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Development of spent hen Chicken Chakli added with wheat and Bengal gram flour

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Abstract
Present study was carried to find out suitable combination of wheat and Bengal gram flours to chicken meat for the preparation of chicken Chakli. Several preliminary trials were conducted to optimize the best level of flours in the formulation chicken Chakli. Chakli was prepared by mixing minced chicken meat and different levels of flours (20%, 30%, 40% and 50% in control). Best levels of flours in chicken Chakli was decided on the basis of sensory evaluation, physico-chemical and proximate composition. Optimum sensory scores in terms of appearances, flavor, juiciness, texture and overall acceptability recorded in chicken Chakli incorporated with 40% wheat and Bengal gram flour separately. pH and oil absorption significantly increased (p<0.05) with addition of flours. Cooking yield decreased with increase in levels of flours. Proximate composition such as moisture, protein, fat, and ash decreased with increase in levels of flours. Hence, it is concluded that incorporation of 40% wheat and Bengal gram flours separately found optimum for the preparation of better quality of chicken Chakli.

Keywords: Spent, Chicken, Chakli, Bengal, gram

Introduction
India has a rich tradition of traditional meals, and its citizens use these delicacies for a variety of purposes, including as food, a source of income, and many other things. Snacks are incredibly popular all throughout the world since they are inexpensive, portable, and come in a broad variety. Because it is less expensive and a superior source of animal protein, poultry meat is preferred to meat from other species. Value addition is a crucial part of the food processing business, particularly in the export-focused processing sector because to increased knowledge of highly valuable foreign currency. About 20-50 percent population in the Asian countries consumes wheat in the form of various snacks products, which is lack in protein and minerals (Hou, 2020) [5]. The main component of Chakli is cereal, which makes them deficient in protein and, consequently, in vital amino acids like tryptophan, threonine, and lysine. The nutritional value of snacks, particularly in terms of amino acids, flavour, and taste, can be improved by using meat in the preparation. Chakli is extruded based deep-fried snacks available in variety of shape and preparation. In several Indian states, "Chakli" is referred to by various names. "Jantikalu" is used in Telangana, "Chakkuli" in Karnataka, "Murukku" in southern India, and "Chakralu" in Andhra Pradesh. "Chakri" or "Chakli" are used in Gujarat and Maharashtra respectively. Chakli is prepared in homes and sold for profit on the streets in a variety of forms (Tanna *et al.*, 2020) [16].
As per ICMR analysis, everyone consuming 10.5 kg of poultry meat and 180 eggs annually but the average person consume only 3.5 kg of meat and 30 eggs (ICMR, 2019) [6]. Now a days peoples in India are more conscious about their health so they demanding meat products with low fat and high fiber diet. Due to its short shelf life and severe perishability, chicken meat is rarely utilized in flour-based snacks. Wheat is most commonly consumed in the form of cereal grains. It is made from (*Triticum aestivum*), a species of grass that is found in numerous variations all over the world. Due to the inclusion of the protein gluten, which can cause an adverse immunological reaction, it is quite contentious. If added at the proper proportions, starch, such as wheat flour, can also be used to boost the gel strength of meat products, enhancing the product yield (Serdaroglu *et al.*, 2005) [14].

Bengal Gram (*Cicer arietinum*), also known as besan, is a flour made from pounded chickpeas. It is a good source of fibre, protein, and vitamins. In order to develop Chakli use of chicken meat enrich the nutritional aspect as well as success of chicken industry. Thus the main objective of this experiment is to find out best combination of flours to chicken meat ratio for development of chicken Chakli.

