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Evaluation of the basic ingredients and processing conditions for preparation of Khokha

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ABSTRACT
The present study was undertaken to evaluate the basic ingredients and processing conditions for preparation of khokha. Optimization of basic formulation and processing conditions were done for preparation of Khokha. On the basis of preliminary trials, two flour viz. Moth flour and Bengal gram flour were optimized for preparation of khokha. Three different combination of these two flours were taken viz. 1.) 75% moth flour and 25% Bengal gram flour, 2.) 50% Moth flour and 50% Bengal gram flour and 3.) 25% Moth flour and 75% Bengal gram flour for formulation of Khokha. Khokha prepared with 75% Moth flour and 25% Bengal gram flour had better efficacy in terms of proximate, physico-chemical and sensory attributes and had higher protein content than other combination due to increased level of Moth flour. Cooking time of 4±0.5 mins. and cooking temperature of 180±5°C was optimized for deep frying of khokha.
Keywords: *Khokha, Bengal flour, Moth flour, sensory attributes proximate parameters.*

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INTRODUCTION

In modern era, food habits have been changed, snacks are being relished by all age group persons whether they are children or young ones due to their specific flavour, different varieties and particular taste. In the emerging world, people are no longer pleased with the traditional foods. They are in seek of such foods which not only satisfy their nutritional requirement but concomitantly are convenient to prepare. Snacks are light, ready to eat foods. American heritage dictionary describes a snack as a "hurried or light meal" or "food eaten between meals. Most of the snacks are generally cereal based which are not only the poor source of protein but also having poor nutritional quality [1]. Usually snacks are having small serving size, easily transferable, and able to satisfy short term hunger [2]. Snacks are generally formulated from different type of pulses and flours, which are source of dietary fibre. Snack consumption depends upon various factors such as serving in gathering, psychological or emotional factors, socio-cultural traditions, and genetic factors. Serving of snacks at a meeting, at the beginning of parties, snacks time session in conferences or seminars has become the trend of society. Zizza et al. [3] described that snacks consumption contributed to 25 per cent of total energy and 14 per cent of total daily protein. As they contain low moisture content so it's easy to store at room temperature without any risk of microbial spoilage. With the ever-increasing focus on a healthy and balanced diet, the development of nutrient dense and energy less snacks (providing essential nutrients and exerting beneficial effect on consumer's health along with functional properties) is the top priority of the snack industry.

MATERIAL AND METHODS

The present investigation was carried out at the Department of Livestock Products Technology, SKUAST-J, R. S. Pura.The following composition of spices formula was followed and is described in Table - 1. The spices were purchased from local market. After removal of extraneous matter, all spices were dried overnight in an oven at 50°C and then ground in grinder to form powder. The coarse particles were removed by using a sieve and then fine powder was stored in airtight container for further use.

Table No. 1 Composition of spices mix

S.No.	INGREDIENTS	PERCENT
1.	Dried Ginger (*Zingiber officinale*)	20
2.	Black Cardamom (*Amomum subulatum.)*	05
3.	Mace (javitri) (*Myristica fragrans*)	03
4.	Cinnamon (*Cinnamomum verum*)	07
5.	Bay leaves (*Laurel noblis*)	20
6.	Cloves (*Syzygium aromaticum*)	04
7.	Nutmug (jayfal) (*Myristica fragrans*)	03
8.	Black pepper (*Piper nigrum*)	20
9.	Peepal (*Piper longum*)	08
10.	Black cumin (*Cuminum cyminum*)	10
	Total	100

Refined "Rajdhani brand" Bengal gram flour was purchased from local market of R.S. Pura. Moth flour was purchased from Bacchu flour mill in Bikaner market. All the chemicals used were of analytical grade and were obtained from standard firms (Qualigens, CDH, Hi- media etc.). BULBUL brand name oil was used having the nutritional specification given in the table was purchased from local market of R.S. Pura, Jammu.Aluminum laminated pouches of 12 micrometer thickness were purchased from local market of Jammu.

Methodology for preparation of khokha

Preparation of dough

The Bengal gram flour, Moth flour, spice mixture, tiger longi mirch, salt, thymol (ajwain), cumin seed, baking powder, refined oil and lukewarm water was added in a bowl to make dough. Three different type of percentage of both flour was used.

Filling of manual extruder

The obtained dough was filled in manual extruder and by manual rotation of its handle, khokha of desired shape was obtained.

