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Development of a Novel Marinade with Lemon Grass and Green Tea Powder for Chicken Meat

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ABSTRACT

A study was conducted to develop a novel marinade for chicken meat by optimizing the level of basic marinade (BM), lemongrass powder (LGP), and green tea powder (GTP). The boneless chicken breast chunks (2cm^3 size) was added with the ingredients like oil (6%), water (10%) and basic marinade (5%, 7% and 9%), hand mixed well and marinated at refrigeration temperature (4±1°C) for 1 hour. Sensory evaluation indicated that the samples with 7% basic marinade had higher, overall organoleptic scores. The lemongrass powder (0%, 0.5%, 0.75% and 1%) and green tea powder (0%, 1%, 1.5% and 2%) was added to the meat chunks along with the 7% basic marinade in each treatment, respectively. The results revealed that 7% basic marinade demonstrated better scores for appearance (7.55), flavor (7.52), juiciness (7.51) and overall acceptability (7.56) on the 8-point hedonic scale. The sensory scores for the 0.5 %, 0.75% and 1% lemongrass powder incorporated product were in the range of 6.74 to 7.14; 6.78 to 7.85 and 6.36 to 6.85, respectively, indicating a generally positive response and higher ranking of 0.75% LGP product among the treatment. The chicken meat marinated with 1% green tea powder and 7% basic marinade received better scores for appearance (6.54), flavour (6.85), juiciness (6.53), and overall acceptability (6.65) compared to other treatment groups. The novel marinade inclusive of basic marinade (7%), lemongrass powder (0.75%) and green tea powder (1%) can be used for the marination of chicken meat.

Keywords: Chicken meat, novel marinade, lemon grass powder, green tea powder

INTRODUCTION

In India, the total meat production is 10.5 million tonnes and the meat from poultry is 49% of the total meat production with a growth rate of 4-6% growth (BAHS 2025). Chicken meat is important economically, socially and culturally in India, in addition to contributing to better human nutrition and food security as a primary source of high-quality protein (Mandal 2022).

Marination is commonly employed to incorporate flavour and colouring agents to modify texture of poultry meat and meat products (Xiong and Kupski, 1999). Meat has traditionally been marinated to improve taste, softness and shelf life. Natural or dry ingredients, spices, herbs, and other extracts are all possible additions to marinade solutions (Miller 1998). Ready-to-cook Indian style marinated chicken in small packs have better acceptability among the consumers due to convenience for storage and use. Presently there is trend for marketing marinated meat and there is potential for providing ready marinade mix along with the chicken

meat packet.

Lemongrass (*Cymbopogon citratus)* is an aromatic perennial tall grass with rhizomes and densely tufted fibrous root. The natural flavonoids contribute to their antioxidant, anti-carcinogenic and anti-inflammatory properties owing to their lipid anti-peroxidation effects (Martin et al. 2002). Lemongrass contains many bioactive compounds, that are helpful in various health problems (Olorunnisola et al. 2014).

Tea is a very popular drink worldwide and produced from the plant *Camellia sinensis*, which is grown in at least 30 countries, mainly in tropical and subtropical regions (Gupta and Kumar, 2017). Green tea is made from mature unfermented leaves. The health benefits that have been studied using green tea are as an antioxidant, antimicrobial anti-inflammatory, anticarcinogenic, in cardiovascular health and oral health (Vishnoi et al. 2018). Green tea is high in phenolic compounds that exhibit the ability to scavenge free radicals and thus inhibit any free radical reactions (Jigisha et al. 2012).

The commercial marinade available in the market is not having any specific natural antioxidant or antibacterial compound which has good sensory property, increase the shelf life of marinated meat product. In view of all the facts above, the present study is designed with the objectives of development of a novel marinade with lemon grass powder and green tea powder for chicken meat.

MATERIALS AND METHODS

Preparation of meat chunks

Boneless chicken breast meat was procured from the local retail shop Chengicherla, Hyderabad. The tendon, connective tissue and fat were removed and the meat used for experimental purpose after completion of rigor mortis. The entire boneless breast meat was kept at 4°C for 2 hours for setting. These boneless breast portions were cut into chunks of uniform size of about $2cm^3$.