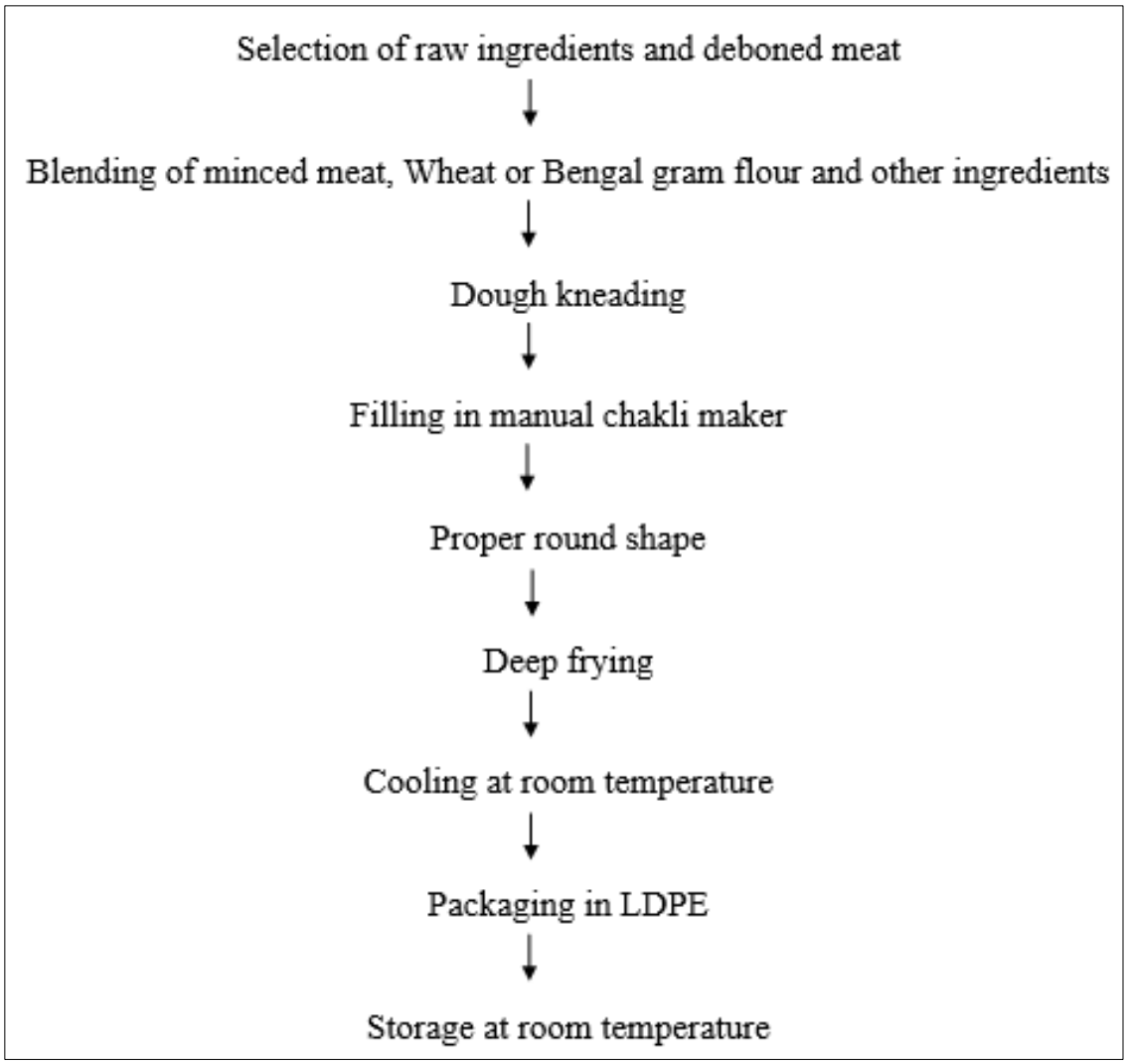
Materials and Methods

Chicken Chakli was prepared as per the method used by (Tanna *et al.*, 2020) [16] with slight modification. Frozen deboned spent hen chicken meat was chopped into pieces and minced in a meat mincer after thawing at room temperature. Wheat and Bengal gram flour were wrapped in muslin cloth and cooked for 10 minutes in pressure cooker. After cooking, wheat and Bengal gram flour was sieved to remove foreign particles. Different levels of wheat and Bengal gram flour (20%, 30%, 40% and 50% in control) and other ingredients like vegetable oil, corn starch, spices were added to form emulsion. Then the emulsion was manually filled in Chakli maker and Chakli was prepared with proper round shape. Then Chakli was fried and packed in low-density polyethylene pouches. Best level of flours to chicken meat evaluated on the basis of sensory, physico-chemical and proximate composition.