Cooking of khokha

Frying method was employed for cooking of khokha. Khokha obtained from manual extruder were directly in the mustard oil of "BULBUL" brand name having the nutritional value.

Table No. 2: Optimization of basic formulation for preparation of khokha

Ingredients	**C_1**	**C_2**	**C_3**
Moth flour (MF)	69	46	23
Bengal gram flour (BGF)	23	46	69
Spice mix. (%)	0.88	0.88	0.88
Longi mirch (%)	1.12	1.12	1.12
Ajwain (%)	0.88	0.88	0.88
Jeera (%)	0.52	0.52	0.52
Salt (%)	4.2	4.2	4.2
Baking powder (%)	0.4	0.4	0.4
Total	100	100	100
Refined oil (ml)	10	10	10
Luke warm water(ml)	50	50	50

***C_1: 75%MF + 25%BGF, * C_2: 50%MF + 50% BGF, * C_3 : 25%MF + 75% BGF**

RESULTS

Standardization of level of Bengal gram flour and Moth flour, cooking time and cooking Temperature

The table no. 3 represents the mean values of physico-chemical properties and proximate composition of khokha prepared by 3 different combinations of Bengal gram flour and moth flour. The mean value of pH in C3 (6.74 ± 0.03) is significantly ($p<0.005$) higher as compared to both C1 (6.61±0.009) and C2 (6.65±0.02).

The mean value of fat in C3 (32.60±0.32) is significantly ($p<0.05$) higher as compared to C1 (30.89±0.11) and C2 (31.14±0.42). Protein content of C1 (16.49±0.14) is significantly ($p<0.005$) higher from both C2 (15.88±0.14) and C3 (14.4±0.21) as well as C2 is significantly ($p<0.05$) different than C3. Ash content of C1 (2.48±.01) is significantly higher than C2 (2.25±0.01) and C3 (2.04±.03). No significant difference ($p>0.05$) was observed in moisture content in C1 (1.58±0.05), C2 (1.51±0.02) and C3 (1.61±0.02) and in

carbohydrate content in C1 (48.54±0.12), C2 (49.21±0.54) and C3 (49.29±0.52).

Table No. 3:Effect of different levels of Bengal gram flour and Moth flour on proximate parameters and pH of khokha (Mean±SE)*

Parameter	Control -1 (C_1)	Control-2 (C_2)	Control-3 (C_3)
Moisture	1.58 ± 0.5	1.51 ± 0.02	1.61 ± 0.02
Fat	30.89 ± 0.11^{a}	31.14 ± 0.42^{a}	32.60 ± 0.32^{b}
Ash	2.48 ± 0.016^{c}	2.25 ± 0.018^{b}	2.04 ± 0.030^{a}
Protein	16.49 ± 0.143^{c}	15.88 ± 0.144^{b}	14.4 ± 0.210^{a}
Carbohydrate	48.54 ± 0.12	49.21 ± 0.54	49.29 ± 0.52
pH	6.61 ± 0.009^{a}	6.65 ± 0.029^{a}	6.74 ± 0.036^{b}

Mean ± SE* with different superscripts in a row wise (lower case alphabet) differ significantly ($p<0.05$). n = 6 for each treatment

