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## Impact of addition of honey on sensory characteristics of meat spread prepared from broiler breeder spent hens under refrigerated conditions

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### Abstract

Spent hen meat is known for being tough and contain high levels of connective tissue compared to broiler meat, which limits its consumer acceptance. Spent hen meat is a rich source of animal protein and lipids, making them suitable for developing value-added products. The present investigation was undertaken to assess the influence of honey incorporation on the sensory attributes of meat spread developed from spent hen meat during a refrigerated storage period of 28 days. The formulations were standardized with different inclusion levels of honey: T<sub>1</sub> (0 per cent), T<sub>2</sub> (3 per cent) and T<sub>3</sub> (5 per cent). Sensory attributes of all treatments were evaluated periodically throughout the storage duration. During refrigerated storage, the sensory attributes of the meat spread with 5 per cent honey increased significantly ( $p < 0.01$ ) compared to the control group. However, sensory scores decreased as storage duration progressed. The inclusion of honey improved the overall sensory quality of meat spread prepared from broiler breeder spent hens.

**Keywords:** Broiler breeder spent hen, Meat spread, Sensory quality, Honey

### 1. Introduction

India's total meat production reached 10.25 million tonnes in 2023- 2024, marking a 4.95 per cent increase compared to the previous year (2022-2023). Poultry meat production alone accounted for 5.24 million tonnes or about 51.14 per cent of total meat production. (Basic Animal Husbandry Statistics., 2024) <sup>[1]</sup>. The meat processing sector in India is experiencing consistent growth, largely influenced by rapid urbanization, increasing consumer awareness of quality and evolving dietary preferences. There is a rising demand for scientifically processed meat products, particularly those that are packaged, convenience-based, and ready-to-eat or ready-to-serve, requiring minimal preparation time. Conversion of meat into value-added products offers significantly higher economic returns, with profit margins ranging from 15 to 20 per cent, compared to only 4 to 5 per cent from the sale of fresh meat (Muthukumar *et al.*, 2021) <sup>[9]</sup>.

In this context, chicken meat represents a suitable raw material due to its desirable functional and nutritional attributes, offering significant potential for the development of spreadable meat products and diversification of convenience foods. Poultry meat is broadly accepted across different consumer groups owing to its affordability, high nutritive value, wide availability, and absence of major religious restrictions. Meat spread, as a value-added convenience product, is typically formulated using meat, fat, spices, and various food additives to achieve the desired quality characteristics (Khanam *et al.*, 2020) <sup>[3]</sup>.

Spreadable food products are widely consumed convenience items intended for application on substrates such as bread, primarily to improve palatability and texture. Although products like cheese spread, mayonnaise, jam, and jelly are well established in the Indian market, meat-based spreads have not yet gained substantial consumer acceptance (Kumar *et al.*, 2015b) <sup>[5]</sup>. Chicken meat represents a suitable raw material due to its desirable functional and nutritional

attributes, offering significant potential for the development of spreadable meat products and diversification of convenience foods. Poultry meat is broadly accepted across different consumer groups owing to its affordability, high nutritive value, wide availability, and absence of major religious restrictions. Meat spread, as a value-added convenience product, is typically formulated using meat, fat, spices, and various food additives to achieve the desired quality characteristics (Khanam *et al.*, 2020) [3].

Spent hens, which are laying hens at the end of their laying cycles, are produced in large numbers globally each year. Attitudes towards using spent hens as food vary by country. Despite being considered waste, spent hen meat is a rich source of animal protein and lipids, making them suitable for developing value-added products (Fan and Wu, 2022) [2]. Efficiently utilizing spent hen meat in food products could revolutionize the meat industry by developing appropriate and economical processing technologies for underutilized meat, thereby creating value-added products that are both palatable and economically viable (Kumar *et al.*, 2015b) [5].