Table 1: Basic formulation of chicken Chakli

Sr. No.	Ingredients	Levels of flours (%) (Wheat and Bengal Gram)			
		Control (50)	20	30	40
1.	Minced chicken meat	26	42	36	31
2.	Flour (wheat flour or Bengal gram flour	26	10	16	21
3.	Cumin roasted + coriander powder	2.59	2.59	2.59	2.59
4.	Red Chilli powder	1.29	1.29	1.29	1.29
5.	Salt	1.29	1.29	1.29	1.29
6.	Oil	7.79	7.79	7.79	7.79
7.	Chakli masala	1.29	1.29	1.29	1.29
8.	Corn starch	2.59	2.59	2.59	2.59
9.	Warm water	31.16	31.16	31.16	31.16
	Total	100	100	100	100

Flow chart for the preparation of Chicken Chakli



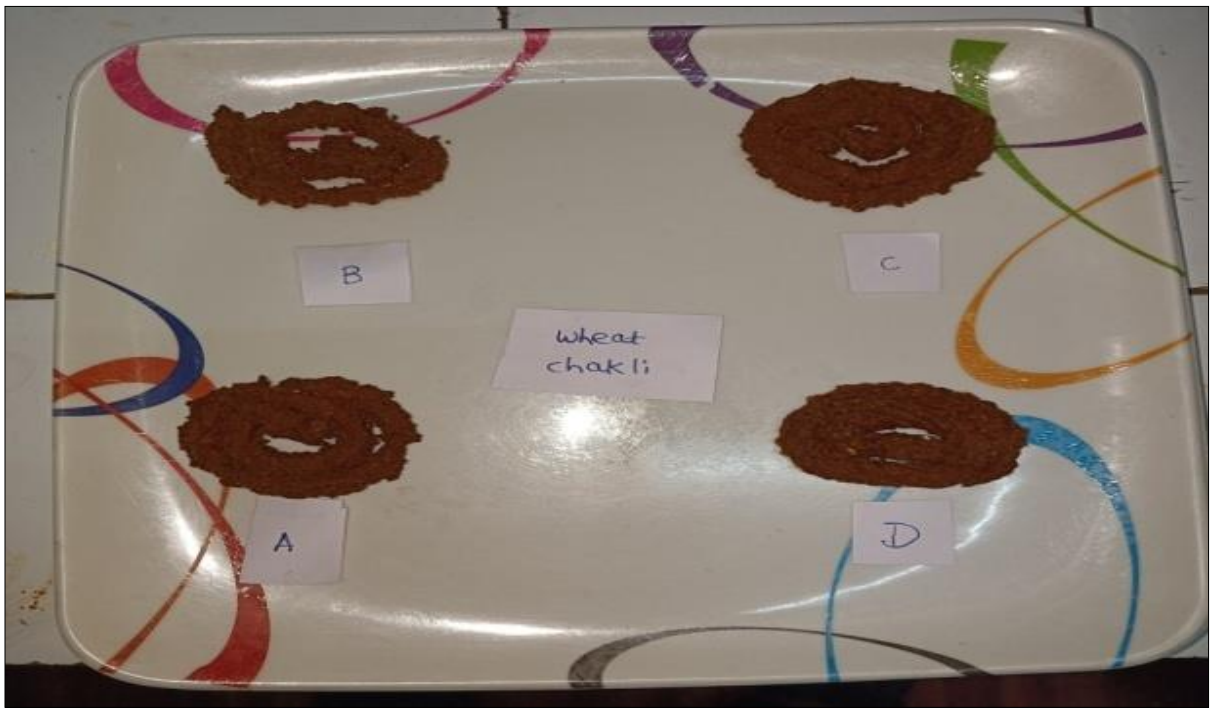


Fig 1: Chicken Chakli added with Wheat flour

Fig 2: Chicken Chakli added with Bengal gram flour

Analytical parameter

Sensory evaluation

Using an 8-point descriptive scale (Keeton 1983) [8], a panel of academic staff members and post graduate students from the College of Veterinary and Animal Sciences, Parbhani were evaluated the quality of chicken Chakli on the basis of sensory attributes such as appearance, flavor, juiciness, texture, and overall acceptability.

