

## **EFFECT OF VACUUM TUMBLING ON SENSORY AND ECONOMY OF TANDOORI CHICKEN PREPARED FROM ASEEL NATIVE CHICKEN MEAT**

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**Abstract:** The present study was aimed to assess the sensory evaluation and economy of tandoori chicken prepared from native chicken meat by marinating the chicken at different vacuum tumbling time exposures, giving rise to five treatments *viz.* T<sub>0</sub> (no tumbling), T<sub>1</sub> (30 minutes), T<sub>2</sub> (1 hour), T<sub>3</sub> (2 hours) and T<sub>4</sub> (3 hours). After marination, the samples were immediately cooked for 10-20 minutes at 250°C to prepare tandoori chicken. The whole design was replicated twelve times. Significantly highest sensory scores and profit per Kg were observed in treatment T<sub>3</sub> and lowest in T<sub>0</sub> (control) with progressive increase from T<sub>0</sub> to T<sub>3</sub>. The results revealed that marination at 2 hours vacuum tumbling followed by 10-20 minutes cooking at 250°C was ideal for the production of tandoori chicken with better quality and economy.

**Keywords:** Tumbling, Tandoori chicken, Sensory quality, Economy

### **Introduction**

The rapidly increasing demand for meat products suitable for fast food consumption, it would be beneficial to develop simple, easy to prepare, low cost further-processed meat products having improved nutritive values thus providing health benefits for consumers (Gurikar *et al.*, 2014). Commercial marinade solutions usually contain a complex solution of water, salts, polyphosphate, flavorings and other ingredients and are applied to the meat by soaking, blending, tumbling or injection. It is well known that marination is a popular technique used to tenderize and improve the quality characteristics of meat products. Various new techniques have been introduced to accelerate marinade transport throughout the meat. As a kind of physical-mechanical treatment, tumbling is well recognized and accepted (Pietrasik and Shand, 2003). The combination of marination and tumbling provides a useful means of loosening the muscle structures, disrupting muscle cells and destroying the connection between the myofibers and the connective tissue. Also, it promotes the degradation of sarcomere I-filaments and Z-lines, thus facilitating the uniform penetration of the marinade

into meat by extracting salt soluble proteins (SSP) (Cassidy *et al.*, 1978; Alvarado and McKee, 2007), and consequently improving the physical characteristics and sensory qualities of prepared pork chops (Plimpton *et al.*, 1991; Yusop *et al.*, 2012).

Tumbling of meat is usually performed using a vacuum tumbler, which promotes marinade solution penetration and improves colour stability of meat. Tumbling treatments are either continuous or intermittent. Intermittent tumbling is used to obtain a balance between optimal tumbling time and marinade migration time (Hayes *et al.*, 2007), whereas continuous tumbling can effectively avoid intrinsically elastic shrink of tumbled meat samples that occurs in the “rest period” of the intermittent tumbling process. The objective of this work was to determine which time period was most suitable to prepare tandoori chicken. Various tumbling time periods were investigated under vacuum for their effects on the sensory quality and economy of tandoori chicken production.

### **Materials and Methods:**

#### **Experimental design:**

For the present study, meat obtained from native chicken of same hatch and age of 6 weeks, was utilized. Meat was subjected to marination at different vacuum tumbling time exposures as follows.

- i) T<sub>0</sub> (Control group): No tumbling
- ii) T<sub>1</sub>: 30 minutes tumbling
- iii) T<sub>2</sub>: 1 hour tumbling
- iv) T<sub>3</sub>: 2 hour tumbling
- v) T<sub>4</sub>: 3 hour tumbling

For each treatment, meat from a single bird was used. The composition of the marinade solution was optimized in preliminary investigations and designed as given in Table 1 (g/kg meat). The breast cuts were weighed and placed in a vacuum tumbler together with the corresponding volume of marinade for tumbling marination treatments, whereas, in T<sub>0</sub> group, meat pieces were left in marinade solution for three hours. After marination, the samples were immediately patted with tissue paper to absorb surface water and were hung in the earthen tandoori oven with the use of skewers and cooked for 10 - 20 minutes at 250°C to prepare tandoori chicken. The whole design was replicated twelve times. Tandoori prepared thereof were subjected to sensory evaluation.

**Sensory evaluation:** The eating quality parameters like appearance, flavour, juiciness, tenderness and overall acceptability were judged by five semi-trained panelists. The

samples were coded so as to mask the identity of the samples. Care was taken to provide uniform sized ready-to-eat tandoori on white porcelain plates for judging. Each panel member was provided with a sensory evaluation score card to mark their observations and preferences in the appropriate box provided against each attribute of a particular sample.

**Table 1. Ingredients of Marinade solution (Narasimha Rao *et al.*,1996)**

<b>Ingredients</b>	<b>Quantity (g/Kg of dressed chicken)*</b>
Anise	5
Black pepper	5
Caraway	3
Cardamom	3
Clove	2
Cumin	5
Red chilli powder	10
Turmeric powder	5
Salt	35
Kachri	1
Peeled Onion	50
Peeled garlic	20
Curd	500
Lemon	Juice from two lemon fruits (10 ml)
Cinnamon	2
Peeled ginger	20
*Excluding of giblets	

### **Cost of Production**

#### **Statistical analysis**

All data were analyzed by one-way analysis of variance using the general linear model (GLM) procedure of the SPSS software-20. The Duncan's New Multiple Range Test was used to detect significant differences between individual means when the treatment effect was significant ( $p < 0.05$ ). All values were reported as means  $\pm$  standard error for each treatment.