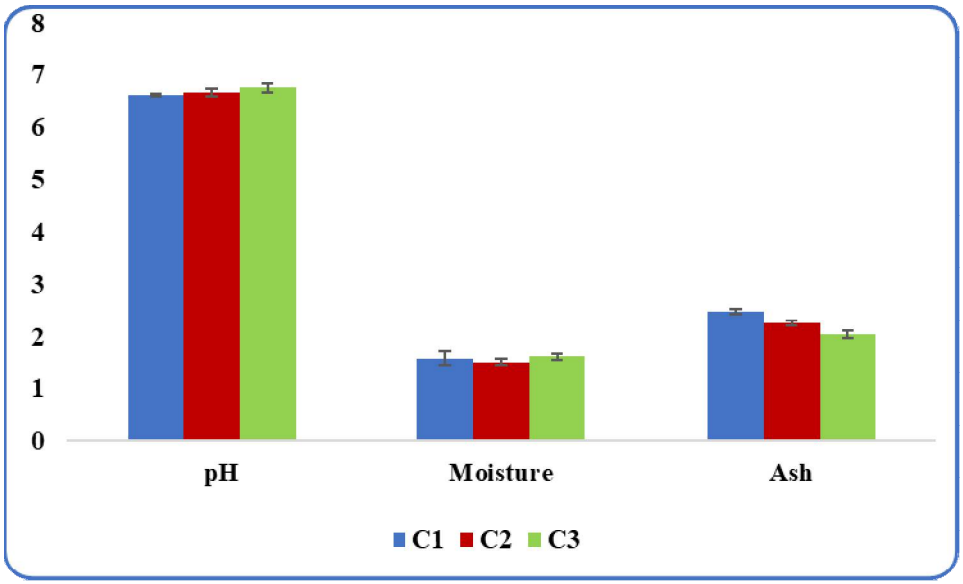

Fig. No. 1:Effect of different levels of Bengal gram flour and Moth flour on proximate parameters (Moisture, Ash) and pH of khokha

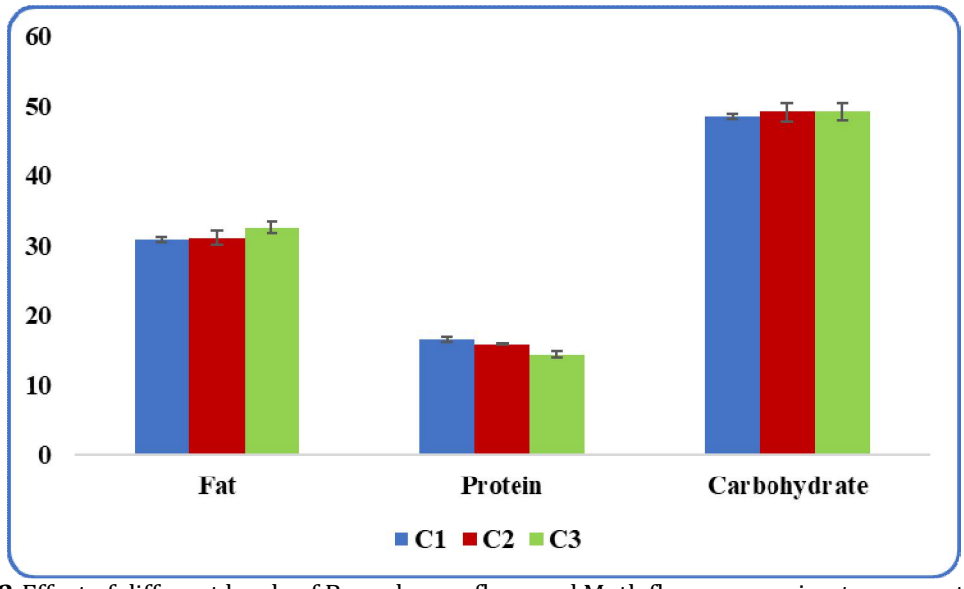

Fig. No. 2: Effect of different levels of Bengal gram flour and Moth flour on proximate parameters (Fat, Protein & Carbohydrate) of khokha.

Table no. 4 represents the mean value of sensory attributes of khokha prepared from 3 different

combinations viz. C1, C2 and C3. The mean score of colour and appearance C1 (8.16± 0.03) was significantly higher (p<0.05) from C2 (7.37±0.06) and C3 (6.95±0.05). Flavour of C1 (8.11±0.04) was significantly higher (p<0.05) than C2 (7.2±0.07) and C3 (7.01±0.07). The mean value of texture of C1 (8.10±0.06) was significantly higher (p<0.05) than C2 (7.70±0.06) and C3 (7.01±0.06). The mean score of oiliness in C1 (8.07±0.05) was significantly higher (p<0.05) than C2 (7.30±0.07) and C3(6.99±0.07). Crispiness of C1 (8.20±0.04) was significantly higher (p<0.05) than C2 (7.2±0.08) and C3 (7.0±0.07). The mean score of saltiness for C1 (8.05±0.04) was significantly higher (p<0.05) than C2 (7.4±0.06) and C3 (7.3±0.05). The overall acceptability for C1 (8.28±0.03) was significantly higher than C2 (7.57±0.07) and C3 (7.0 ± 0.06).

