



A survey on different cooking methods of chicken products sold in different outlets in Chennai: Its texture profile and sensory properties

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ABSTRACT

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This survey was envisaged to study the effect of different cooking methods (dry heat cooking and moist cooking) on the texture profile and sensory characteristics of chicken products sold in three different outlets (street outlets, small hotels and restaurants) and around Chennai. Hardness, gumminess and chewiness values were found higher in street outlets than that of small hotels and restaurants. Whereas, adhesiveness, springiness and cohesiveness values ($P>0.05$) were found non-significant in all the four chicken products prepared by dry and moist cooking, in street outlets, small hotels and restaurants, except for cohesiveness value ($P<0.05$) in chicken gravy. But in all the three outlets, highly significant differences ($P<0.01$) were found between products, of which chicken 65, than grilled chicken, chicken biryani and chicken gravy was found higher in all the texture profile properties. Colour and appearance, flavour, tenderness, juiciness and overall acceptability score were higher ($P<0.01$), in chicken products from restaurant than that from street vendors and small hotels. In street outlets and small hotels chicken biryani, followed by chicken gravy scored the lowest value in all the sensory properties when compared with chicken 65 and grilled chicken. Whereas, in restaurants all the four chicken products scored the highest value ($P<0.01$) in all the sensory properties, except for juiciness score was found not significant. The result showed that dry cooked and moist cooked chicken products such as chicken 65, grilled chicken, chicken biryani and chicken gravy sold in restaurants had better texture profile and sensory properties among different products. Grilled chicken had good sensory scores in all the three outlets.

Keywords: Chicken products, Texture profile, Sensory properties, Different outlets

INTRODUCTION

Chicken products are generally consumed more and is considered as a good popular food commodity worldwide, as chicken meat constitutes low fat, low cholesterol content and high nutritional value (Choi *et al.*, 2011). In India chicken is the most popular meat, but its demand widely varies depending on economic status, family values, holidays, festivals and considerations for animal welfare. India is the world's sixth largest producer of chicken meat, and produces 5.3 million metric tons (MT) of chicken which shares around 51.44 % of total meat production as per the statistics (BAHS, 2022). However, there was a steady increase in consumption of chicken meat over the last few decades in many countries. Cooking makes meat more digestible, nutritious, palatable, and safe (Tornberg, 2005) for consumption. Tiwari and O'Donnell (2012) categorized meat-cooking methods as dry heat cooking, moist heat cooking and other novel heating methods (i.e. microwave and infrared). In moist heat cooking methods, such as braising, hot water or condensing steam, which have high surface heat transfer coefficients, effectively transfers heat to the meat surface (Hanson, 2004). By contrast, in dry heat cooking methods, such as oven cooking or roasting, dry heat is transferred to meat surface from a flame, oven, or other heat sources, and consequently, creates

temperature gradient inside the meat product, which leads to an increase in internal temperature, loss of moisture, denaturation of protein, shrinkage in meat fibre, as well as develops unique flavors and appearance which is probably due to the browning reaction (Tiwari and O'Donnell, 2012). In the study of demonstrated that the consumers found that differences in the quality of meat supplied according to different classes of outlets (Rani, 2015). So, in order to ensure the supply of quality and safe chicken products to the consumers it is necessary to assess the quality parameters such as texture profile properties and sensory evaluation of chicken products cooked under moisture and dry heat cooking sold in Chennai. In our previous study, we also evaluated the how different cooking methods had influenced the proximate composition (Vanathi *et al.*, 2022) physico-chemical and microbial qualities of chicken products (Vanathi *et al.*, 2024) sold at different outlets in and around Chennai. Therefore, this study investigates the effects of moist- and dry-heat cooking on the texture profile properties and sensory characteristics of chicken meat sold in and around Chennai.

MATERIALS AND METHODS

The studies were carried out in the Department of Livestock Products Technology (Meat Science), Madras Veterinary College, Chennai – 600 007 during the year 2020 - 2021.