Preparation of a basic marinade (BM)

The ingredients required for the preparation of basic marinade were from the local market of Hyderabad. Salt, Sugar, Kashmiri chilli, Chilli and Turmeric were purchased as powder form available in market. The other ingredients such as cinnamon, cardamom, mace, bay leaf were cleaned and dried (60^0C/18 hours) and onion, ginger and garlic were peeled washed and cut into pieces and dried (55^0C/48 hours). The dried ingredients were ground separately and sieved through a fine mesh and stored in air tight plastic bottles for subsequent use. The ingredients were mixed in the following proportion to create a basic marinade (BM) Table 1.

Table 1: Composition of Basic Marinade (BM)

Ingredients	Percentage
Salt	25
Garlic powder	15
Onion powder	13
Ginger powder	12
Kashmiri chilli powder	8
Chilli powder	7
Turmeric powder	5
Cinnamon powder	5
Cardamom powder	5
Sugar	2
Mace	1
Nutmeg	1
Bay leaf	1
Total	100

Incorporation of basic marinade

To the boneless breast chunks $2cm^3$ size, ingredients like oil (6%), water (10%) and basic marinade (5%, 7% and 9%) was added in each treatment (Table 2). All the ingredients of each treatment were hand mixed well with the chicken pieces. Then the chicken pieces were packed in a low-density polyethylene (LDPE) bag and marinated at refrigeration temperature (4±1°C) for 1 hour. Optimum level of basic marinade required was determined from the sensory evaluation.

Table 2: Determination of optimum level of Basic Marinade

S.No	Ingredients	Treatments Levels of basic marinade (%)		
		I	II	III
1	Basic marinade	5	7	9

In all the treatment oil and water were added at the rate of 6% and 10%, respectively

Preparation of Lemongrass powder

Fresh Lemongrass procured from the local market were cleaned of extraneous matter and dried in the hot air oven at 45^0C for 48 hours. After drying, the dried leaves were ground separately and sieved through a fine mesh. Finely powdered leaves were stored at room temperature in air tight plastic bottles for subsequent use.

Incorporation of lemongrass powder in the marinade

The boneless breast meat cut into 2cm³ chunks was mixed with basic marinade, oil and water as per the requirements to the chicken. Then the lemongrass powder (0%, 0.5%, 0.75% and 1%) in each treatment was added to the meat chunks (Table 3). All the ingredients of each treatment were hand mixed well with the chicken pieces. Then the chicken pieces were packed in a LDPE bag and marinated at refrigeration temperature (4±1°C) for 1 hour. Suitable level of lemongrass powder was selected based on sensory evaluation and added to the basic marinade to develop the Novel marinade.

Table 3: Determination of optimum level of lemongrass powder

S.No	Ingredients	Control (%)	Treatments Levels of lemongrass powder		
			I (%)	II (%)	III (%)
1	Basic marinade	7	7	7	7
2	Lemongrass powder	Nil	0.5	0.75	1

In all the treatment oil and water were added at the rate of 6% and 10%, respectively

Preparation of green tea powder

Tetley brand green tea packet procured from the market were ground separately and sieved through a fine mesh. Finely powdered leaves were stored at room temperature in air tight plastic bottles for subsequent use.

Incorporation of green tea powder in the marinade

The boneless breast meat cut into 2cm³ chunks was mixed with basic marinade, oil and water as per the requirements to the chicken. Then the green tea powder (0%, 1%, 1.5% and 2%) in each treatment was added to the meat chunks (Table 4). All the ingredients of each treatment were hand mixed well with the chicken pieces. Then the chicken pieces were packed in a LDPE bag and marinated at refrigeration temperature (4±1°C) for 1 hour. Suitable level of green tea powder was selected based on sensory evaluation and added to the basic marinade to develop the novel marinade.

