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Organo-leptic Evaluation of A Product Incorporating Treated Fenugreek (Trigonella Foenum Graecum) Flour-Diabetes Case Control Study

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Abstract

Despite the evidence demonstrating the efficacy of fenugreek in the treatment of diabetes, its use for that purpose has been inhibited by its extremely bitter taste. Impairment in taste modalities is described long before in patients with T2DM. To determine any significant difference in bitter flavor and taste perception between diabetics and normoglycaemics at each per cent level of fenugreek incorporation. To determine the significant difference in the thresh hold level for bitter flavor and taste perception in diabetics between different per cent level of fenugreek incorporation. To determine per cent level of fenugreek incorporation and the product acceptability in terms of visual attributes and tactile feel. Dhoklas the Indian recipe was standardized with each receipe consisting of 10,15, 20 and 25 per cent variation of treated fenugreek flour with a control coded as S1,S2,S3 and S4.at the dietary department of Sri Avinashilingam deemed university. The experimental group consists of 20T_2DM and the control with 20 normoglycaemic subjects .They were in the age group of 35-45 years from among the staff members. The product was evaluated using score card based on product related lexicon of 5 point hedonic scale rating. The results were statistically analysed using 2-way a nova with interaction model and post-hoc test for paired comparison. Statistically there was significant difference(P<0.001) in evaluation of dhoklas at 20 and 25 per cent. The post-hoc test in diabetics showed significant difference (P<0.005) in taste perception. The threshold for bitter taste was perceived by diabetics slightly at 25 per cent level. In terms of visual attributes and tactile feel dhoklas were acceptable at 10 percent. The study revealed a lower sensitivity to bitter flavor and taste modality in diabetics. Treated fenugreek flour can be incorporated to about 25 per cent to reduce blood sugar in type II diabetes.

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Introduction

Inflammatory diseases of oral cavities and soft tissue changes are associated with diabetesmellitus[1]. Taste disorder is a common observation in type 1 and type 2 diabetes. The threshold for bitter taste is reduced in these patients due to diabetic neuropathy. It is

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reported that more than 250 medications affect smell and taste sensation in diabetes[2].Dietary intervention plays a major role in the treatment of type II diabetes along with drugs and exercise. Low carbohydrate diet (30-40%) followed for more than hundreds of years is no longer necessary. It is universally agreed that carbohydrate may form 60-65% of total calories. Three fourth of total carbohydrate may come preferably from complex carbohydrate like unrefined cereals in the form of hand pounded rice, whole wheat, ragi and cumbu[3]. The gluten present in wheat increases the chewing counts and the sense of satiety. The dietary fiber present in milled cereals increases the standing time of food in the gut and fullness to prevent hyperglycemia. An optimum level of fiber would be 25gms per 1000 calories. Green leafy vegetables like cluster beans, kovakkai, plantain stem and ladies finger are rich sources of dietary fiber. In the management of hyperlipedemia in obese T_2dm fat content should be reduced to 20-25%. The unsaturated fatty acid (UFA) present in olive oil, cotton seed oil, corn oil, soy bean oil and sunflower oil, are necessary for the metabolism and function[4].There is evidence that T2dm can be treated by the use of indigenous foods like bitter gourd juice, ginger, garlic oil, thulasi extract, jamun seed extract and fenugreek seeds[5]. Fenugreek (Trigonella foenum graecum) is a common condiment used in Indian homes as a spice and food to reduce hyperglycemia[6]. About 25-100gms of fenugreek seeds taken daily can diminish reactive hyperglycemia. The beneficial effect of soluble dietary fiber fraction of fenugreek on in sulinemic and lipidimic status in type 2 diabetes is well established[7].Indian diet recipes and food ingredients are yet to be standardized. In a heterogeneous culture like ours one has to necessarily take into account the factors such as regional and local food habits, cooking habits, eating habits, timing and frequency of food intake, various recipes, and indigenous dietetic ideas prevalent in the society[8]. Sensory analysis of a product is related to the or ganoleptic feel of the product. They are the visible attributes like appearance and color. The tactile feel consists of texture and the olfactory and gustatory sensation are the flavor per se and taste per se[9].

Materials and method

The study was approved by the research committee of Sri Avinashilingam deemed university and designed to include eligible T_2DM and normoglycaemic individuals A written consent was obtained and were appraised of the study. The ingredients for recipe standardization was procured from chintamani supermarket (Coimbatore).

Sample size

Purposive sampling procedure was followed. Eligible 20T_2DM taking oral hypoglycaemic drugs (Past 2-3years) and 20 normoglycaemic individuals in the age group of 35-45 years from among the staff members comprised the study.