Table No.4:Effect of different levels of Bengal gram flour and Moth flour on Sensory attributes of khokha (Mean±SE)*

Parameter	Control-1 (C_1)	Control-2 (C_2)	Control-3 (C_3)
Colour & appearance	8.16 ± 0.03^{c}	7.37 ± 0.06^{b}	6.95 ± 0.05^{a}
Flavour	8.11 ± 0.04^{c}	7.2 ± 0.07^{b}	7.01 ± 0.07^{a}
Texture	8.10 ± 0.06^{c}	7.70 ± 0.06^{b}	7.01 ± 0.06^{a}
Oiliness	8.07 ± 0.05^{c}	7.30 ± 0.07^{b}	6.99 ± 0.08^{a}
Crispiness	8.20 ± 0.04^{b}	7.2 ± 0.08^{a}	7.00 ± 0.07^{a}
Saltiness	8.05 ± 0.04^{b}	7.4 ± 0.06^{a}	7.03 ± 0.05^{a}
Overall acceptability	8.28 ± 0.03^{c}	7.57 ± 0.07^{b}	7.00 ± 0.06^{a}

Mean ± SE* with different superscripts in a row wise (lower case alphabet) differ significantly (p<0.05).

n = 21 for each treatment

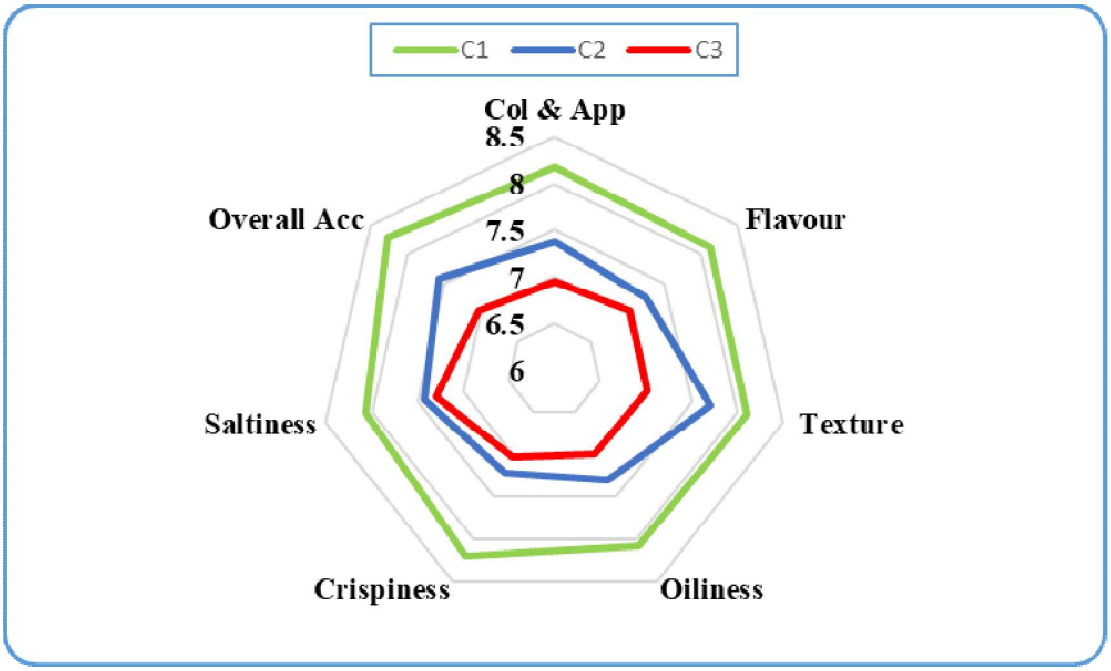

Fig. No. 3: Effect of different levels of Bengal gram flour and Moth flour on Sensory attributes of khokha

Table no. 5 represents the mean value of sensory attributes of khokha prepared at 3 different temperatures, Khokha were kept for cooking to reach a temperature of 160±5°C, 180±5°C and 200±5°C. It was observed that colour and appearance, flavour, texture, oiliness, crispiness, saltiness and overall acceptability were found significantly higher (p<0.05) when they were kept for cooking at 180°C±5.