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Source of materials

A total of 120 numbers of chicken product samples, based on different cooking methods such as dry heat cooking (grilled chicken, chicken 65), and moist heat cooking (chicken biryani and chicken gravy) were collected from different retail outlets located twelve different zones in and around Chennai such as Chennai Central, Vepery, Purasaiwakkam, Perambur, Erukkancheri, Koymbedu, Egmore, Periamet, Perungudi, Annanagar, Shozhinganallur, and Valasaravakkam as detailed below in Table 1. The collected chicken products samples were placed in UV sterilized polythene bags and transported hygienically in a clean insulated box with ice packs.

Collected chicken products samples were placed in UV sterilized polythene bags and transported hygienically in a clean insulated box with ice packs. The collected samples were immediately evaluated for its texture profile and sensory properties in the Department of Livestock Products Technology (Meat Science), Madras Veterinary College, Chennai – 600 007. The chemicals used for analysis were analytical grade, was purchased from standard firms (M/S Sigma Aldrich, M/S Hi-Media and M/S Loba Chemie).

Texture profile analysis

The chicken products were evaluated for its texture profile properties using Stable Microsystem (Model TA.XT 2i/25 Surrey, U.K.) as per the method Bourne, (1978). The central core of the sample of each of the sample in duplicates of size 1.5 cm³, were placed in the centre of the base plate or sample platform was compressed twice to 60% of the original height to form two bite workforce compression curves. The conditions (test description set) for analysis were:

Crosshead speed	2 mm/s
Load cell	0.15 N
Pretest speed	2mm/sec
Test speed	2mm/sec
Post test speed	5mm/sec
Time	5.00 sec
Trigger force	0.04903N
Probe	75 mm compression platen (P75)

The parameters determined were as follows

Hardness 1 (N/cm²) – Maximum force required to compress the chicken product sample first time.

Hardness 2 (N/cm²)– Maximum force required to compress the chicken product sample second time.

Adhesiveness (Ns/g)– Work necessary to pull the compression plunger away from chicken product sample.

Springiness (cm/mm)– The ability of the chicken product sample to recover to its original shape after the deforming force was removed. It is the extent of elastic recovery property of the chicken products.

Cohesiveness (ratio)= Extent to which the chicken product sample could be deformed prior to rupture (A2/ A1, A1 being the maximum force required for the first compression and A2 the maximum force is being required for the second compression).

Gumminess (N/cm²)– Energy required to disintegrate a semisolid chicken product to a state ready for swallowing (Hardness x Cohesiveness)

Chewiness (N/cm)– Work to disintegrate or masticate the chicken product sample for swallowing (Springiness x Gumminess).

Sensory evaluation

The sensory evaluations were performed in triplicate on each chicken product sample by trained sensory panelist. Selected 12 Nos. of panels consisting faculties and students of the Department of livestock products Technology (Meat Science), Madras Veterinary College, Chennai – 600 007, TANUVS was used to evaluate the chicken products prepared by dry and moist cooking sold in and around Chennai. Each sample was evaluated for the color and appearance, flavor, juiciness, tenderness, and overall acceptability. Prior to evaluation, the chicken products were prewarmed and cooled to 20°C, and served randomly to the panellists. Each chicken product sample was coded with a randomly selected 3 digit number. Also, the panellists were instructed to cleanse their palates with water between the samples. Color and appearance (1 as extremely undesirable, 10 as extremely desirable), flavor (1 as extremely undesirable, 10 as extremely desirable), tenderness (1 as extremely tough, 10 as extremely tender), juiciness (1 as extremely dry, 10 as extremely juicy), and overall acceptability (1 as extremely undesirable, 10 as extremely desirable) of the chicken products were evaluated using a 10 point descriptive scale. This analysis was conducted by using hedonic test as described by Bergara-Almeida and da Silva (2002).

Table 1: Experimental design

S.No.	Chicken meat products		Sample from different outlets		
			Street outlet	Small hotels	Restaurant
1.	Dry heat cooking	Grilled chicken	10 Nos.	10 Nos.	10 Nos.
		Chicken 65	10 Nos.	10 Nos.	10 Nos.
2.	Moist cooking	Chicken biryani	10 Nos.	10 Nos.	10 Nos.
		Chicken gravy	10 Nos.	10 Nos.	10 Nos.