Product development

Idea generation and screening of ideas were the initial step in product (dhokla) development using food-to- food fortification strategy. The fenugreek seeds were treated to remove lectins, debitterized and processed fenugreek powder was used to remove undesirable taste[10].

↓ Fenugreek seeds (purchased in lots)

Soaked (hot boiling water- 1 minute)

↓ Inactivate lectins (To ↓ fenugreek odour)

Seeds Dried (Evaporation)

↓ To remove moisture

Fried slightly

↓ To remove the bitterness

Powdered (Flour mill)

To pass through a 60' mesh sieve

Treated Fenugreek Flour (Packed blends of 10,15, 20 and 25per cent)

After a series of trials using ingredients in various proportion (Table-1) the concept of the enriched product-dhokla took shape. Dhoklas the indian recipe was selected for fortification with treated fenugreek flour due to its commonality of use in Indian homes. The recipe had four variation with four blends (10 per cent, 15 per cent,20 per cent and 25 per cent) with a control. The recipes were standardized in the food science laboratory for its repeated consistency . Score cards were developed

Table 1: (b) Score card to evaluate dhoklas

Appearance	Colour	Texture	Flavour	Taste	Score
a. Very Good	a. Golden Yellow	a. Soft	a. Highly Acceptable	a. Good	5
b. Good	b. Yellow	b. Moderately Soft	b. Acceptable	b. Fair	4
c. Fair	c. Light Yellow	c. Fairly Hard	c. Mild Fenugreek Flavour	c. Slightly Bitter	3
d. Poor	d. Yellowish Brown	d. Soggy	c. Strong Fenugreek Flavour	d. Bitter	2
e. Very Poor	e. Brown	e. Hard	e. Raw Flavour	e. Highly Bitter	1

Table 1: (a) Ingredients in dhokla preparation

S.no	Ingredients	Amount
1	Maize flour	100 gms
2	.Wheat flour	10 gms
3	Onions	20 gms
4	Chillies	2 gms
5	Oil	10 ml
6	Fenugreek	15gms
7	Salt	pinch
8	Water	30 ml

100gms contains 20gms fenugreek flour
100gms yield 5 dhoklas

as given in table 1 using product related lexicon based on 5 point hedonic scale rating . One recipe with four variation was prepared. The recipes were coded as S1 , S2 , S3 and S4 to prevent any bias. The panel members were invited by 12.30pm for sensory analysis. A glass of water was provided to rinse their mouth each time they tasted a different variation.

Statistical Analysis

The results were statistically analyzed using 2- way anova with interaction and post-hoc test for paired comparison.

Results

Table 3 shows that there was significant difference (P<0.001) in rating of dhoklas by diabetics and normoglycaemics at 20 and 25 per cent of fenugreek incorporation. Pathological changes in the peripheral nerves of diabetics affects the myelin sheath resulting in reduced thresh hold for bitter taste[11]. A significant difference (P<0.001) in perception of different attributes was observed at 15, 20 and 25 per cent. An altered sensitivity to various perceptions was seen in diabetics. Continuously a significant difference (P<0.001) in interaction was observed at 25 per cent between experimental and control group for perception of different attributes. Lectins present in fenugreek is the cause for its odour[12].They were removed by soaking with-out compromising the taste and flavor.

Results of post-hoc tukey test revealed that there was significant difference (P<0.005) in taste perception between experimental and control group at all four levels offenugreek incorporation The diabetic mean score (4.2±0.17) was higher than normoglycaemics (3±0.23) at 10 per cent. Diabetic neuropathy has possibility to change all four senses of taste. Continuously a higher mean score was marked by diabetics stating that the taste acquity for bitterness was lesser in diabetics thannormoglycaemics[13]. At 25 per cent level of fenugreek incorporation again diabetics scored maximum (3.7±0.18) compared to normoglycaemics (2±0.18). Acceptability of food products in terms of sensory variables is an important step in determining research priority[14].The perception to bitter flavor was reduced in diabetics with a highest (3.0.23) mean score compared tonormoglycaemics (2.8±0.09) at 15 per cent.

