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Consumption Pattern and Quality Characteristics of Tandoor / Tikka Type of Chicken Meat Product

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ABSTRACT

The present study was envisaged to assess the consumption pattern and influence of different cooking methods on quality characteristics of tandoor/tikka type of chicken meat product. A total of 112 consumers at 8 restaurants throughout Hyderabad were surveyed for consumption pattern of tandoor type muscle food based products. Most of the consumers prefer such type of product prepared from mutton. However, 43.14 % of consumers prefer chicken based and 6.86% of consumers prefer fish products. Amongst the products surveyed, 31 % consumers are preferring tandoor type of product, whereas 10% consumers mostly like tikka/kebabs type of products. The 70 % of total consumers take these types of products twice in a week. The 42.50 % of consumers are taking more than 200 gm of such products at a time. Cooking methods significantly ($P<0.05$) influenced by the both physico-chemical and sensory attributes of chicken tikka. Cooking yield (%) was significantly ($P<0.05$) more in oven cooked tikka as compared to barbecue and gas tanoor. The shear force value was more (27.43 N) in barbecued chicken tikka thant the product cooked in other two methods. Chicken tikka cooked in hot air oven method recorded more moisture and less fat content than other cooking methods. Colour, taste, mouth coating and overall palatability scores was rated higher in gas tandoor cooked product. Chicken tikka cooked in hot air oven rated superior tenderness and juiciness scores compared to other cooking methods. Based on this study, it can be concluded that alternatively chicken tikka can be produced in hot air oven, rather than open flame/tandoor oven with hither yield and superior tenderness and juiciness scores.

Keywords : *Chicken tikka, consumption pattern, cooking methods, quality character*

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INTRODUCTION

Chicken tikka is a popular dish in India. It is traditionally small pieces of boneless chicken baked using skewers in a clay-based oven called a tandoor after marinating in spices and yogurt (Piatkus 1993). The word tikka means "bits" or "pieces". It is also a chicken dish served in Punjabi cuisine. The Punjabi version of the dish, however, is grilled over red-hot coals, and does not always contain boneless pieces. The pieces are brushed with ghee (clarified butter) at intervals to increase its flavour, while being continuously fanned. It is typically eaten with green coriander and tamarind chutney served with onion rings and lemon, or used in preparing a chicken tikka masala.

Chicken tikka and chicken tikka masala is served in restaurants around the world (Aravind 2006 and Hindu 2007). A survey in the United Kingdom (UK) claimed that it is that country's most popular restaurant dish and one in seven curries sold in the UK is chicken tikka masala (Lloyd and Mitchinson 2006). It is most popular dish and widely served in Indian subcontinent restaurants. Chicken tikka is chunks of chicken marinated in spices and yogurt, that is then baked in a tandoor oven, served as chicken tikka or added in a masala ("mixture of spices") sauce served as chicken tikka masala. A tomato and coriander sauce is common, but there is no standard recipe for chicken tikka and a survey found that of 48 different recipes, the only common ingredient was chicken and cooking methods (Cyclopedia 2001). The sauce usually includes tomatoes, frequently as puree; cream and/or coconut cream; and various spices. The sauce or chicken pieces (or both) are coloured orange with food dyes or using foodstuffs such as turmeric powder, paprika powder or tomato puree. Because of popularity of this product in Indian subcontinent many diverse cooking styles in global and regional preparation techniques existed in different parts of the India depending upon the place of consumption. In some restaurants babecue oven also utilized for preparation of chicken tikka due to the similarity in the preparation of barbecue chicken include cooking and saucing techniques.

Effect of cooking methods/styles on acceptance and quality of chicken tikka has received considerable attention because, consumer preference and this quality aspects usually dictates the method of cooking, in addition to efficiency and cost. Numerous techniques have been employed to cook meat; however the variations in cooking time and meat palatability prevent the universal use of any single technique (Wood et al.1995). However, an economic and simple alternative cooking methods suitable for both household and industrial use is required to cater the growing demand of tandoor/ tikka type of meat products. Though, the usual practice for preparation of tanoor/ tikka type of products in Indian restaurants and

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homes involves clay tandoor oven, gas tanoor oven, barbecued oven and hot air oven is also of significance and is believed to be reliable methods to optimize the quality of chicken products.

A literature survey revealed that very little work has been done on quality of tanoor/tikka type of chicken products. Hence present study was aimed on the consumption pattern of tandoor type of muscle food based products and influence of different cooking methods on various physico-chemical and sensory attributes of tanoor/tikka type of chicken product.

MATERIALS AND METHODS

Consumption pattern of tandoor/tikka type of muscle food products

A total of 112 consumers at 8 restaurants throughout Hyderabad were surveyed for consumption pattern of tandoor type of muscle food based products.

