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Khakra Bhel for Obesity

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Abstract: ***Obesity has emerged as one of the global health problems. Overweight and obesity are important determinants of health leading to adverse metabolic changes and increase the risk of non-communicable diseases. The factors attributing to increasing obesity are increased intake of high calorie foods that are low in vitamins, minerals, and micronutrients coupled with decreased physical activity. Individuals with low fat, ad libitum, complex carbohydrate (LFAL) diet produced substantial weight loss as compared with a low energy diet. Low fat and high fiber intake had shown to produce more weight loss as compared to high fat and low fiber diet. The objective of this study was to modify a snack product i.e. traditional bhel which is high in fat and low in fiber into a healthy snack to improve its fiber and fat content. The khakra as a modified snack was made from complex carbohydrate and high protein flour and corns, sprouted moong, cucumber were used to improve the fiber content of the traditional bhel. A sensory evaluation of the modified snack was conducted by using 5-point rating scale for analyzing the modified food product. The modified khakrabhel was found to have low fat and high fiber content as compared to the traditional bhel and thus can be beneficial for weight control***

Keywords: Obesity; Metabolic disorder; Modified food product; LFAL diet;.Khakra

1. Introduction

Obesity is an important public health problem in both developing and developed countries.(1)Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems.(1)Body weight is determined by an interaction between genetic, environmental, psychological factors acting through the physiological mediators of energy intake and expenditure.(2)Overweight and obesity are the fifth leading risk for global deaths and are linked to more death compared to malnutrition.(3)Lower BMI (body mass index) cut-offs of 23 and 25 kg/m^2 have been suggested by the World Health Organization (WHO) and IOTF for Asian Indian adults for overweight and obesity, respectively.(4)The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended.(3)Globally, there has been an increased intake of energy-dense foods that are high in fat, salt and sugars and a decrease in physical activity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanizationand thereby leading to overweight or obesity.(3)Traditional bhel is originally made from puffed rice and contains sev, bengal gram dal which is deep fried, also groundnuts which are high in fat. As health is a major concern, in day-to-day life, nutritious and health beneficial products are on high demand. Keeping this in mind, an innovative idea of making a khakrabhelwas introduced.Khakra'sare thin crackers originally made from mat bean, wheat flour and oil,originating from the state of Gujarat, as a part of Jain Gujarati cuisine in India.The khakra which was a base for bhel, is made from flours of wheat, ragi, jowar, bajra and green gram. Sprouted green gram, corn, cucumber were used to improve the fiber content of the bhel. The traditional bhel was modified to have low fat and improved fiber content.

2. Literature Survey

The association between the intakes of dietary fiber and whole- or refined-grain products and weight gain over time were studied.Weight gain was inversely associated with the intake of high-fiber, whole-grain foods but positively related to the intake of refined-grain foods, which indicated the importance of distinguishing whole-grain products from refined-grain products to aid in weight control.(5)

Randomized intervention studies comparing low fat diets to normal fat diets show that low fat diets prevent weight gain in normal weight subjects and produce weight loss in overweight individuals. This meta-analysis of ad libitum low fat interventions included 16 trials involving 1728 individuals. The difference in weight loss between intervention and control groups was 2.5 kg (95% CI, 1.5-3.5; P < 0.0001). Weight loss was positively related to pre-treatment body weight (r = 0.52, P < 0.05) and to reduction in percentage energy as fat (0.37 kg/%, P < 0.005). Extrapolated to a body mass index (BMI) ~ 30 kg/m^2, and assuming a 10% reduction in dietary fat, the predicted weight loss would be 4.4 kg (95% CI, 2.0-6.8 kg), which has been confirmed in subsequent studies.(6)

A low-fat diet, high in protein and fibre -rich carbohydrates, mainly from different vegetables, fruits and whole grains, is highly satiating for fewer calories than fatty foods. This diet composition provides good sources of vitamins, minerals, trace elements and fibre, and may have the most beneficial effect on blood lipids and blood-pressure levels. A reduction in dietary fat without restriction of total energy intake prevents weight gain in subjects of normal weight and produces a weight loss in overweight subjects, which is highly relevant for public health.(7)

Human studies published on dietary fiber and body weight which were reviewed and summarized. Epidemiologic support that dietary fiber intake prevents obesity is strong. Fiber intake is inversely associated with body weight and body fat. In addition, fiber intake is inversely associated

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with body mass index at all levels of fat intake after adjusting for confounding factors. Results from intervention studies are more mixed, although the addition of dietary fiber generally decreases food intake and, hence, body weight.(8)

