean scores for the overall acceptability of the modified recipe of Chickpea lentils incorporated with 20% Basil Seed Powder for Test 1 were 6.3, Test 2 was 7.1 and Test 3 was 8.2 respectively.

Consumer Acceptability for Chickpea lentils cooked with Basil Seed Gum and Powder

The students of Kinnaird College evaluated the selected percentage of Basil Seed Gum in chickpea lentils using 9-point Hedonic Scale which showed the consumer acceptability of the modified recipe.

The bar chart showed the evaluation results of chickpea lentils in which 30% of Basil Seed Gum was incorporated as the final percentage selected by the expert panelists based on its sensory evaluation results. The highest mean value was observed for taste i.e., 8.57.

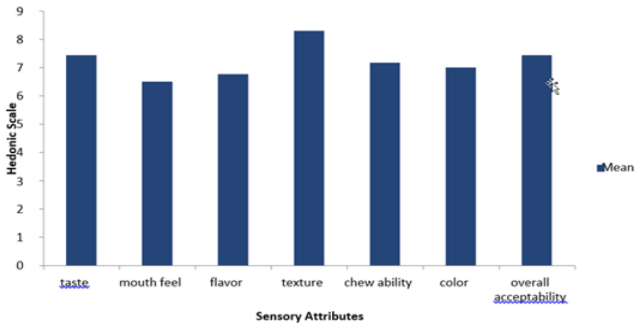

Figure 4: Consumer acceptability of chickpea lentils with 20% BSP

Table 1: ANOVA for sensory evaluation of mix vegetables using BSP at different ratio

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	12.857	3	4.286	21.176	.000
color	Within Groups	4.857	24	.202		
	Total	17.714	27			
	Between Groups	8.107	3	2.702	10.810	.000
texture	Within Groups	6.000	24	.250		
	Total	14.107	27			
	Between Groups	10.286	3	3.429	11.077	.000
taste	Within Groups	7.429	24	.310		
	Total	17.714	27			
	Between Groups	6.286	3	2.095	9.263	.000
Chew ability	Within Groups	5.429	24	.226		
	Total	11.714	27			
	Between Groups	7.714	3	2.571	10.800	.000
flavor	Within Groups	5.714	24	.238		
	Total	13.429	27			
	Between Groups	7.143	3	2.381	9.091	.000
mouth feel	Within Groups	6.286	24	.262		
	Total	13.429	27			
	Between Groups	7.143	3	2.381	9.091	.000
Overall acceptability	Within Groups	6.286	24	.262		
	Total	13.429	27			

Table 2: ANOVA for sensory evaluation of mix vegetables using BSG at different ratio

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	12.107	3	4.036	12.107	.000
Taste	Within Groups	8.000	24	0.333		
	Total	20.107	27			
	Between Groups	18.429	3	6.143	18.429	.000
Mouthfeel	Within Groups	8.000	24	0.333		
	Total	26.429	27			
	Between Groups	9.821	3	3.274	9.483	.000
Flavour	Within Groups	8.286	24	0.345		
	Total	18.107	27			
	Between Groups	18.571	3	6.190	14.444	.000
Texture	Within Groups	10.286	24	0.429		
	Total	28.857	27			
	Between Groups	25.571	3	8.524	21.697	.000
Chew ability	Within Groups	9.429	24	0.393		
	Total	35.000	27			
	Between Groups	14.857	3	4.952	10.947	.000
Color	Within Groups	10.857	24	0.452		
	Total	25.714	27			
	Between Groups	15.143	3	5.048	10.341	.000
Overall acceptability	Within Groups	11.714	24	0.488		
	Total	26.857	27			

Table 3: ANOVA for sensory evaluation of Semolina dessert BSG at different ratio

Sum of Squares			df	Mean Square		F	Sig.
	Between Groups	.095		2	.048	.125	.883
Taste	Within Groups	6.857		18	.381		
	Total	6.952		20			
	Between Groups	.000		2	.000	.000	1.000
Mouthfeel	Within Groups	5.143		18	.286		
	Total	5.143		20			
	Between Groups	.286		2	.143	.375	.693
Flavour	Within Groups	6.857		18	.381		
	Total	7.143		20			
	Between Groups	.667		2	.333	.955	.404
Texture	Within Groups	6.286		18	.349		
	Total	6.952		20			
	Between Groups	.095		2	.048	.167	.848
Chew ability	Within Groups	5.143		18	.286		
	Total	5.238		20			
	Between Groups	.667		2	.333	.955	.404
Color	Within Groups	6.286		18	.349		
	Total	6.952		20			
	Between Groups	.095		2	.048	.125	.883
Overall_acceptibility	Within Groups	6.857		18	.381		
	Total	6.952		20			