Effect of cooking methods on quality characteristics of chicken tikka

Source of meat and other ingredients: The slaughtering technique and transportation of birds was approved by the local ethical committee. Birds used in this study were procured from local market and slaughtered at the National Research Centre on Meat following standard protocol and allowed to bleed for 3 minutes in bleeding cones. The birds were dressed as per approved scientific methods and manually de-boned. The meat obtained was washed with clean water. Boneless lean meat was collected and chilled at 4±1°C in a refrigerator (Whirlpool, Mod.No: FF-285-Elite) for about 24 hours. Later, the meat was portioned, packed in LDPE bags and transferred to the Deep freezer (Coldcel, Voltas Pvt. Ltd) maintained at -18±1°C until further processed. The meat was thawed at 4±1°C for 16 hours before and utilized for further processing.

Refined salt, lime, curd, red chilli powder, onion and garlic were procured from local market of Hyderabad city. Fine paste of onion and garlic in the ratio of 3:1 was made in a mixer (Preeti, Mod.No: 4250) and used in different experimental trails. Spice ingredients were procured from local super market and dried in hot air oven at 50°C for 4 hours. The ingredients were ground in a home mixer and sieved through a fine mesh. The powders were mixed in suitable proportions to make a spice mix for tanoodr/tikka type of chicken product. All the chemical used in the study were of analytical grade and were obtained from standard firms (Hi media, Merck; India).

Preparation of chicken tikka: Thawed bone less lean meat was cut into small cubes of nearly one inch size with the help of deboning knife. Spice and condiment mix was prepared as per the formulation given in Table 1. Add all of the ingredients except the chicken to a non-metallic mixing bowl and mix thoroughly and make a paste. Add the chicken cubes and mix until fully coated the entire ingredients paste. Ideally, the chicken cubes should kept in a refrigerator to marinate for at least 24 hours. After completion of marination, the chicken cubes were taken out and weighed equally about three parts and each part cooked separately in barbecued, gas tandoor and hot air oven. For barbecued oven cooking the marinated chicken cubes cooked on skewers under a medium grill for 5-8 minutes on each sides in barbecued oven (cooking times depend on the temperature of the oven). For gas tandoor oven cooking the marinated chicken cubes place on skewers and cook in a tandoor oven. For hot air oven cooking the marinated chicken cubes cooked in preheated hot air oven to maximum of 140°C. In all ovens cooking has ensured smokeless, moderate and uniform heat. The temperature was maintained in the ovens throughout the cooking period of about 20 min. to permit thorough and uniform cooking. During cooking the meat pieces were turned over once to avoid drying, charring or blistering. Cooking was done till the meat attained a golden brown colour and was fully cooked. Then the chicken tikka was taken out from the ovens and cool it and analyzed for physico-chemical and sensory attributes.

Table 1: Formulation of marination for tikka/ kabab type of chicken products

S.No.	Ingredients	%
1	Ginger – garlic paste	6
2	Red chilly powder	10
3	Garam masala powder	10
4	Curd	30
5	Lime	5
6	Salt	3

Estimation of cooking yield: The weight of samples was recorded before (raw weight) and after cooking of chicken tikka. Percent cooking yield was determined by calculating weight differences for samples before and after cooking according to Murphy et al.1975). Cooking Yield (%) = (Weight of cooked chicken tikka/Weight of raw tikka) X 100.

Warner-Bratzler shear force value: Samples cooked in different methods were chilled and samples were equilibrated to room temperature before texture measurement. After equilibration, the 1.25 cm cores were taken using tissue borer with muscle fibres parallel to the direction of the borer. The Warner-Bratzler shear force (WBSF) of the cores were measuring Texturometer (Tinius Oslen, Model H1KF, 6 Perrywood Business park, Redhill, RH1 5DZ, England) with

V-shaped stainless steel blade (60° angle) and triangular whole in the middle. The cores were sheared perpendicular to the muscle fibre orientation with 75 Newton load range and a crosshead speed set at 200 mm/minute. The force required to shear the samples was recorded in Newton (N).

Estimation of proximate composition: The moisture content was determined by hot air oven drying, protein by automatic Kjeldahl method, fat by Soxhlet extraction with petroleum ether and total ash by muffle furnace as described in AOAC (2002).

Sensory evaluation: The sensory panel consist of scientists from National Research Centre on Meat were requested to evaluate various sensory attributes like color, flavor, taste, tenderness, juiciness, mouth coating and overall palatability of the chicken tikka by using a 8 point hedonic scale (Keeton 1983) where 8= extremely good and 1=extremely poor.

Statistical analysis: The experiment was repeated three times and the data generated for different quality attributes of chicken tikka were compiled and analyzed following the methods of Snedecor and Cochran (1995).