Table No. 5:Effect of cooking temperature on sensory attributes of khokha (Mean±SE)*

Parameter	160±5ºC	180±5ºC	200±5ºC
Colour & appearance	6.48 ± 0.05^{a}	7.82 ± 0.10^{b}	6.57 ± 0.06^{a}
Flavour	6.52 ± 0.04^{a}	7.60 ± 0.08^{b}	6.43 ± 0.06^{a}
Texture	6.69 ± 0.07^{a}	7.65 ± 0.09^{b}	6.59 ± 0.07^{a}
Oiliness	6.57 ± 0.12^{a}	7.70 ± 0.12^{b}	6.52 ± 0.06^{a}
Crispiness	6.35 ± 0.07^{a}	7.52 ± 0.12^{c}	6.84 ± 0.06^{b}
Saltiness	6.75 ± 0.11^{b}	7.56 ± 0.11^{c}	6.45 ± 0.06^{a}
Overall acceptability	6.31 ± 0.04^{a}	7.31 ± 0.11^{c}	6.68 ± 0.31^{b}

Mean ± SE* with different superscripts in a row wise (lower case alphabet) differ significantly ($p<0.05$). n = 21 for each treatment.

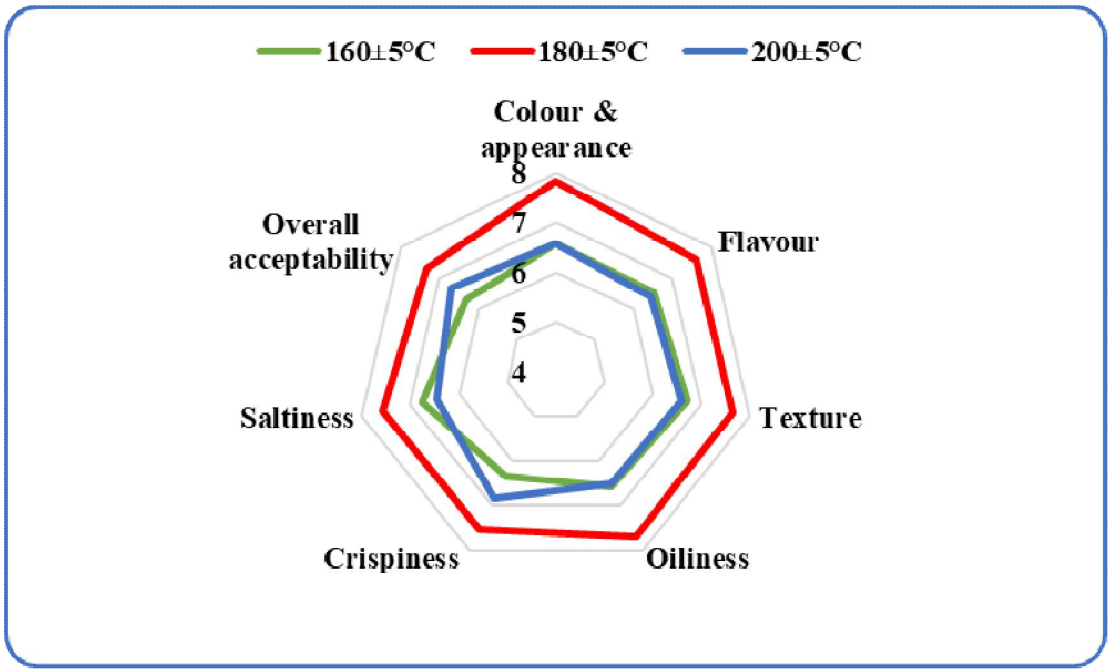

Fig. No. 4: Effect of cooking temperature on sensory attributes of khokha

Table no. 6 represents the mean value of sensory attributes of Khokha cooked for duration of 3±0.5 min, 4±0.5min and 5±0.5min respectively. The mean value of colour and appearance, flavour, texture, oiliness, saltiness and overall acceptability was significantly ($p<0.05$) higher for Khokha cooked for 4±0.5min. The mean value for crispiness of Khokha was significantly ($p<0.05$) higher when cooked for 4±0.5min than 5±0.5min.