Table 4: ANOVA for sensory evaluation of Semolina dessert BSP at different ratio

Sum of Squares	df	Mean Square	F	Sig.
11.000 Between Groups	3	3.667	16.211	.000
overall_acceptibility Within Groups 5.429	24	.226		
Total 16.429	27			
8.000 Between Groups	3	2.667	11.200	.000
flavor Within Groups 5.714	24	.238		
Total 13.714	27			
7.250 Between Groups	3	2.417	9.667	.000
color Within Groups 6.000	24	.250		
Total 13.250	27			
8.857 Between Groups	3	2.952	14.588	.000
mouth_feel Within Groups 4.857	24	.202		
Total 13.714	27			
12.000 Between Groups	3	4.000	12.444	.000
chew_ability Within Groups 7.714	24	.321		
Total 19.714	27			
9.250 Between Groups	3	3.083	15.235	.000
taste Within Groups 4.857	24	.202		
Total 14.107	27			
8.857 Between Groups	3	2.952	14.588	.000
texture Within Groups 4.857	24	.202		
Total 13.714	27			

Table 5: ANOVA for sensory evaluation of Chicken gravy BSG at different ratio

Sum of Squares			df	Mean Square		F	Sig.
	Between Groups	1.238		2	.619	2.053	.157
Taste	Within Groups	5.429		18	.302		
	Total	6.667		20			
	Between Groups	.286		2	.143	.600	.559
Mouthfeel	Within Groups	4.286		18	.238		
	Total	4.571		20			
	Between Groups	.095		2	.048	.231	.796
Flavour	Within Groups	3.714		18	.206		
	Total	3.810		20			
	Between Groups	.667		2	.333	.913	.419
Texture	Within Groups	6.571		18	.365		
	Total	7.238		20			
	Between Groups	.857		2	.429	1.350	.284
Chew ability	Within Groups	5.714		18	.317		
	Total	6.571		20			
	Between Groups	.286		2	.143	.600	.559
Color	Within Groups	4.286		18	.238		
	Total	4.571		20			
	Between Groups	.095		2	.048	.231	.796
Overall_acceptibility	Within Groups	3.714		18	.206		
	Total	3.810		20			

Table 6: ANOVA for sensory evaluation of Chicken Gravy BSP at different ratio

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	5.821	3	1.940	14.818	.000
color	Within Groups	3.143	24	.131		
	Total	8.964	27			
	Between Groups	6.964	3	2.321	10.833	.000
flavor	Within Groups	5.143	24	.214		
	Total	12.107	27			
	Between Groups	10.107	3	3.369	17.688	.000
mouth_feel	Within Groups	4.571	24	.190		
	Total	14.679	27			
	Between Groups	7.143	3	2.381	8.696	.000
chew_ability	Within Groups	6.571	24	.274		
	Total	13.714	27			
	Between Groups	7.571	3	2.524	8.833	.000
Overall acceptability						
	Within Groups	6.857	24	.286		
	Total	14.429	27			
	Between Groups	6.964	3	2.321	9.750	.000
taste	Within Groups	5.714	24	.238		
	Total	12.679	27			
	Between Groups	7.821	3	2.607	11.526	.000
texture	Within Groups	5.429	24	.226		
	Total	13.250	27			

Table 7: ANOVA for sensory evaluation of Chickpea lentils using BSG at different ratio

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	.095	2	.048	.111	.895
Taste	Within Groups	7.714	18	.429		
	Total	7.810	20			
	Between Groups	.381	2	.190	.632	.543
Mouthfeel	Within Groups	5.429	18	.302		
	Total	5.810	20			
	Between Groups	.286	2	.143	.600	.559
Flavour	Within Groups	4.286	18	.238		
	Total	4.571	20			
	Between Groups	.381	2	.190	.800	.465
Texture	Within Groups	4.286	18	.238		
	Total	4.667	20			
	Between Groups	.000	2	.000	.000	1.000
Chew ability	Within Groups	4.286	18	.238		
	Total	4.286	20			
	Between Groups	.667	2	.333	.568	.577
Color	Within Groups	10.571	18	.587		
	Total	11.238	20			
Overall accept ibility	Between Groups	.095	2	.048	1.000	.387
	Within Groups	.857	18	.048		
	Total	.952	20			