Table 4: Determination of optimum level of green tea powder

S.No	Ingredients	Control (%)	Treatments Levels of Green tea powder		
			I (%)	II (%)	III (%)
1	Basic marinade	7	7	7	7
2	Green tea powder	Nil	1	1.5	2

In all the treatment oil and water were added at the rate of 6% and 10%

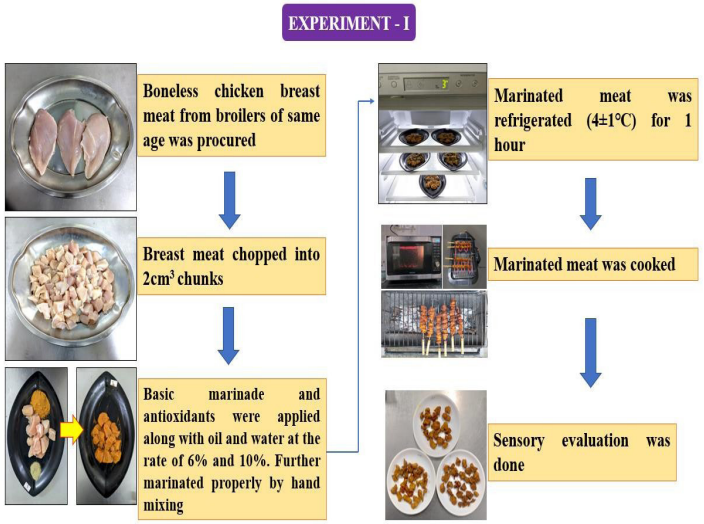

Figure 1: Flow chart on preparation of marinated chicken

Organoleptic evaluation

The marinated chicken meat was judged by the trained panelists consisting of scientists and post-graduate students of ICAR - National Meat Research Institute, Hyderabad for appearance, flavour, tenderness, juiciness and overall acceptability using a 8-point descriptive scale (Keeton, 1983).

Statistical analysis

The experiments were repeated thrice and samples were analysed in duplicate. The data generated on sensory quality was analyzed by one way ANOVA with least significant difference, and Duncan's multiple range test (Steel and Torris, 1981).

RESULT AND DISCUSSION

Determination of suitable level of basic marinade

The sensory evaluation of chicken meat marinated with basic marinade at three different concentrations revealed significant ($P<0.05$) differences among the treatment groups in terms of appearance, flavor, tenderness, juiciness, and overall acceptability (Table 5). The 7% basic marinade demonstrated better scores for appearance, flavor, juiciness, and acceptability. However, there was a significant ($P>0.05$) decrease in tenderness in the 7% basic marinade compared to the 5% basic marinade, possibly due to the higher marinade concentration in the 7% group. All the sensory

scores obtained for the chicken meat marinated with the 7% basic marinade fell within the range of 7.02 to 7.56 on the 8-point hedonic scale, ranking it better than the other two. Based on these results, chicken meat marinated with a 7% basic marinade was selected. Abida et al. (2014) reported that inclusion of the marinade of around 8.25% in the chicken meat was selected for further experimental studies. Jinap et al. (2015) observed that control group of beef was marinated with 1, 2, 3 and 4% of marinade containing the basic ingredients required for marination, among which 4 % was found to be optimum.

Table 5: Effect of basic marinade concentrations on the sensory quality of marinated chicken meat

Parameters	Treatment groups (BM)		
	5 %	7%	9%
Appearance	6.95±0.05^{b}	7.55±0.05^{c}	6.52±0.05^{a}
Flavour	6.96±0.05^{a}	7.52±0.06^{b}	7.00±0.04^{a}
Tenderness	7.54±0.03^{b}	7.02±0.02^{a}	6.95±0.05^{a}
Juiciness	7.01±0.02^{a}	7.51±0.05^{b}	6.99±0.03^{a}
Overall acceptability	7.03±0.02^{a}	7.56±0.05^{b}	7.07±0.05^{a}

BM - Basic marinade.

Means bearing same superscripts in the row differ significantly (P<0.05);