RESULTS AND DISCUSSION

Consumption pattern of tandoor/tikka type of muscle food products: For assessing the consumption pattern of tandoor/tikka type of muscle food products, 112 consumers were surveyed in 8 restaurants across the Hyderabad city and the results are presented in Table 2. Most of the consumers (50 %) preferred the muscle food products prepared from mutton. However, 43.14 % of consumers preferred chicken based and 6.86 % of consumers preferred fish products. Considering these results most of the consumers are preferred the products from mutton and then chicken followed by fish. The highest acceptance of mutton based muscle foods might be due to consumer's esthetic sense on mutton acceptability and high per centage of intramuscular fat in mutton comparing to chicken and fish which will give excellent juiciness during chewing of tandoor/tikka based muscle foods.

TTable 2 : Consumption pattern of tandoor/tikka type of muscle food based products

Species of meat	Type of product	Frequency of consumption	Quantity of consumption per serving
Mutton (50%)	Fried (45%)	Once in a week (30%)	100 gm – 26.25 %
Chicken (43.14%)	Grilled (14%)		200 gm – 31.25 %
Fish (6.86%)	Tan door (31%)	Twice in a week (70%)	> 200 gm – 42.50 %
	Tikka (10%)		

Amongst of the products surveyed, 45 % of consumers preferred fried products, 31 % consumers preferred tandoor type of products, 14 % consumers preferred grilled products and 10 % of consumers preferred tikka type of products. The highest preference of fried products might be due to more taste, juicy and perception of oil frying of consumers. For the frequency of product, 70 % of total consumers take these types of products twice in a week and 30 % of consumers take once in a week. Many factors are influencing the consumer for frequency of consumption of meat products per week and mostly are socio-economic and religious factors. For quantity of meat products taken at a time also indicating that more than 42.50 % consumers are taking more than 200 gram of such products at a time followed by 31.25 % of consumers taking 200 gram at a time and 26.25 % taking 100 gram a time. These results revealing that the cost of such type of products is not a factor for *consuming more quantity at a time.*

Effect of cooking methods on quality characteristics of chicken tikka

Physico-chemical attributes: The cooking method had the most important effect on cooking yield of any cooked meat products. Cooking yield/losses are affected by three main variables: the surface temperature of the meat, the heat transfer method, and the internal temperature profile (i.e., temperature/ time). In present investigation cooking yield is significantly ($P<0.05$) affected by different types of cookery methods (Table 3). Chicken tikka cooked in hot air oven method recorded significantly ($P<0.05$) highest cooking yield than gas tandoor and barbecued methods. The per cent cooking yield values are 64.14, 60.61 and 59.35 respectively for hot air oven, gas tandoor and barbecued cooking methods. The highest cooking yield resulted in hot air oven cooking method due to initial low temperature of oven and cooking was longer time (at low temperature) than remaining cookery methods which resulted less moisture loss. The transfer of heat in in barbecued and gas tandoor cooking methods, the higher temperatures causes denaturation and shrinkage of endomysial and perimysial collagen sheaths contributes to the more loss of water which resulted in more cooking loss (Asghar and Pearson 1980; Bailey 1988). These results are in agreement with Aaslyng et al. (2003) in cooked pork and Combes et al. (2003) in rabbit meat.

Shear force values of chicken tikka significantly ($P<0.05$) influenced by different cooking methods (Table 3). Chicken tikka cooked in barbecued oven significantly ($P<0.05$) recorded highest shear force value (N) i.e 27.43. The shear force values of chicken tikka increased in the barbecued oven cooking method due probably to the shortening and shrinkage

Table 3: Effect of cooking methods on physico-chemical attributes of chicken tikka (Mean ± S.E)

Physico-chemical attributes	Barbecued	Gas tandoor	Hot air oven
Cooking yield (%)	59.35±1.23a	60.61±1.39b	64.14±1.08c
Shear force value (N)	27.43±2.42c	20.39±1.73a	21.33±3.74b
Moisture (%)	56.78±0.25a	57.22±1.8b	58.45±0.77c
Fat (%)	2.75±0.25b	3.50±0.39c	1.75±0.75a
Ash (%)	5.47±0.25	4.99±0.2	5.20±0.66

Mean values bearing same superscript do not differ significantly (P>0.05).

of myofibrils by heat, whereas in the long cooking time in barbecue oven the tikka meat causes jelly formation and the swelling of the connective tissue which increased the tenderness by spacing out the muscle fibers (Grau 1978). A similar trend was reported by Leander et al. (1980) in beef and Cyril et al. (1996) in rabbit which observed a shear force of boiled meat similar to that of raw meat. Cooking temperatures in different cooking methods thus dramatically affected the shear force values as also observed by Combes et al. (2003).