In determining the sensitivity to bitter flavor and taste perception in diabetics a significant difference (P<0.005) was seen at different levels of fenugreek incorporation. The diabetic shad low threshold for bitter flavor and scored a maximum (3.7±0.17) at 10 per cent. The bitterness was not felt until 20 per

Table 2: Organoleptic evaluation of dhoklas as rated by diabetics and normoglycaemics

Variation	Diabetic					Normoglycaemic					P-Value		
	Apper-ance	Col-our	Text-ure	Fla-vour	Taste	Appe-rance	Col-our	Tex-ture	Fla-vour	Taste	Pati-ents	Char-acters	P× CI
10 percent S1	4±0. 25^{a}	4±0. 25^{a}	4.6±0. 11^{a}	3.7±0. 18^{ab}	4.2±0. 17^{a}	3.7±0. 18^{ab}	4±0. 23^{a}	4±0. 18^{a}	3.8±0. 2^{ab}	3±0. 23^{b}	o.o o3	0.01	0.0 08
15 percent S2	3.7±0. 18^{bc}	3.8±0. 2^{ab}	4.6±0. 11^{a}	3.4±0. 18^{bc}	3.8±0. 2^{ab}	3.6±0. 15^{bc}	3.8±0. 2^{ab}	3.8±0. 2^{ab}	3.4±0. 18^{bc}	3.0±0. 23c	0.0 04	<0.0 01	0.0 36
20 PercentS3	3.2±0. 22^{bc}	3.8±0. 2^{ab}	4.4±0. 11^{a}	3.0±0. 23^{c}	3.8±0. 2^{ab}	3.4±0. 18^{bc}	3.4±0. 18^{bc}	3.8±0. 2^{ab}	2.8±0. 092^{c}	2.8±0. 092^{c}	<0.0 01	<0.0 01	0.0 15
25 PercentS4	3.2±0. 22^{bc}	3.7±0. 18^{ab}	4.2±0. 17^{a}	2.8±0. 092^{c}	3.7±0. 18^{ab}	3.4±0. 18^{bc}	3.4±0. 18^{bc}	3.4±0. 18^{bc}	2.8±0. 092^{c}	2±0. 018^{d}	<0.0 01	<0.0 01	<0.0 01

Values are means ±SEM,n =20 per treatment group.

Means in a row without a common superscript letter differ(<0.005) as analysed by two-way anova.

P×CI = Patients ×Characters interaction effect

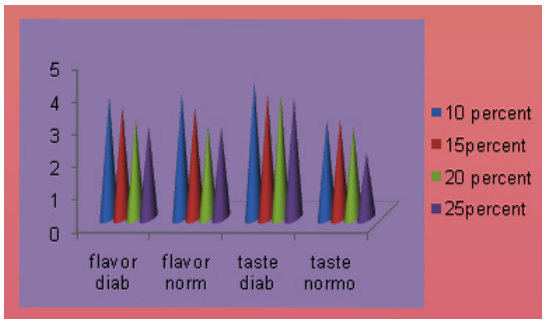

Fig. 1:Mean scores of flavor and taste

cent. The threshold for bitterness was perceived at 25 percent with a minimum (2.8±0.09) score. Systemic disorders like diabetes mellitus can secondarily cause taste changes through neuropathy [15]. In terms of taste perception again the thresh hold was decreased with a maximum score (4.2±0.17) at 10 per cent. A higher thresh hold for bitter taste was perceived at 25 per cent with a (3.7±0.17) minimum score. Sensory analysis techniques have been developed into powerful tool for understanding how sensory attributes emphasize product quality and consumer preferences. Modern techniques of sensory processing can be very useful for optimizing, new product[16].

The dhoklas had a high level of acceptability (fig-2) at 10 per cent of fenugreek incorporation in terms of appearance (4±0.25), colour (4±0.25) and texture (4.6±0.17). The product was less acceptable at 20 and 25 per cent with the lowest mean score.

Discussion

Fenugreek was found bitter in taste but incorporating treated fenugreek flour in recipes in varied concentration decreased the bitterness. The diabetics have decreased taste sensitivity for all taste parameters i.e. sweet, salt, sour and bitter[17].Asignificant difference (P<0.001) at 20

Fig. 2: Dhoklas with variation in fenugreek flour

and 25 per cent was found between diabetics and normoglycaemics. The post-hoc test reveals significant difference (P<0.005) in taste perception between diabetics and normoglycaemics at all four levels. The flavor perception also differed significantly (P<0.005) between various concentration in diabetics. The threshold for bitter taste was perceived slightly at 25 per cent level in diabetics. The product was acceptable at 10 per cent.

Conclusion

The study revealed a lower sensitivity to bitter flavor and taste modality in diabetics. The threshold for bitter taste was perceived only at higher concentration of 25 percent in, dhoklas. Treated fenugreek flour can be incorporated to about 25 per cent to reduce blood sugar in type II diabetes due to its higher threshold for bitter sensitivity.

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