Physico-chemical properties

pH

The pH of chicken Chakli was tested using the (Trout *et al.*, 1992) technique. The pH of the samples was measured using a digital pH meter after ten gram of cooked chicken Chakli was combined with 50 ml of distilled water.

Oil absorption: The Oil absorption percentage of chicken Chakli was analyzed by using standard method used by (Mohamed *et al.*, 1988) [12].

$$\text{Oil absorption} = \frac{\textbf{Wt.}\text{ of chakli before frying - }\textbf{Wt.}\text{ of chakli after frying}}{\text{Wt. of chakli before frying}} \times 100$$

Cooking yield: The weight of chicken Chakli was taken before and after frying and expressed in percentage.

$$\text{Cooking yield} = \frac{\text{Weight of chakli after frying}}{\text{Weight of chakli before frying}} \times 100$$

Proximate composition
The moisture, fat, protein, and ash content of chicken Chakli were measured using the AOAC technique (1995) [1].

Statistical analysis: The data collected during the study were analyzed using the analysis of variance technique, as described by Snedecor and Cochran (1994) [15]. Data generated during study will be analyzed by analysis of variance technique by software SPSS 20 test.

Results and Discussion
Trials were conducted with different levels of wheat and Bengal gram flours (20%, 30%, 40%) replacing proportionate amount of chicken and compared with control (50%). Best level of different flours was selected on the basis of proximate composition, physic-chemical properties and sensory quality.

A. Quality of chicken Chakli added with wheat flour
The mean scores for sensory quality of chicken Chakli added with different levels of wheat flour (20, 30 and 40%) are presented in Table 2.

Table 2: Sensory properties, Physio-chemical and proximate composition of chicken Chakli incorporated with different levels of Wheat flour (WF)

Parameters	Control	Wheat flour (WF) levels		
		WF-20	WF-30	WF-40
	Sensory evaluation#			
Appearance	7.27±0.18^{b}	6.39±0.13^{a}	6.50±0.22^{a}	7.11±0.14^{b}
Flavour	7.22±0.31^{b}	6.61±0.29^{a}	6.77±0.16^{a}	7.16±0.30^{b}
Juiciness	6.94±0.16^{c}	6.27±0.09^{a}	6.61±0.07^{b}	6.83±0.11^{c}
Texture	7.22±0.30^{b}	6.39±0.11^{a}	6.55±0.33^{a}	7.16±0.20^{b}
Overall acceptability	7.33±0.21^{b}	6.66±0.13^{a}	6.88±0.11^{a}	7.22±0.30^{b}
	Physico-chemical attributes			
pH	6.04±0.30	5.89±0.22	5.92±0.21	5.97±0.20
Oil absorption (%)	29.47±0.25^{b}	28.21±0.19^{a}	29.14±0.29^{b}	29.41±0.26^{b}
Cooking Yield (%)	70.92±0.25^{a}	72.54±0.37^{b}	72.29±0.34^{b}	72.20±0.17^{b}
	Proximate composition			
Moisture (%)	4.84±0.03^{a}	8.65±0.15^{d}	6.85±0.14^{c}	5.79±0.11^{b}
Protein (%)	14.04±0.40^{a}	15.93±1.03^{b}	15.35±0.67^{b}	15.09±0.56^{b}
Fat (%)	5.54±0.78^{a}	9.45±0.21^{c}	8.14±0.35^{b}	6.13±0.42^{a}
Ash (%)	1.17±0.11^{a}	1.86±0.05^{d}	1.67±0.08^{c}	1.45±0.13^{b}

n = 6, #n=21 *Mean ± SE. with different superscripts row wise (small alphabets) differ significantly (p<0.05). Control=Chakli with 50% wheat flour and 50% chicken, WF-20= Chakli with 20% wheat flour and 80% chicken, WF-30= Chakli with 30% wheat flour and 70% chicken and WF-40= Chakli with 40% wheat flour and 60% chicken.