Honey is widely used as sweetener in the food industry, containing 181 components, with fructose (38 per cent) and glucose (31 per cent) being the most significant. Honey can be processed into various value-added products, ranging from intermediate moisture foods to dried products (Raziuddin *et al.*, 2021) [10]. It contributes functional characteristics such as humectants, viscosity, flavour enhancement, colour, hygroscopic, miscibility and spreadability (La Bell, 1988) [7]. This study aims to evaluate the impact of two different levels of honey (3 per cent and 5 per cent) on the sensory quality of broiler breeder spent hen meat spread over a refrigerated ( $5 \pm 1^\circ\text{C}$ ) storage period of 28 days.

## 2. Materials and Methods

### 2.1 Preparation of Meat Spread

A series of preliminary trials were carried out to optimize ingredient composition and processing parameters for the development of spent hen meat spread, following the methodology outlined by Kumar *et al.* (2015a) [4]. Broiler breeder spent hens (64 weeks of age), weighing approximately 5.0 to 5.5 kg, were slaughtered under standard hygienic conditions. The carcasses were subsequently deboned, and all visible fat and connective tissues were carefully removed. The lean meat was cut into small pieces and minced using a 4 mm plate in a meat mincer, followed by conditioning at  $5 \pm 1^\circ\text{C}$  for 24 hours.

After conditioning, the minced meat was divided into three treatment groups: T<sub>1</sub> (control, without honey), T<sub>2</sub> (3 per cent honey), and T<sub>3</sub> (5 per cent honey). The respective formulations were prepared by blending the minced meat with measured quantities of salt, spice mix (Table 1), condensed milk, condiments (onion and garlic), oil, tomato extract, vinegar, corn flour, and water (Table 2) to obtain a homogeneous emulsion. Honey was incorporated into the formulations according to the treatment levels prior to grinding. The prepared batter was subjected to steam cooking under pressure for 15 minutes until an internal temperature of  $80 \pm 2^\circ\text{C}$  was attained, followed by braising for an additional 10 minutes. Subsequently, the cooked mixture was finely comminuted in a mixer for approximately 3 minutes to achieve a smooth, spreadable consistency. The final product was packed in sterilized, food-grade, airtight PET containers and stored under refrigerated conditions ( $5 \pm 1^\circ\text{C}$ ) for a period of 28 days for sensory evaluation. The experimental data were analyzed using one-way analysis of variance

(ANOVA), and the results were expressed as mean  $\pm$  standard error (Snedecor and Cochran, 1995) [11].

**Table 1:** Composition of spice mix

| S. No. | Ingredients               | Per cent in the mix |
|--------|---------------------------|---------------------|
| 1.     | Coriander powder (Dhania) | 20                  |
| 2.     | Black pepper (Milagu)     | 15                  |
| 3.     | Capsicum (Milagai)        | 13.5                |
| 4.     | Aniseed (Sombu)           | 12                  |
| 5.     | Cumin seeds (Zeera)       | 12                  |
| 6.     | Turmeric (Manjal)         | 6                   |
| 7.     | Dried ginger (Sukku)      | 6                   |
| 8.     | Cinnamon (Pattai)         | 5                   |
| 9.     | Cardamom (Elakkai)        | 3                   |
| 10.    | Cloves (Kirambu)          | 3                   |
| 11.    | Caraway seed (Omam)       | 2.5                 |
| 12.    | Nutmeg (Jathikkai)        | 1                   |
| 13.    | Mace (Jathipatri)         | 1                   |
| Total  |                           | 100                 |

**Table 2:** Formulation for meat spread

| S. No. | Ingredients            | Percentage (w/w)       |                                 |                                 |
|--------|------------------------|------------------------|---------------------------------|---------------------------------|
|        |                        | T <sub>1</sub> Control | T <sub>2</sub> 3 per cent honey | T <sub>3</sub> 5 per cent honey |
| 1      | Breeder spent hen meat | 48.3                   | 48.3                            | 48.3                            |
| 2      | Salt                   | 1.2                    | 1.2                             | 1.2                             |
| 3      | Spice Mix              | 2                      | 2                               | 2                               |
| 4      | Condensed milk         | 3                      | 3                               | 3                               |
| 5      | Condiments             | 5.5                    | 5.5                             | 5.5                             |
| 6      | Tomato extract         | 2                      | 2                               | 2                               |
| 7      | Oil                    | 2                      | 2                               | 2                               |
| 8      | Corn flour             | 2                      | 2                               | 2                               |
| 9      | Vinegar                | 1                      | 1                               | 1                               |
| 10     | Honey                  | 0                      | 3                               | 5                               |
| 12     | Water                  | 33                     | 30                              | 28                              |
| Total  |                        | 100                    | 100                             | 100                             |