## **Results and Discussion**

### **Appearance**

Appearance of the product played a very crucial role in the consumer's acceptability of the product. Tandoori prepared from broiler and native chicken meat had high appearance score throughout the study period. As compared to control, treatments had more appearance score; especially native chicken with 2 hours tumbling had high appearance score. It may be due to more penetration of the marinate which containing different spices (Crocker, 1948).

### **Flavour**

In present study, tandoori secured high taste panel score for treatments as compared to control. The results of this study revealed that two hours tumbling had high flavour score. Lipid oxidation leads to formation of aldehydes and other low molecular compounds with low sensory thresholds. Such components could give odours and flavours typically associated with rancidity (Olsen *et al.*, 2005). Cooking developed meaty flavour due to chemical changes that takes place in the fiber than in meat juices. On boiling for 35 minutes, meaty flavour was noted in the fiber. The flavour that developed on cooking varies with the species, food and environment of the animal (Crocker, 1948).

### **Juiciness**

In present study product, juiciness was more in treatments as compared to control and there was highly significant difference in score of juiciness. Two hours tumbling have highest juiciness score. Juiciness includes moisture of the product during the initial phase of mastication as well as just prior to mastication. Degree of shrinkage on cooking was directly correlated with loss of juiciness to the palate. The first was the impression of wetness during the first few chews and was produced by the rapid release of meat fluid; the second was one of sustained juiciness, due to stimulatory effect of fat on salivation (Siemens and Hanning, 1953). Marination increases water binding capacity of meats, thus reducing cooking losses and improving meat juiciness (Brotsky *et al.*, 1976).

### **Overall acceptability**

The overall general appeal, palatability characteristics and receptivity of the product were evaluated by the overall acceptability of the product (Table 2). In present study there was significant increase in overall acceptability scores in treatments as compared to control. Two hours tumbling secure highest score for overall acceptability.

Tenderness of meat products, together with juiciness, flavour and colour were the main eating quality characteristics that influenced the consumers overall judgment of quality

(Wood *et al.*, 1995). Sensory evaluation as a scientific discipline used to evoke measure, analyze and interpret results of those characteristics of food materials as they were perceived by the senses of sight, smell, taste, touch and hearing (Dharampal, 1995 and Reaume, 1975).

Parameter	Appearance	Flavour	Texture	Juiciness	Overall acceptability
T <sub>0</sub>	6.16 <sup>a</sup> ± 0.14	6.03 <sup>a</sup> ± 0.14	5.98 <sup>a</sup> ± 0.14	5.76 <sup>a</sup> ± 0.14	5.93 <sup>a</sup> ± 0.13
T <sub>1</sub>	6.94 <sup>b</sup> ± 0.11	6.64 <sup>b</sup> ± 0.13	6.75 <sup>b</sup> ± 0.13	6.60 <sup>b</sup> ± 0.13	6.71 <sup>b</sup> ± 0.11
T <sub>2</sub>	7.66 <sup>c</sup> ± 0.08	7.33 <sup>c</sup> ± 0.11	7.67 <sup>cd</sup> ± 0.08	7.65 <sup>d</sup> ± 0.09	7.51 <sup>c</sup> ± 0.09
T <sub>3</sub>	7.60 <sup>c</sup> ± 0.08	7.73 <sup>d</sup> ± 0.08	7.83 <sup>c</sup> ± 0.08	7.89 <sup>d</sup> ± 0.08	7.85 <sup>d</sup> ± 0.07
T <sub>4</sub>	7.48 <sup>c</sup> ± 0.08	7.54 <sup>cd</sup> ± 0.08	7.44 <sup>c</sup> ± 0.11	7.34 <sup>c</sup> ± 0.10	7.39 <sup>c</sup> ± 0.10
F Value	39.80**	40.50**	47.01**	62.87**	54.92**

Column bearing different superscripts (ABC) differ significantly. NS-Not significant (P>0.05)

### Economics of tandoori chicken preparation

The economics of cost of production of 1 kg tandoori of native chicken meat, curd, spices and condiments is given in Table 3. From the table it is vividly clear that the profit per kg tandoori progressively increases with increase in tumbling time up to 2 hour only. The highest profit of Rs. 99.0/Kg of meat was observed at 2 hours of vacuum tumbling and lowest in treatment without tumbling. The profit increases as a result of increasing processing yield. The processing yield increases with tumbling time as it increases the marinate uptake (Froning and Sackett, 1985). The product tumbled for a longer time has a lower cooking loss as compared to those cooked for a short time due to increased amount of extractable soluble proteins (Dzudie and Okubanjo, 1999; Muller, 1991; Ghavimi *et al.*, 1986).

**Table 3. Economics of Tandoori chicken production**

Treatment	Meat cost/Kg	Processing cost/Kg	Marinade cost/Kg	Total expenditure/Kg	Cost/Kg tandoori	Processing yield (%)	Total income/Kg	Profit /Kg
T <sub>0</sub>	160	0	35	195	400	50	200.0	05.0
T <sub>1</sub>	160	2	35	197	400	60	240.0	37.0
T <sub>2</sub>	160	4	35	199	400	70	280.0	79.0
T <sub>3</sub>	160	6	35	201	400	75	300.0	99.0
T <sub>4</sub>	160	10	35	205	400	72	288.0	82.0

## Conclusion

From the results of the above study, it is concluded that marination at 2 hours vacuum tumbling followed by 10-20 minutes cooking at 250°C was considered ideal for the production of tandoori chicken product from Native Aseel chicken meat with better quality and economy.

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