RESULTS AND DISCUSSION

Texture profile properties

The results for the effect of different types of cooking methods on the texture profile properties of chicken products sold at different outlets in and around Chennai are shown in Table 2. The present study revealed that significant difference ($P>0.01$ and $P>0.05$) were noticed in the hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness value between products prepared by dry and moist cooking method in all the outlets such as street outlet, small hotel and restaurant. It indicates that there was highly significant difference ($P>0.01$) was noticed between dry and moist cooked products. Dry cooked chicken products, chicken

65 was found highest in all the texture profile properties in all three outlets. Among moist cooked chicken products chicken gravy was found lowest in all the texture profile properties, in all the three outlets. Comparison with different outlets chicken products, from restaurants was found lowest in hardness, gumminess and chewiness values. No significant difference ($P<0.05$) were noticed in adhesiveness, springiness value of chicken products sold all the three outlets except for cohesiveness value for chicken gravy. In the study of Oh *et al.* (2014), reported that superheated steam cooked products showed decrease in hardness, cohesiveness and chewiness properties. Whereas, Seo *et al.* (2014) observed that samgyetang prepared using superheated steam type of

Table 2: Effect of different cooking methods on the texture profile properties of chicken products sold in different outlets in and around Chennai

S. No.	Parameters	Type of cooking	Chicken products	Different outlets			
				Street outlet	Small hotel	Restaurant	F value
1.	Hardness (N/cm ²)	Dry cooking	Chicken 65	2606.05±93.46cC	2136.03±115.9bC	1827.32±60.31cD	7.86**
			Grilled chicken	2597.75±142.9cC	1801.01±83.80bBC	1457.43±62.65aC	32.73**
		Moist cooking	Chicken biryani	19.6.68±79.41cB	1520.04±154.9bB	1195.21±31.22aB	12.16**
			Chicken gravy	1424.99±130.05A	1147.33±126.79A	949.11±52.03A	4.80
			F value	25.26**	11.63**	50.24**	
2	Adhesiveness (Ns)	Dry cooking	Chicken 65	- 33.09c±10.17	- 52.62ab±11.62	- 64.08aA±6.10	2.67
			Grilled chicken	-47.46±6.35	-46.01±4.04	- 34.36B±6.56	1.55
		Moist cooking	Chicken biryani	-45.70±6.91	-57.24±12.54	-63.83 A±12.75	0.68
			Chicken gravy	-42.90±6.45	-44.24±4.80	-33.51B±4.54	1.20
			F value	0.70	0.43	12.25**	
3.	Springiness (cm)	Dry cooking	Chicken 65	0.625bC±0.04C	0.644b±0.05D	0.488aB±0.03B	3.22
			Grilled chicken	0.519aB±0.02B	0.533ab±0.02C	0.599cC±0.01C	2.96
		Moist cooking	Chicken biryani	0.379A±0.14A	0.415±0.09B	0.370A±0.02A	0.60
			Chicken gravy	0.320A±0.01A	0.294±0.01A	0.333A±0.01A	1.90
			F value	15.17**	19.57**	23.38**	
4.	Cohesiveness (ratio)	Dry cooking	Chicken 65	0.549C±0.01C	0.476B±0.02B	0.511C±0.02C	2.05
			Grilled chicken	0.479B±0.03B	0.439AB±0.02AB	0.465BC±0.02BC	0.56
		Moist cooking	Chicken biryani	0.341A±0.07A	0.390A±0.04A	0.348A±0.06A	2.13
			Chicken gravy	0.302aA±0.02A	0.387bA±0.03A	0.400bA±0.03AB	3.24*
			F value	22.17**	2.93*	7.40**	
5.	Gumminess (N/cm ²)	Dry cooking	Chicken 65	1420.41±81.14bB	851.25±56.49aC	746.87±54.30aB	30.98**
			Grilled chicken	1262.52±108.00bB	938.80±70.08aC	856.35±67.48aC	6.54*
		Moist cooking	Chicken biryani	647.82±45.91bA	598.75±69.81bB	417.56±26.50aB	5.74**
			Chicken gravy	432.24±51.31A	414.77±33.10A	380.76±36.61A	0.40
			F value	59.50**	19.25**	12.34**	
5.	Chewiness (N/cm ²)	Dry cooking	Chicken 65	820.62±109.9bB	602.06±68.22abC	416.02±41.77aB	6.65*
			Grilled chicken	736.20±62.85bB	456.58±42.03aD	449.25±37.02aB	13.53**
		Moist cooking	Chicken biryani	235.67±70.68bA	246.68±31.49bB	154.68±14.82aA	4.65*
			Chicken gravy	141.51±19.76A	122.31±11.83A	129.59±16.10A	0.35
			F value	30.26**	24.23**	31.61**	