Table 8: ANOVA for sensory evaluation of Chickpea lentils BSP at different ratio

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	8.143	3	2.714	15.200	.000
color	Within Groups	4.286	24	.179		
	Total	12.429	27			
	Between Groups	8.964	3	2.988	13.944	.000
flavor	Within Groups	5.143	24	.214		
	Total	14.107	27			
	Between Groups	7.821	3	2.607	8.760	.000
taste	Within Groups	7.143	24	.298		
	Total	14.964	27			
	Between Groups	10.286	3	3.429	18.000	.000
overall_ acceptability	Within Groups	4.571	24	.190		
	Total	14.857	27			
	Between Groups	6.679	3	2.226	8.905	.000
mouth_feel	Within Groups	6.000	24	.250		
	Total	12.679	27			
	Between Groups	6.000	3	2.000	9.882	.000
aroma	Within Groups	4.857	24	.202		
	Total	10.857	27			

DISCUSSION

Basil seeds are historically known worldwide to be used for restorative cause to enhance the circulation of blood, for reduction of inflammation, (Johary *et al*., 2017) suppress the oxidation of cholesterol, to boost up the immune system and to control glucose level. In a study, Soxhlet apparatus was used to separate the active components of basil seeds with using two solvents methanol and petroleum ether. The results of the anticancer activity of the basil seeds showed that the basil seeds are a potential source of stable bioactive compounds. (Gajendiran *et al*., 2016). In another research, the researchers characterized and isolated mucilage which was separated from *Ocimumbasilicum* seed as a pharmaceutical excipient. The outcomes concluded that Ocimumbasilicum seed mucilage can used in straight compression with other excipients and as a superdisintegrant in wet granulation technology (Sayyad and Sakhare, 2018).

Basil Seed Gum can also be utilized as a fiber rich source, suspending agent, anti-diabetic agent and disintegrant. (Naji-Tabasi., 2017). Mix Vegetables cooked with Basil Seed Gum was the first recipe developed. Basil Seed Gum was incorporated in three different ratios (i.e, 10%, 20% and 30%) in order to replace the fat content of the selected recipe. Sensory evaluation of all the three ratios was done by the expert panel which resulted with most acceptance level of Mix Vegetables cooked with 30% fat replacement by Basil Seed Gum as shown by the bar chart (Fig. 4.1). The mean scores for taste of Treatment 1 (10%) were 7.0 ± 0.6, for Treatment 2 (20%) were 7.6 ± 0.5, for Treatment 3 (30%) were 8.7 ± 0.5. A study was conducted in which Basil Seed Gum (BSG) and Tracaganth Gum (TG) were used as a fat replacer in low fat mayonnaise formation. The results of the study concluded that Basil Seed Gum is a suitable fat substitution for high fat or full fat mayonnaise without leaving any adverse effects on the sensory as well as quality attributes of mayonnaise. (Garavand et al. 2015). The second recipe developed by using Basil Seed Gum was Semolina dessert. The mean scores of taste for Treatment 1 (10%) were 6.1 ± 0.4, for Treatment 2 (20%) were 7.3 ± 1.1, for Treatment 3, were 8.4 ± 0.5. These results indicate that Treatment 3 (30%) had the highest mean values for each sensory attribute hence it was then standardized. A study was conducted in order to replace fat by using Basil Seed Mucilage (BSM) extracted by hot water. In this study, basil seed mucilage was added as a fat substitute in place of butter in a sponge cake. 1g of Basil Seed Mucilage replace 15g of butter which finally resulted in 75% reduction of the total fat content of sponge cake (Song et al. 2017). The third recipe prepared by using Basil Seed Gum was Chicken Gravy. The results evaluated for Treatment 1 (10%) showed the mean scores of taste as 6.6 ± 0.5, for Treatment 2 (20%), were 7.1 ± 0.4, for Treatment 3 (30%), were 8.4 ± 0.5. A research was performed in order to evaluate rheological properties of myofibrillar protein gels (MPs) by using Basil Seed Gum (BSG) alone or in combination with gelatin (0.25%, 0.5%). The results of the study showed that in low fat sausages, addition of Basil Seed Gum reduced the levels of expressible moisture content and cooking loss while the combination of Basil Seed Gum and gelatin improved the cohesiveness and gumminess. (Lee et al. 2017). The fourth recipe prepared by using Basil Seed Gum was Chickpea lentils. The mean scores of taste for Treatment 1 (10%) were 6.6 ± 0.5, for Treatment 2 (20%) were 7.1 ± 0.4, for Treatment 3 (30%) were 8.2 ± 0.5.Another study was conducted in order to determine the influence of Basil Seed Gum (BSG), guar gum (GG) and their blend (MGB) at different concentrations on the sensory, rheological and physical characteristics of low fat ice-cream by comparing it with the full fat Ice cream sample as control. The results showed that BSG and MSG provided satisfactory rheological properties in low fat ice cream. (Javidi et al. 2016)