Sensory evaluation
It was observed that with addition of wheat flour sensory properties of chakli differed significantly (p<0.05). Control (50% flour and 50% chicken) recorded highest sensory attributes than other treatments. WF-20 had significantly (p<0.05) lower appearances scores as compared to control and other treatments. Scores were non-significant between control and WF-40. Findings are in agreement with (Kapse, 2016) [7] reported highest sensory scores in the whole-wheat flour chevon noodle having highest (50%) level of chicken meat. Similar findings reported by (Verma *et al.,* 2014) [18] that incorporation of animal protein in flour based products improves sensory attributes upto certain levels. On the basis of sensory properties, inclusion of wheat flour at 40% level considered optimum for preparation and better than other treatments.

Physico-chemical attributes
Result indicated that addition of wheat flour with replacement of chicken gradually increase pH value. WF-20 recorded lower pH while highest pH was observed for control, which might be due to acidic nature of chicken meat. Similar finding recorded by (Chin *et al.,* 2012) [2] for wet yellow noodles incorporated with Surimi powder. Oil absorption percentage increased significantly (p<0.05) with addition of wheat flour, however highest value was recorded for control. This might be due to higher oil absorption properties of wheat flours (Habeebrakuman *et al.,* 2019) [4]. Similar observation reported by (Tanna *et al.,* 2020) [16] for fish Chakli prepared by using combination of fish powder and wheat flour. Non-significant gradual decline in cooking yield was noticed with increase in levels of wheat flours upto 40% further increase results decrease in yield of chicken Chakli in control (50% flour and 50% chicken). Result revealed that wheat flour upto 40% had no any adverse effect on cooking yield. This might be due to higher water binding capacity and protein content of chicken meat as compare to wheat flour. Similar observation were recorded by Rindhe *et al.* (2018) [13] for spent hen nuggets incorporated with hydrated wheat bran. Mahmoud (2012) [11] also observed that cooking yield of high protein noodles was higher than flour based noodles having low protein content.

Proximate composition
For moisture content significantly (p<0.05) decreasing trend was recorded in chicken Chakli due to addition of wheat flour. Control chicken Chakli showed significantly (p<0.05) higher moisture as compare to other treatments. This might be due higher moisture content of chicken meat. (Verma *et al.,* 2014) [18] reported gradual increase in moisture content of chicken meat noodles with incorporation of whole wheat flour. With the addition of wheat flour, the protein, fat, and ash content of chicken Chakli decreased significantly (p<0.05). With an increase in the amount of chicken in the Chakli, all the parameters increased significantly (p<0.05). This might be due to higher proximate value of chicken meat. Eyidemir and Hayta (2009) [3] also recorded similar findings for apricot kernel flour based noodles. Based on the

above mentioned findings, it was shown that chicken Chakli prepared with 40% wheat flour had better sensory evaluations, proximate composition, and ideal physico-chemical properties than other treatments.

B. Quality of chicken Chakli added with Bengal gram flour: The mean scores for sensory quality of chicken Chakli added with different levels of Bengal gram flour (20, 30 and 40%) are presented in Table 3.

Table 3: Sensory properties, Physio-chemical and proximate composition of chicken Chakli incorporated with different levels of Bengal gram flour (BGF)