## 3. Results and Discussion

The mean ( $\pm$  S.E.) scores for sensory attributes of the meat spread during refrigerated storage from day 0 to day 28 is presented in Table 3. The appearance scores for the meat spread throughout the storage period had no significant difference between all treatment groups. The texture scores for the meat spread were significantly higher in T<sub>3</sub> (5 percent honey) and T<sub>2</sub> (3 percent honey) compared to T<sub>1</sub> on 0<sup>th</sup>, 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> and 28<sup>th</sup> day of storage. The flavour scores of the meat spread decreased significantly in T<sub>1</sub> compared to T<sub>2</sub> (3 percent honey) and T<sub>3</sub> (5 percent honey). On 0<sup>th</sup>, 7<sup>th</sup> and 14<sup>th</sup> day the flavour scores of the meat spread had no significant difference between T<sub>2</sub> (3 percent honey) and T<sub>3</sub> (5 percent honey). T<sub>3</sub> (5 percent honey) had significantly higher ( $p < 0.01$ ) flavour scores than T<sub>1</sub> (control) on 21<sup>st</sup> and 28<sup>th</sup> day of storage followed by T<sub>2</sub> (3 percent honey). The juiciness scores for the meat spread were significantly higher ( $p < 0.01$ ) in T<sub>3</sub> (5 percent honey) and T<sub>2</sub> (3 percent honey) compared to the T<sub>1</sub> (control) on 0<sup>th</sup>, 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> day of storage. T<sub>3</sub> had significantly higher ( $p < 0.01$ ) juiciness score among all treatment groups, followed by T<sub>2</sub>. T<sub>1</sub> had the lowest juiciness score among all treatment groups. The mouth coating scores for the meat spread were significantly higher in T<sub>3</sub> (5 percent honey) and T<sub>2</sub> (3 percent honey) than in T<sub>1</sub> (control), with no significant differences observed between T<sub>3</sub> and T<sub>2</sub> throughout the storage period. The overall acceptability scores for the meat spread were significantly higher ( $p < 0.01$ ) in T<sub>3</sub> (5 percent honey), followed by T<sub>2</sub> (3 percent honey) and T<sub>1</sub> (control) on 0<sup>th</sup>, 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> and 28<sup>th</sup> day of refrigerated

storage, T<sub>3</sub> and T<sub>2</sub> had significantly higher overall acceptability scores than T<sub>1</sub>. Sensory scores for attributes including appearance, juiciness, texture, flavour, mouthfeel, and overall acceptability exhibited a gradual decline within each treatment group over the refrigerated storage period from 0 to 28 days.

The sensory scores of this study are in accordance with the observations of Kumar *et al.* (2015a<sup>[04]</sup>) who reported a gradual decrease in sensory scores of the meat spread and remained acceptable to sensory panelists over 21 days of refrigerated storage. Similarly, Kumar *et al.* (2015b<sup>[05]</sup>) noted a significant decrease in sensory attributes of meat spread

such as appearance and overall acceptability as refrigerated storage days increased. The findings correlate with reports of Raziuddin *et al.* (2021<sup>[10]</sup>) who found a significant increase in sensory scores for goat meat spread when incorporated with honey. The juiciness score obtained in the present study was correlated with the findings of Karthikeyan *et al.* (2024<sup>[06]</sup>), who reported a significant increase in sensory attributes of meat spread upon incorporation of butter. At the end of the refrigerated storage period, the meat spread containing 5 per cent honey (T<sub>3</sub>) had consistently achieved the highest overall acceptability scores, suggesting that honey positively influenced the sensory quality of meat spread.