N= 120, n=10 Mean bearing different superscripts differ significantly.

A, B, C - Mean bearing different superscripts differ significantly between cooking methods a, b, c - Mean bearing different superscripts differ significantly between outlets

*= significant ($P<0.05$), **= highly significant ($P<0.01$) and NS= Non significant ($P>0.05$)

cooking has lower hardness, cohesiveness, gumminess, and chewiness properties when compare with boiled samgyetang. Jeon *et al.* (2013) observed that grilled or oven heated beef showed higher shear force value among other cooking methods. From the above findings it was observed that moist cooked chicken products was tender, which is normally a major quality attribute of meat products (Callahan *et al.*, 2013).

Sensory properties

The effect of different cooking methods on the sensory properties of chicken products sold in and around Chennai are given in Table 3. Based on the dry and moist cooking chicken products such as chicken 65 and grilled chicken, chicken biryani and chicken gravy were evaluated for color and appearance, flavour, tenderness, juiciness and overall acceptability score. Chicken biryani scored the lowest value ($P<0.01$) in all the sensory properties, followed by chicken gravy among moist cooked products in all the three outlets. Dry cooked

chicken products comparatively scored the highest value ($P<0.05$ and $P>0.05$) when compare with moist cooked products, of which grilled chicken scored the highest value when compare with chicken 65, in all the sensory properties in all the three different outlets, except for juiciness score ($P>0.05$). Of the three different outlets chicken products prepared by both dry and moist cooking had highest score ($P<0.01$) from restaurants, when compare with street outlets and small hotels in all the sensory properties. These results agree with Liu *et al.*, (2022) reported that aroma score, texture and overall acceptance score was higher in pan fried and deep fried meat than baked and boiled Black Tibetan sheep meat. Similar results were obtained by Feng *et al.*, (2020) found that sensory evaluation results indicates that consumers preferred baked and fried sturgeon steak compared with microwaved and steamed samples. However, Seo *et al.*, (2014) who found that steam cooking contributes to increase the satisfaction scores for taste, texture, juiciness,

Table 3: Effect of different cooking methods on the sensory properties of chicken products sold in different outlets in and around Chennai