Beta glucan, a soluble oat fiber is able to attenuate blood postprandial glycemic and insulinemic responses, to lower blood total cholesterol and low- density lipoprotein (LDL) cholesterol, and to improve high-density lipoprotein (HDL) cholesterol and blood lipid profiles as well as to maintain body weight. Thus, OβG intake is beneficial in the prevention, treatment, and control of diabetes and cardiovascular diseases.(9)

Comparison of a low-fat, ad libitum complex-carbohydrate diet with a low-energy diet in moderately obese women showed that individuals with low fat, ad libitum, complex carbohydrate (LFAL) diet produced substantial weight loss as compared with a low energy (LE) diet and is associated with improved palatability and QOL (quality of life) compared with an LE diet.(10)

There is increased association of obesity and diseases. These include Diabetes, Hypertension, Osteoarthritis, Pancreatitis, Cholelithiasis and dyslipidemia.(1)

The association between overweight and health problems of the lower extremities, i.e. osteoarthritis (OA), pain and disability was examined. Moderate overweight was associated with self-reported OA of the hip or knee, chronic pain of the lower extremities at one or more location(s) and disability in mobility. For obesity these odds were higher. Also, among those with OA, moderate overweight and obesity were associated with disability in mobility.(11)
Overweight and obesity were significantly associated with diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status.(12)

3. Methodology

Developing the Food Product

Applied food science and product modification denotes modifying a food product in order to improve its nutritive value and quality. The food product can be modified from a traditional food product or it can be newly developed.Product modification involves including ingredients that are beneficial and suitable for that specific condition. Thus deleting the unhealthy ingredients from the traditional recipe in order to make it nutritious. This paper aims to modify traditional bhel into a healthy khakrabhel to lower its fat content and to improve the fiber content.

- Puffed rice in the traditional bhel was replaced by khakra. This multiflourkhakra was made from flours of ragi, jowar, bajra, wheat and green gram. The simple carbohydrate in the traditional bhel was replaced by complex carbohydrate in khakrabbhel.
- Sprouted green gram were used to improve protein content of the food product and along with corn and cucumber, it improve the dietary fiber content.

Table 1: Ingredients for traditional bhel

Ingredients	Amount (in grams)
Puffed rice	20
Onion	25
Tomato	25
Groundnut	10
Chana dal	5
Sev	10
Chat masala	
Salt to taste	

Table 2: Ingredients for khakrabhel

Ingredient	Amount (in grams)
Wheat flour	5
Jowar flour	10
Bajra flour	5
Ragi flour	5
Moong flour	5
Onion	25
Tomato	25
Cucumber	25
Corn	25
Sprouted moong	10
Garam masala	½ tsp
Chat masala	¼ tsp
Jeera (cumin seeds)	½ tsp
Salt to taste	

Table 3: Ingredients for green chutney and sweet chutney used in both the bhel

For green chutney

Ingredients	Amount (in grams)
Mint leaves	5
Coriander leaves	5
Lemon juice	½ tsp
Garlic	1 clove
Green chilli	1 nos
Salt to taste	

For sweet chutney

Ingredients	Amount (in grams)
Jaggery	5
Tamarind	5
Water	25ml

4. Method of Preparation

For khakra

- Take all the flours.
- Add garam masala, pinch of chat masala and jeeraand salt to it and mix with water.
- Knead it like dough.
- Roll it like thin roti.
- Cook it on flat pan to make khakra.
- Make sure it is thin as cracker. Once it is made, break it into small pieces.

For chutney

- Green chutney-grind all the ingredients to make it paste.
- Sweet chutney-soak tamarind and jaggery in water and make it paste by smashing.

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For bhel

- Take a bowl.
- Add listed amount of onion, tomato, corn (boiled), sprouted moong (partially boiled), cucumber into the bowl and add to it both green and sweet chutney,salt to taste,chat masala and mix it well.
- To this mixture, add the small pieces of khakra& Mix well.
- Serve it in a bowl.Garnish with either coriander leaves or tomato or cucumber slice.

5. Results and Discussion

The nutritional values of the traditional bhel and modified bhel i.e. khakrabhel was obtained, calculated and compared. Calculation with reference to Nutritive value of Indian foods, NIN was done for standardized product and it was compared with the nutritional values of original product. (13) The energy content of traditional bhel (217 kcal) was found to be higher than that of khakrabhel (207 kcal). The carbohydrate content of traditional bhel (30.6 g) was lower than that of khakrabhel (41.9 g). The protein content of traditional bhel (7.5g)was found to be lower than that of khakrabhel (8.1g).