**Table 3:** Mean  $\pm$  S.E. sensory attributes scores of the meat spread during refrigerated storage (5 $\pm$ 1 °C)

| Sensory attributes    | Treatments     | 0                             | 7                               | 14                             | 21                             | 28                             | Overall mean    |
|-----------------------|----------------|-------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|-----------------|
| Appearance            | T <sub>1</sub> | 7.01 <sup>W</sup> $\pm$ 0.04  | 6.91 <sup>WX</sup> $\pm$ 0.04   | 6.88 <sup>WX</sup> $\pm$ 0.05  | 6.80 <sup>X</sup> $\pm$ 0.03   | 6.6 <sup>Y</sup> $\pm$ 0.03    | 6.84 $\pm$ 0.03 |
|                       | T <sub>2</sub> | 7.16 <sup>W</sup> $\pm$ 0.12  | 7.01 <sup>X</sup> $\pm$ 0.07    | 6.96 <sup>XY</sup> $\pm$ 0.06  | 6.85 <sup>Z</sup> $\pm$ 0.06   | 6.75 <sup>Z</sup> $\pm$ 0.09   | 6.95 $\pm$ 0.04 |
|                       | T <sub>3</sub> | 7.26 <sup>W</sup> $\pm$ 0.10  | 7.1 <sup>X</sup> $\pm$ 0.06     | 6.96 <sup>Y</sup> $\pm$ 0.09   | 6.88 <sup>Y</sup> $\pm$ 0.06   | 6.88 <sup>Z</sup> $\pm$ 0.06   | 6.99 $\pm$ 0.04 |
| Texture               | T <sub>1</sub> | 6.83 <sup>bW</sup> $\pm$ 0.02 | 6.75 <sup>bWX</sup> $\pm$ 0.05  | 6.53 <sup>bX</sup> $\pm$ 0.01  | 6.15 <sup>bY</sup> $\pm$ 0.05  | 5.63 <sup>bZ</sup> $\pm$ 0.10  | 6.38 $\pm$ 0.08 |
|                       | T <sub>2</sub> | 7.20 <sup>aW</sup> $\pm$ 0.07 | 6.86 <sup>abWX</sup> $\pm$ 0.06 | 6.78 <sup>aX</sup> $\pm$ 0.05  | 6.43 <sup>aY</sup> $\pm$ 0.04  | 6.26 <sup>aY</sup> $\pm$ 0.12  | 6.71 $\pm$ 0.07 |
|                       | T <sub>3</sub> | 7.33 <sup>aW</sup> $\pm$ 0.05 | 7.06 <sup>aWX</sup> $\pm$ 0.10  | 6.86 <sup>aXY</sup> $\pm$ 0.03 | 6.61 <sup>aYZ</sup> $\pm$ 0.14 | 6.41 <sup>aZ</sup> $\pm$ 0.14  | 6.86 $\pm$ 0.07 |
| Flavour               | T <sub>1</sub> | 6.81 <sup>bW</sup> $\pm$ 0.06 | 6.73 <sup>bW</sup> $\pm$ 0.04   | 6.33 <sup>bX</sup> $\pm$ 0.04  | 6.00 <sup>cY</sup> $\pm$ 0.01  | 5.35 <sup>cZ</sup> $\pm$ 0.03  | 6.24 $\pm$ 0.10 |
|                       | T <sub>2</sub> | 7.08 <sup>aW</sup> $\pm$ 0.11 | 7.08 <sup>aW</sup> $\pm$ 0.05   | 7.00 <sup>aW</sup> $\pm$ 0.03  | 6.55 <sup>bX</sup> $\pm$ 0.01  | 6.45 <sup>bY</sup> $\pm$ 0.08  | 6.86 $\pm$ 0.05 |
|                       | T <sub>3</sub> | 7.25 <sup>aW</sup> $\pm$ 0.01 | 7.16 <sup>aW</sup> $\pm$ 0.06   | 7.01 <sup>aWX</sup> $\pm$ 0.04 | 6.81 <sup>aXY</sup> $\pm$ 0.05 | 6.76 <sup>aXY</sup> $\pm$ 0.20 | 7.00 $\pm$ 0.04 |