Table No. 6:Effect of cooking time on the sensory attributes of khokha (Mean±SE)*

Parameter	3 ± 0.5mins.	4 ± 0.5mins.	5± 0.5mins.
Colour & Appearance	6.57 ± 0.06^{a}	6.95 ± 0.05^{b}	6.40 ± 0.07^{a}
Flavour	6.43 ± 0.06^{a}	7.01 ± 0.07^{b}	6.38 ± 0.06^{a}
Texture	6.59 ± 0.07^{b}	7.01± 0.06^{c}	6.29 ± 0.05^{a}
Oiliness	6.52 ± 0.06^{a}	6.99 ± 0.08^{b}	6.43 ± 0.06^{a}
Crispiness	6.84 ± 0.06^{b}	7.02 ± 0.07^{b}	6.56 ± 0.06^{a}
Saltiness	6.45 ± 0.06^{b}	7.3 ± 0.05^{c}	6.24 ± 0.07^{a}
Overall acceptability	6.68 ± 0.06^{a}	7.03 ± 0.06^{b}	6.55 ± 0.06^{a}

Mean ± SE* with different superscripts in a row wise (lower case alphabet) differ significantly ($p<0.05$). n = 21for each treatment.

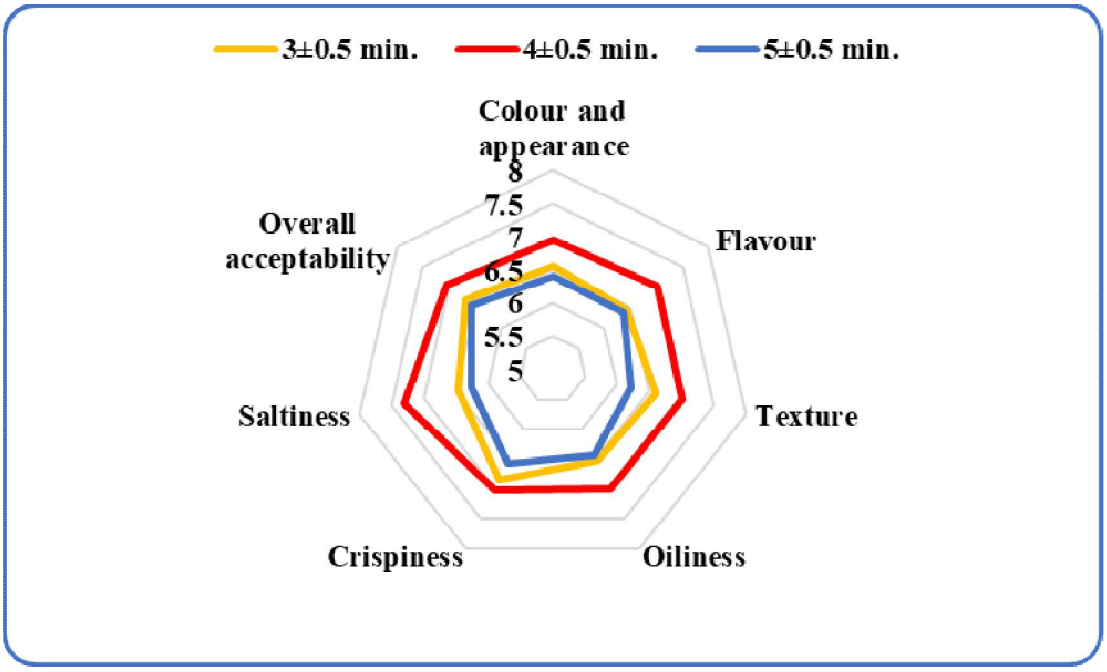

Fig. No. 5: Effect of cooking time on the sensory attributes of khokha

DISCUSSION

Evaluation of the basic ingredients and processing condition for preparation of Khokha.

The khokha were prepared by incorporating different levels of Moth flour and Bengal gram flour. C1 (75% Moth flour + 25% Bengal gram flour), C2 (50% Moth flour + 50% Bengal gram flour) and C3 (25% Moth flour + 75% Bengal gram flour). The khokha thus prepared were analyzed for various physico-chemical, sensory parameters, cooking temperature and cooking time.

Physico-chemical characters

1. pH

The mean value of pH in C3 (6.74 ± 0.03) is significantly ($p<0.005$) higher as compared to both C1 (6.61±0.009) and C2 (6.65±0.02). The pH of khokha increased gradually with the increase in level of incorporation of Bengal gram flour in the formulation. Increase in pH with increase in the flour level might be attributed to basic nature of flour used in the formulation. Similar findings were observed by Prabhakara and Janardhana [4], Kumar and Sharma[5] and Bhat and Pathak [6] in meat products extended with legume flours.