Table 5: Nutritional composition of traditionalbhel

Ingredients	Amount	Energy(kcal)	Carbohydrate(g)	Protein(g)	Fats(g)	TDF(g)
Puffed rice	20g	67	14.6	1.8	0.2	0.82
Onion	25g	6	1.25	0.3	0.05	0.63
Tomato	25g	7	1.25	0.3	0.05	0.43
Groundnut	5g	33	1	1	2.4	0.55
Sev	10g	57	4.3	1.76	3.6	-
Chana dal	5g	23	2.75	0.95	0.9	0.8
Chutney:						
Mint	5g	2	0.2	0.2	0.03	0.3
Coriander	5g	2	0.2	0.2	0.03	0.3
Green chilli	1nos.	-	-	-		
Lemon juice	½ tsp	-	-	-		
Tamarind	5g	-	-	-	-	-
Jaggery	5g	20	5	-	-	-
	TOTAL	217kcal	30.6g	7.5g	7.3g	3.8g

Table 6: Nutritional composition of khakrabhel

Ingredients	Amount	Energy(kcal)	Carbohydrate(g)	Protein(g)	Fats(g)	TDF(g)
Wheat flour	5g	17	3.6	0.45	0.06	0.63
Ragi flour	5g	17	3.6	0.45	0.06	0.6
Jowar flour	10g	33	7.2	0.9	0.12	0.97
Bajra flour	5g	17	3.6	0.45	0.06	0.57
Moong flour	5g	16	2.9	1.13	0.1	0.8
Onion	25g	6	1.25	0.3	0.05	0.63
Tomato	25g	7	1.25	0.3	0.05	0.43
Cucumber	25g	6	1.25	0.3	0.05	0.65
Corn	25g	31	6.12	1.2	0.2	2.9
Sprouted moong	10g	33	5.8	2.26	0.2	1.67
Salt	1g	-	-	-	-	-
For chutney (same as traditional bhel)		24	5.4	0.4	0.06	0.6
	TOTAL	207	41.9g	8.14g	1g	10.4g

The fat content of traditional bhel (7.3 g) was higher than that of khakrabhel (1 g), thus the modified bhel had lower fat content. The fiber content of traditional bhel which was 3.8g was improved to have high fiber content in the modified bhel i.e. 10.4g. A study conducted by Shah et.al showed that low fat, ad libitum, complex carbohydrate (LFAL diet) produced substantial weight loss as compared to low energy diet.(10)Thus, the modified food product i.e khakrabhel had low energy, high protein, low fat and high fiber content.

Table 7: Comparison between traditional and modified bhel

Sr.No.	Nutrient	Unit	Khakrabhel	Traditional bhel
1	Energy	Kcal	207	217
2	Carbohydrate	G	41.9	30.6
3	Protein	G	8.14	7.5
4	Fats	G	1	7.3
5	TDF	G	10.4	3.8

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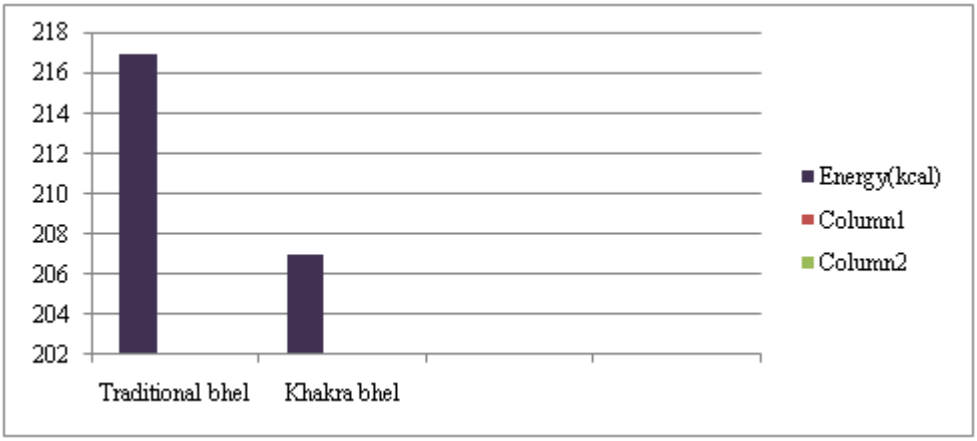


Figure 1: Graph for comparison between energy content of traditional bheland khakrabhel