Different cooking methods significantly (P<0.05) affected the proximate composition of chicken tikka (Table 3).Tikka cooked in hot air oven method significantly (P<0.05) highest per cent moisture compare to gas tandoor and barbecued methods. The per cent moisture values are 56.78, 57.22 and 58.45, per cent fat values are 2.75, 3.50 and 1.75, per cent ash values are 5.47, 4.99 and 5.20 respectively for chicken tikka cooked in barbecued, gas tandoor and hot air oven methods. No significant difference was found in ash content of chicken tikka cooked in three methods. However, lesser fat per centage was observed in hot air oven cooked sample as compared to other cooking methods. It is generally agreed that reductions in moisture content in cooking temperature increases are due to myofibrillar protein denaturation and structural changes in muscle which cause water to be expelled from the tissue (Davey and Gilbert 1974). At higher temperatures, denaturation and shrinkage of endomysial and perimysial collagen sheaths contributes to the loss of water and increase in toughness also (Bailey 1988). This is in agreement with Fillion and Henry (1998) who reported that frying has little or no impact on the proximate composition of foods. Schock et al. (1970) observed a higher moisture loss in fried than in roasted semi-membranosus muscle of beef.

Sensory attributes: A sensory profile analysis of meat is a method for description of the eating quality in an objective way. The attributes usually cover appearance, odour, flavour and texture including tenderness and juiciness. All sensory attributes can therefore be influenced by changes in the technique and method and temperature of cooking. In this study, the influence of different cooking methods on sensory attributes of chicken tikka has been presented in Table 4. Sensory attributes of chicken tikka was significantly (P<0.05) affected by different cooking methods. The colour, taste, mouth coating and overall palatability scores was rated significantly (P<0.05) higher in gas tandoor chicken tikka compared to barbecued and hot air oven cooked chicken tikka. In flavour scores, there is no significant (P>0.05) difference were found between barbecued and gas tandoor cooking methods. The tenderness and juiciness scores was less in barbecued type chicken product than tikka cooked in gas tandoor and hot air oven methods.

Table 4 : Effect of cooking methods on sensory attributes of chicken tikka (Mean ± S.E)

Sensory attributes	Barbecued	Gas tandoor	Hot air oven
Color	6.20 ± 0.37^{a}	7.00 ± 0.31^{b}	6.30 ± 0.37^{a}
Flavor	6.80 ± 0.20^{b}	6.80 ± 0.20^{b}	6.20 ± 0.37^{a}
Taste	6.40 ± 0.24^{a}	6.80 ± 0.37^{c}	6.60 ± 0.24^{b}
Tenderness	6.20 ± 0.37^{a}	6.60 ± 0.40^{b}	6.60 ± 0.24^{b}
Juiciness	5.90 ± 0.40^{a}	6.40 ± 0.50^{b}	6.40 ± 0.40^{b}
Mouth coating	6.17 ± 0.16^{b}	6.33 ± 0.33^{c}	6.00 ± 0.23^{a}
Overall palatability	6.10 ± 0.33^{a}	6.60 ± 0.40^{c}	6.40 ± 0.40^{b}

Mean values bearing same superscript do not differ significantly (P>0.05).

Several investigations have focused on optimum cooking conditions for meat. Studies have in general indicated that an increasing core temperature results in decreasing juiciness and tenderness but in increasing flavour (Cross et al. 1976; Heymann et al. 1990; Wood et al. 1995). If focus is put on flavour, the sensation of the sensory attribute differs according to core temperature and cooking technique. Oven cooking resulted in a darker colour compared to other cooking methods which leads to less colour scores during sensory evaluation. Hot air oven cooked chicken tikka scored less flavour scores due to long cooking time (at low temperature) which in turn causes increased amount of Maillard reactions involving carbohydrates, proteins and lipids and their degradation products (Mottram 1992). This study showed that juiciness was most affected by cooking method, the changes being directly related to the water losses incurred. The less tenderness and juiciness scores in chicken tikka cooked by barbecued oven is due to more myofibrillar protein denaturation and structural changes in muscle which cause water to be expelled from the tissue. At higher temperatures in barbecued oven, denaturation and shrinkage of endomysial and perimysial collagen sheaths contributes to the loss of water

and increase in toughness (Bailey 1988). Further, Water evaporation and melted fats escaping from meat sample reduced the meat tenderness, hence possibly reducing the consumers' acceptability. Moreover, the cooking loss results also significantly correlated with the type of cooking method. The results of the present study revealing that hot air oven cooking method of chicken tikka had highest cooking yield per cent, less shear force values, highest per cent moisture content. But in respect to sensory attributes gas tandoor oven cooking method recorded superior sensory scores compare to barbecue oven and hot air oven cooking methods except juiciness and tenderness scores. Based on this study, it can be concluded that alternatively chicken tikka can be produced in hot air oven, rather than open flame/tandoor oven with hither cooking yield and superior tenderness and juiciness scores.

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