Determination of suitable level of lemongrass powder

Based on the results of the sensory evaluation, the chicken meat marinated with 0.75% lemongrass powder and 7% basic marinade received better scores for appearance, flavor, juiciness, and overall acceptability compared to other treatment groups (Table 6). The scores for tenderness did not show a significant (P>0.05) difference among the treatment groups. The scores for juiciness between the 0.5% and 0.75% lemongrass powder incorporated groups did not show a significant (P<0.05) difference. This suggests that increasing the lemongrass powder concentration beyond 0.5% did not provide a significant additional improvement in juiciness. All the scores for the 0.75% lemongrass powder were in the range of 6.78 – 7.85 on the 8-point hedonic scale, indicating a generally positive response and higher ranking among the other two. Based on these results, chicken meat marinated with 0.75% lemongrass powder and 7% basic marinade was selected. Biney (2022) reported that among 0, 2, 4 and 8% inclusion of lemongrass powder in the buffalo meat sausage, 2% gained significantly (p<0.05) higher overall accepatabililty in the sensory evaluation. Olorunsanya et al. (2010) treated pork patties with lemongrass powder at 0, 0.5, 1 and 1.5% and compared against BHT treated pork patties, where the 1.5% lemongrass treated patties had better shelf life than BHT treated samples on 9 days of refrigerated storage.

Table 6: Effect of lemongrass powder at different concentrations with basic marinade on the sensory quality of marinated chicken meat

Parameters	Treatment groups (BM + LGP)		
	0.5%	0.75%	1%
Appearance	7.14±0.05^{b}	7.45±0.06^{c}	6.85±0.05^{a}
Flavour	6.95±0.05^{b}	7.65±0.05^{c}	6.55±0.05^{a}
Tenderness	6.75±0.06^{a}	6.78±0.04^{a}	6.75±0.05^{a}
Juiciness	6.75±0.05^{b}	6.85±0.05^{b}	6.55±0.05^{a}
Overall acceptability	6.74±0.05^{b}	7.85±0.05^{c}	6.36±0.06^{a}

Means bearing same superscripts in the row differ significantly (P<0.05);

BM – Basic marinade; LGP – Lemongrass powder

Determination of suitable level of green tea powder

Based on the results of the sensory evaluation, the chicken meat marinated with 1% green tea powder and 7% basic marinade received better scores for appearance, flavour, juiciness, and overall acceptability compared to other treatment groups (Table 7). The scores for 2% GTP incorporated meat had significant (P<0.05) difference in tenderness compared to 1% and 1.5% GTP. The findings indicate that the incorporation of 1% green tea powder in the marinade positively influenced the sensory attributes of the chicken meat. It enhanced the appearance, flavor, and juiciness of the meat, leading to scores significantly (P<0.05) higher overall acceptability. All the scores for the 1% green tea powder were in the range of 6.33 – 6.85 on the 8-point hedonic scale, indicating a generally positive response and higher ranking among the other two. Based on these results, chicken meat marinated with 1% green tea powder and 7% basic marinade was selected. Suradi et al. (2019) reported that aqueous extract of 2.5, 5, 7.5% of green extract was used to marinate duck meat. Likewise, tea catechins was added to the raw minced duck meat at 0, 300, 500, 800 and 1000 mg/kg in raw minced duck meat and 300mg was found to be optimum on sensory results (Tian and Huang, 2018). Reddy *et* (2017) found that chicken meat patties treated with 0.2% green tea extract gained significantly (p<0.05) higher acceptance than 0.001% BHT treated chicken meat patties.

Table 7: Effect of green tea at different concentrations with basic marinade on the sensory quality of marinated chicken meat

Parameters	Treatment groups (BM + GTP)		
	1%	1.5%	2%
Appearance	6.54±0.05^{c}	6.35±0.05^{b}	5.95±0.06^{a}
Flavour	6.85±0.05^{c}	6.45±0.06^{b}	5.94±0.06^{a}

Tenderness	6.33±0.05[a]	6.36±0.05[a]	7.16±0.05[b]
Juiciness	6.53±0.05[c]	6.26±0.05[b]	6.05±0.05[a]
Overall acceptability	6.65±0.06[c]	6.16±0.05[b]	5.84±0.06[a]

Means bearing superscripts in the same row differ significantly (P<0.05); BM – Basic marinade; GTP – Green tea powder

CONCLUSION

Based on the findings of the present study it is revealed that 7% basic marinade demonstrated better scores for appearance, flavor, juicines and acceptability. It was observed that lemon grass powder of 0.75% incorporated samples had better scores compared to other groups and for the green tea powder with 1% concentration had good scores. The novel marinade inclusive of basic marinade, lemongrass powder and green tea powder can be used at the rate of 70 g for 1 Kg of chicken meat without affecting the sensory quality.

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CONFLICT OF INTEREST

Authors no conflict of interest to declare

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