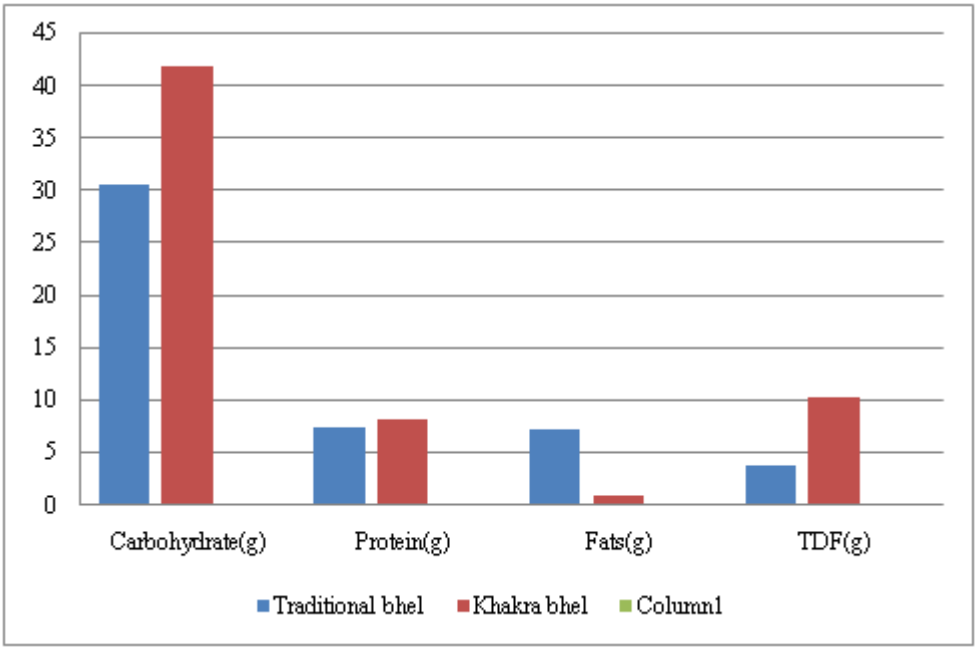
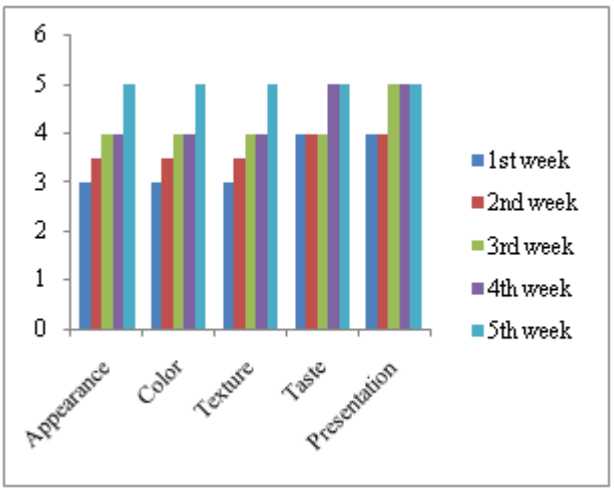


Figure 2: Comparison of nutrients in traditional and modified bhel.

Sensory Evaluation

Khakrabhel was subjected to sensory evaluation based on 5 point scale for appearance, color, texture, taste and presentation using 30 naïve panel members and 3 expert panel members. The score were based on the criteria, 5- Excellent; 4- Very good; 3- Good; 2-Satisfactory; 1-Not good.There was a gradual improvement in the product week after week. The product which was made by keeping obese patients in mind was accepted by all the panel members and experts as well, initially the product was marked as "very good" and later it was marked as "Excellent" with the help of 5 point rating scale method.



Graph of sensory evaluation

6. Conclusion

The need to eliminate food items from diet is not necessary if altered methods of cooking are used, also addition of functional foods adds to the health benefits. As seen above,

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by modification of some ingredients, a snack can be still appealing to appetite as well as healthy.Obesity is an important public health problem in both developing and developed countries. It increases morbidity and mortality in different disease association both among child and adults and in both sexes. However strict diet control in relation to height and weight of the individual age, physical activity, less intake of chunk and high calorie food and increased consumption of vegetables, antioxidants, polyunsaturated fat will decrease the incidence of obesity.The modified khakrabhel had low fat, high carbohydrate, high protein, and high fiber content. Thus, it can concluded that the modified khakrabhel can be consumed by obese or overweight individuals for better weight control.

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