The first recipe developed was Mix Vegetables with incorporation of Basil Seed Powder as a fat replacer in three different ratios i.e. 10%, 20%, and 30%. The mean scores for taste of Treatment 1 (10%) were 5.8 ± 0.4, for Treatment 2 (20%) were 6.7 ± 0.8, for Treatment 3 (30%) for taste were 7.6 ± 0.5. Another research was conducted to study the potential application of sweet Basil Seed Powder (Ocimumbasilicum L.) and its functionality on Baguette bread quality. The results showed that the sensory characteristics and the staling characterics were improved when 0.5% Basil Seed Powder were improved. (Rezapour et al. 2016). The second recipe modified by using Basil Seed Powder was Semolina dessert. The mean scores of taste for Treatment 1 (10%) were 6.4±0.5, for Treatment 2 (20%), were 7.3 ± 0.4, for Treatment 3 were 5.8 ± 0.4. A study was conducted to study the utilization of basil seeds in developing value added beverage and its nutritional assessment. Total phenolic content, proximate and mineral analysis

of basil seeds was done (Munir et al. 2017). Chicken Gravy was the third recipe cooked by adding Basil Seed Powder in three different ratios (10%, 20%, and 30%) as a fat replacer. The results evaluated for taste of Treatment 1 (10%) were 7.6 ± 0.5, for Treatment 2 (20%), were 6.6 ± 0.5, for Treatment 3 (30%), were 5.9± 0.7. The results concluded that the modified recipe with 10% of the Basil Seed Powder was most accepted by the expert panelists (Song et al.2017). Chickpea lentils were the fourth recipe cooked using different ratios of Basil Seed Powder to replace the fat used in cooking process. The mean scores of taste for Treatment 1 (10%) were 6.3 ± 0.5, for Treatment 2 (20%) were 7.1± 0.4, for Treatment 3 (30%) were 5.7 ± 0.8. Chia seed gel was used in a research as fat a replacer in making of sweet pan breads. The replacement was done to lessen the total fat content in the final product and to enhance the nutritive value of products in reference to the composition to fatty acids.(Fernandes and de las Mercedes Salas-Mellado, 2017).

CONCLUSION

The present study was effective in order to achieve the targeted goals as set before conducting the study. Modification of traditional recipes resulted in the achievement of incorporation of basil seed gum and powder as a substitute of fat in selected traditional recipes. Basil seed gum and powder was incorporated in the selected recipes in three different ratios i.e., 10, 20 and 30% in order to substitute fat in them. After the incorporation of these ratios of basil seed gum and powder in the selected traditional recipes, these were evaluated by using 9 point hedonic scale by the expert panel. The results of the sensory evaluation showed that the recipes incorporated with the maximum percentage of Basil Seed Gum (30%) was liked the most and selected for further standardization while for Basil Seed Powder, different ratio for each recipe was selected for standardization. Hence, it can be concluded that Basil Seed Gum and Basil Seed Powder can be used as a fat replacer in traditional recipes which resulted in the enhancement of nutritional value, taste, flavor, texture and overall acceptability of the modified recipes.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

FM and SN: Conceptualization and methodology. FI, AI, SN and BR: Writing original draft. SA, SY and HA: Visualization and investigation. HNK, OA and SN: Data validation. HS, SN and FI: Writing, reviewing and editing. All authors read and approved the final version.

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