Parameters	Control	Levels Bengal gram flour		
		BG-20	BG-30	BG-40
	Sensory evaluation[#]			
Appearance	7.27±0.19[b]	6.61±0.11[a]	6.83±0.09[a]	6.94±0.27[b]
Flavour	6.88±0.17[c]	6.27±0.09[a]	6.39±0.07[b]	6.67±0.11[c]
Juiciness	7.16±0.27[b]	6.45±0.19[a]	6.61±0.09[a]	7.00±0.27[b]
Texture	7.33±0.19[b]	6.33±0.11[a]	6.45±0.27[a]	7.22±0.19[b]
Overall acceptability	7.00±0.18[b]	6.27±0.11[a]	6.45±0.19[a]	6.94±0.11[b]
	Physico-chemical attributes			
pH	6.12±0.31	5.87±0.28	5.95±0.22	5.99±0.47
Oil absorption (%)	25.44±0.22[b]	24.19±0.17[a]	25.12±0.27[b]	25.39±0.24[b]
Cooking Yield (%)	73.96±0.29[a]	75.59±0.32[b]	75.35±0.22[b]	75.29±0.26[b]
	Proximate composition			
Moisture (%)	4.32±0.08[a]	8.14±0.10[d]	6.33±0.27[c]	5.24±0.17[b]
Protein (%)	14.16±0.39[a]	15.98±0.98[b]	15.43±0.59[b]	15.21±0.45[b]
Fat (%)	5.82±0.73[a]	9.67±0.24[c]	8.31±0.39[b]	6.40±0.44[a]
Ash (%)	1.23±0.13[a]	1.91±0.06[d]	1.75±0.09[c]	1.52±0.16[b]

n = 6, [#]n=21 *Mean ± SE. with different superscripts row wise (small alphabets) differ significantly (p<0.05). Control= Chakli with 50% Bengal gram flour and 50% chicken, BG-20= Chakli with 20% Bengal gram flour and 80% chicken, BG-30= Chakli with 30% Bengal gram flour and 70% chicken and BG-40= Chakli with 40% Bengal gram flour and 60% chicken.

Sensory evaluation

Juiciness, texture, and overall palatability sensory scores differ significantly (p<0.05). When compared to the treatment, the control had a significantly (p<0.05) higher score for juiciness, texture, and overall acceptability. However, there was no discernible difference between the control and BG-40, indicating that Bengal gram could be added to the formulation of chicken Chakli up to 40% without having any negative effects.

Physico-chemical attributes

With addition of Bengal gram flour did not appreciably change pH levels of chicken Chakli. The low pH of chicken meat may be the cause of the pH values increased as the amount of chicken meat decreased. (Kumari *et al.*, 2020) [9], recorded similar observations for chicken nuggets added with Bengal gram flour.

Significantly (p<0.05) lower oil absorption values were found for BG-20, which may be related to the larger proportion of chicken (80%) in Chakli formulations as compared to Bengal gram flour (20%). According to (Habeebrakuman *et al.*, 2019) [4] oil absorption percentage of Bengal gram flour was only 4.52%. (Tanna *et al.*, 2020) [16] reported similar findings for fish Chakli that included Bengal gram flour.

An important factor in the development of meat products is the cooking yield. The BG-20 had the highest cooking yield than that of the BG-30 and BG-40, whereas the control Chakli, which contained 50% chicken and 50% Bengal gram flour, had the lowest cooking yield. This might due to relation with higher water binding capacity and protein content of chicken meat. The current study demonstrates that the addition of chicken meat, which has a higher water holding property, was found to resist cooking losses to a greater extent than Bengal gram flour (Luckose *et al.*, 2015). Similar observations were also reported by Mahmoud (2012) [11] for high protein noodles.

Proximate composition

Bengal gram flour was added to chicken Chakli, which significantly (p<0.05) reduced the amount of protein, fat, and ash. This might because of Bengal gram flour has a lower proximate value than chicken meat. The higher mineral content in chicken meat compared to Bengal gram flour may be the cause of the higher ash concentration in BG-20. (Kumari *et al.*, 2020) [9] also recorded similar higher values for moisture, protein and fat for chicken nuggets added with Bengal gram flour.

Conclusion

On the basis of proximate composition, physicochemical properties and sensory evaluation, chicken chickli added with 40% wheat and Bengal gram flour separately resulted better sensory scores, physic-chemical and proximate composition as compared to other treatments. Hence, it is concluded that incorporation of 40% wheat and Bengal gram flours separately found optimum for the preparation of better quality of chicken chakli.

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