2. Proximate composition of khokha

A gradual increase in ether extract of khokha was recorded at all the level of incorporation of Bengal gram flour. At 75 per cent level of Bengal gram flour incorporation, Ether extract (fat) was highest. This increase might be due to higher fat absorption upon frying. Similar finding was observed [7]. where the snacks prepared from Bengal gram flour was having higher fat content rather than multiple level of different flours. Kayacier et al. [8] has reported highest oil absorption in chips made up with Bengal gram flour when he compared different type of legume flour.No significant difference was observed in moisture content of C1, C2 and C3. Such type of similar result was observed by Yousaf et al [9]. in wheat flour cookies supplemented with Bengal gram flour. No significant difference was seen in cookies with increased level of gram flour. The moisture content C3 was found 1.61. The low moisture content was found due to dehydration during deep frying of khokha. Similar results were obtained by Omar et al. [10] in snacks prepared with high protein pulses in multipurpose flour. Our finding was in accordance with Asmaa et al [11] who reported that moisture content was reduced in chicken sausages during deep frying.The crude protein content of khokha decreased significantly ($p<0.05$) with decrease in level of Moth flour from C1 to C3. This might be due to high protein content of Moth flour than Bengal gram flour. The ash content was decreased significantly with decreased level of Moth flour. This might be due to higher mineral content in Moth flour than Bengal gram flour. Similar findings were observed by Siddique et al. [12] in biscuit prepared from composite flour and containing Moth flour. With increased in level of Moth flour the ash content and protein content was increased.There is no significant difference was seen in carbohydrate content in C1, C2 &C3 but non significantly there was gradual increasing in carbohydrate content, seen from C1 to C3. This might be due to almost similar carbohydrate content found in Moth

flour and Bengal gram flour.

3.Sensory parameters of khokha

Color and appearance of food includes all its visible attributes and has becomes the consumer's only consideration when evaluating a food product. The score of C1 was significantly higher than C2 & C3. It increased significantly with increased level of incorporation from 25 per cent to 75 per cent Moth flour. This increase in color and appearance could be attributed to bright creamy color of Moth flour just like rice flour. Similar results were obtained by Omar and Sonkar [13] who found that the panelist preferred the light bright color snacks.Flavor is the sensory impression of a food and is determined by the mainly by the sense of taste and flavor. The score of C1 was significantly higher than C2 & C3. It increased significantly with increased level of incorporation from 25 per cent to 75 per cent Moth flour. It might be due to beany flavour associated with legumes [14] .Texture is the property of food that are sensed in touch in the mouth and the hands. There was significant difference in texture of C1, C2 and C3. There was decrease in texture score also with decrease level of Moth flour. Decrease in dietary fiber content and changed firmness of substituted fat could have been reason for lowering of textural scores. Oiliness is the property of fried food that are sensed oily mouthfeel and sticky on hand touch. There were significant low values of C3 for oily appearance and oily mouthfeel, which is highly undesirable in Khokha. This might be due to more oil absorption on surface of khokha having more percentage of Bengal gram flour. Our findings are in accordance with Ravi and Susheelamma [15] who reported that due to increase in Bengal gram flour concentration in batter oily appearance was increased. Crispiness is one of the most important and desirable attributes of extruded products [16]. It perceived through a combination of kinesthetic, tactile, visual and auditory sensation and represents the key sensory attributes of dry snacks products [17]. The highest value was observed by C1. The type of starch used can affect how hard the initial bite is and how loud the sound is that the snack makes when it is bitten. It might be due to higher gelatinization of Moth flour. Singh and Nath [18] evaluated the higher binding property of Moth bean starch.Saltiness is the sensory parameter used mostly for snacks as they have made with various spices and salt. Score for saltiness was higher for C1. It might be due to higher mineral content found in Moth flour compared to Bengal gram flour.

The overall acceptability of the product depends upon all sensory parameter. significantly higher score was observed for C1. It might be due to higher score of all sensory attributes for C1. Hence, (75% Moth flour + 25% Bengal gram flour) C1 was found optimum for the preparation of khokha.

Cooking temperature

The various sensory attributes viz. color and appearance, flavour, texture, oiliness, crispiness, saltiness and overall acceptability was found highly significant for khokha fried at 180±5℃. Kumar et al. [19] also found similar optimized temperature for deep fried snacks.