S. No.	Parameters	Type of cooking	Chicken products	Different outlets			
				Street outlet	Small hotel	Restaurant	F value
1.	Colour and appearance	Dry cooking	Chicken 65 1	6.91±0.55aC	8.02±0.54bC	9.06±0.47cB	49.36**
			Grilled chicken 3	6.58±0.51aC	7.18±0.97aB	9.27±0.67bB	42.57**
		Moist cooking	Chicken biryani	44.89±0.80aA	6.57±0.42bAB	8.27±0.76cA	68.73**
			Chicken gravy 2	5.70±0.84aB	6.41±0.90bA	9.02±0.55cB	59.63**
			F value	20.56**	10.95**	5.79*	
2.	Flavour	Dry cooking	Chicken 65	7.04±0.68aB	7.83±0.64bB	8.90±0.64cA	24.09**
			Grilled chicken	7.31±0.81aB	8.06±0.86bB	9.60±0.50cB	29.47**
		Moist cooking	Chicken biryani	5.52±0.77aA	6.18±1.48aA	8.3±0.94bA	21.72**
			Chicken gravy	6.06±0.81aA	5.37±1.11aA	8.37±0.94bA	31.79**
			F value	14.06**	17.55**	6.61*	
3.	Tenderness	Dry cooking	Chicken 65	6.58±0.45aC	7.29±0.73bB	7.83±0.88bA	9.32**
			Grilled chicken	6.04±1.19aBC	7.56±1.16bB	9.02±0.66cC	24.88**
		Moist cooking	Chicken biryani	4.97±0.65aA	5.20±0.84aA	7.91±0.97bA	45.80**
			Chicken gravy	5.52±0.77aAB	5.12±0.80aA	8.50±0.71bAB	64.84**
			F value	8.55**	25.38**	5.46*	
4.	Juiciness	Dry cooking	Chicken 65	6.43±0.70aB	7.40±0.48bB	8.14±0.84cAB	18.27**
			Grilled chicken	6.23±0.81aB	7.86±1.12bB	8.89±0.66cB	27.25**
		Moist cooking	Chicken biryani	5.33±0.84aA	5.89±0.99aA	7.62±1.13bA	17.22**
			Chicken gravy	5.14±0.59aA	6.04±1.19aA	8.12±0.98bAB	30.61**
			F value	8.91**	11.83**	3.85	
5.	Overall acceptability	Dry cooking	Chicken 65	6.35±0.71aB	7.58±0.45bB	8.31±0.69cA	29.57**
			Grilled chicken	6.71±0.86aB	8.56±0.64bC	9.62±0.40cC	58.81**
		Moist cooking	Chicken biryani	4.97±0.52aA	7.02±1.08bAB	8.77±0.70cAB	66.65**
			Chicken gravy	4.72±0.74aA	6.23±0.81bA	9.18±0.79cBC	99.39**
			F value	8.55**	25.38**	5.46*	

N = 120, n=10 Mean bearing different superscripts differ significantly.

A, B, C - Mean bearing different superscripts differ significantly between cooking methods a, b, c - Mean bearing different superscripts differs significantly between outlets

*= significant ($P<0.05$), ** = highly significant ($P<0.01$) and NS = Non significant ($P>0.05$).

and overall preference compare with boiling, convection oven, and microwave oven. This might be due to superheated steam cooking condition of oven temperature (300°C), steam temperature (330°C), and an 8 minutes of cooking time was used in their study. Fabre *et al.*, 2018 reported that cooking methods had significant influence on color, odor and overall acceptability due to different ways of heat transfer and time in sturgeon steak. Another possible reason may be the intensity of Maillard reaction that occurs in different cooking methods produces different flavor substances such as ketones and aldehydes. Similar findings of enhanced sensory attributes in deep fat fried chicken meat caruncles (Singh *et al.*, 2012) and chicken patties (Cholan *et al.*, 2011) prepared by different cooking methods. in their study on. Thus, dry cooked chicken product showed the best sensory properties in all the three outlets than moist cooking. Among three different outlets, chicken products of both dry and moist cooking from restaurants showed the highest sensory score. Therefore, a relationship was observed between different outlets and sensory qualities of chicken products in accordance with cooking methods.

CONCLUSION

The results of this study provides information about the different cooking methods such as moist and dry cooked chicken products, as well as chicken meat products sold in different outlets its effect on the texture profile and sensory properties. The findings revealed that tenderness was found to be the most important criterion that influence the consumer perception on quality of chicken products at different outlets. In general chicken products sold in restaurants had reduced hardness properties in both moist and dry cooked chicken products when compare with street outlets and restaurants. This might be due to enhanced processing techniques and product preparation strategies followed in restaurants for which it fetches more price when compare with small hotels and street outlets in Chennai. Therefore, lacunae of education and training regarding processing techniques in street outlets and small hotels had influence on the quality of chicken products must be taken into account. This would enable chicken products of better quality can be supplied to the consumers. Also, this study provides practical information on how cooking methods, difference in processing of chicken meat in different outlet had influence on the texture profile properties, and sensory properties of chicken products.

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