Color and appearance of khokha cooked at 200 ±5℃ was dark brown in color. This might be due to maillard reaction. The changes in the color of fried products are as a result of the maillard reaction that depends on the content of reducing sugars and amino acids at the surface, as well as the temperature and frying time as reported by Marquez and Anon [20]. Color is considered as one of the most important quality parameters of deep fat fried snacks. As the frying temperature increased, the lightness parameter of the fried product decreased, whereas the redness and yellowness parameters increased for the same frying time [21-22].

The texture and flavour was significant higher for khokha fried at 180 ±5℃ temperature. This might be due to Protein-starch interactions which partially contribute to the characteristic flavor and texture of such fried products. Further, heating enhances the complexity of protein-starch interactions and when temperature rise to 200±5℃ the flavour and texture becomes undesirable.

One important quality parameter of desirable sensory characteristic of fried foods is crispness because it signifies freshness and high quality. Crispiness score was found significantly higher for khokha, fried at 180±5℃ temperature. Breaking force reduces if the fried snack becomes crispier and this could be made possible by increasing the frying time and temperature [19]. This is in agreement with Rossell [23] who reported that at higher frying temperature, crust formation is enhanced. At 160±5℃ temperature, the score was found significantly lower. It might be due to lack of formation of crust that is responsible for crispiness at higher temperature.

Oiliness score was significant higher for khokha that was fried at 180±5℃ temperature. While score for khokha that was fried on 160±5℃ temperature was significant lower means was undesirable for consumer. The snacks having low crispness were found oilier [19]. The pore size distribution in the sev samples and/or mass of air developed during frying process would result in higher oil content due to high capillary pressure within the pores during cooling [24].

Over all acceptability was found highly significant for khokha which was fried on 180±5℃ temperature. As all sensory parameter found higher score for this temperature. Hence, the frying temperature 180±5℃

was optimized for preparation of khokha as well as for preparation of meat khokha in further experiments.

Cooking time

The various sensory attributes viz. color and appearance, flavour, texture, oiliness, crispiness, saltiness and overall acceptability was found highly significant for khokha fried for 4±0.5mins. Increased duration of deep oil frying of the khokha might have resulted in decreased color and appearance and flavour score.
Oiliness score for khokha fried for 3±0.5 mins., was found significant lower score than 4±0.5 mins. Oil content of the snacks reduced with increased frying time. The results may be explained by the formation of a crust, which acts as a barrier to reduce the oil uptake. The crust formation prevents the inside water from escaping to the outside and consequently preventing further oil uptake. Oil absorption is affected by the porosity of the product. Porosity increases during frying and longer frying times resulted in more uniform pore size distribution [25].
The crispiness score was found less for khokha cooked for 3±0.5mins than 4±0.5mins. Greater duration of deep fat frying might have improved the crispiness of snacks. Fan et al. [26] reported greater duration of deep fat frying improve crispiness of snacks.
The overall acceptability was significantly higher for khokha cooked for 4±0.5mins. As all sensory parameter found higher score for this cooking time. Hence, 4±0.5mins. was taken optimum as cooking time for preparation of khokha

CONCLUSION

The khokha were prepared by incorporating different levels of Moth flour and Bengal gram flour. C1 (75 % Moth flour + 25 % Bengal gram flour), C2 (50 % Moth flour + 50 % Bengal gram flour) and C3 (25 % Moth flour +75 % Bengal gram flour). The pH of khokha increased gradually with the increase in level of incorporation of Bengal gram flour in the formulation. A gradual increase in ether extract of khokha was recorded at all the levels of incorporation of Bengal gram flour. At 75 per cent level of Bengal gram flour incorporation, Ether extract (fat) was highest. No significant difference was observed in moisture content of C1, C2 and C3. The crude protein content of khokha decreased significantly ($p<0.05$) with decrease in level of Moth flour from C1 to C3. No significant difference was seen in carbohydrate content in C1, C2 and C3 however, there was gradual increase in carbohydrate content with increase in Bengal gram flour. All the sensory attributes increased significantly with increased level of incorporation from 25 per cent to 75 per cent Moth flour. The various sensory attributes were found highly significant for khokha fried at 180±5℃ temperature and all sensory attributes was found highly significant for khokha fried for 4±0.5mins. Increased duration of deep oil frying of the khokha might have resulted in decreased colour and appearance and flavour score. Based on the results obtained, a combination of 75 per cent Moth flour and 25 per cent Bengal gram flour, cooking temperature of 180±5℃ and cooking time of 4±0.5mins. were optimized.

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