| Juiciness             | T <sub>1</sub> | 6.85 <sup>bV</sup> $\pm$ 0.01 | 6.78 <sup>bV</sup> $\pm$ 0.07   | 6.41 <sup>bW</sup> $\pm$ 0.03  | 6.01 <sup>bX</sup> $\pm$ 0.03  | 5.46 <sup>cY</sup> $\pm$ 0.02  | 6.30 $\pm$ 0.09 |
|                       | T <sub>2</sub> | 7.31 <sup>aV</sup> $\pm$ 0.06 | 6.95 <sup>aW</sup> $\pm$ 0.00   | 6.75 <sup>aX</sup> $\pm$ 0.03  | 6.60 <sup>aY</sup> $\pm$ 0.18  | 6.31 <sup>bZ</sup> $\pm$ 0.02  | 6.78 $\pm$ 0.06 |
|                       | T <sub>3</sub> | 7.43 <sup>aV</sup> $\pm$ 0.03 | 7.04 <sup>aW</sup> $\pm$ 0.03   | 6.85 <sup>aX</sup> $\pm$ 0.00  | 6.73 <sup>aX</sup> $\pm$ 0.03  | 6.43 <sup>aY</sup> $\pm$ 0.02  | 6.89 $\pm$ 0.02 |
| Mouth coating         | T <sub>1</sub> | 6.15 <sup>bW</sup> $\pm$ 0.04 | 5.96 <sup>bW</sup> $\pm$ 0.04   | 5.68 <sup>bX</sup> $\pm$ 0.02  | 5.25 <sup>bY</sup> $\pm$ 0.03  | 4.76 <sup>bZ</sup> $\pm$ 0.09  | 5.56 $\pm$ 0.09 |
|                       | T <sub>2</sub> | 7.13 <sup>aW</sup> $\pm$ 0.09 | 6.91 <sup>aW</sup> $\pm$ 0.07   | 6.83 <sup>aW</sup> $\pm$ 0.09  | 6.43 <sup>aX</sup> $\pm$ 0.05  | 6.35 <sup>aX</sup> $\pm$ 0.11  | 6.73 $\pm$ 0.06 |
|                       | T <sub>3</sub> | 7.36 <sup>aW</sup> $\pm$ 0.15 | 7.13 <sup>aWX</sup> $\pm$ 0.16  | 7.03 <sup>aWX</sup> $\pm$ 0.13 | 6.73 <sup>aX</sup> $\pm$ 0.05  | 6.71 <sup>aX</sup> $\pm$ 0.06  | 6.99 $\pm$ 0.07 |
| Overall acceptability | T <sub>1</sub> | 7.31 <sup>cV</sup> $\pm$ 0.05 | 7.05 <sup>cW</sup> $\pm$ 0.00   | 6.36 <sup>cX</sup> $\pm$ 0.01  | 5.75 <sup>cY</sup> $\pm$ 0.07  | 4.30 <sup>cZ</sup> $\pm$ 0.03  | 6.15 $\pm$ 0.20 |
|                       | T <sub>2</sub> | 7.43 <sup>bV</sup> $\pm$ 0.06 | 7.25 <sup>bW</sup> $\pm$ 0.00   | 6.78 <sup>bX</sup> $\pm$ 0.03  | 6.73 <sup>bX</sup> $\pm$ 0.02  | 6.38 <sup>bY</sup> $\pm$ 0.05  | 6.91 $\pm$ 0.07 |
|                       | T <sub>3</sub> | 7.81 <sup>aV</sup> $\pm$ 0.06 | 7.46 <sup>aW</sup> $\pm$ 0.03   | 7.18 <sup>aX</sup> $\pm$ 0.08  | 7.10 <sup>aXY</sup> $\pm$ 0.06 | 6.90 <sup>aY</sup> $\pm$ 0.07  | 7.29 $\pm$ 0.06 |

n = 12, T<sub>1</sub>: Control, T<sub>2</sub>: Meat spread with 3 per cent honey, T<sub>3</sub>: Meat spread with 5 per cent honey

Mean values bearing different superscripts within column (a, b, c) and within rows (V, W, X, Y, Z) differ significantly ( $p < 0.01$ )

Mean values bearing with same super scripts within column do not differ significantly

#### 4. Conclusion

Spent broiler breeder meat can be effectively utilized for the development of a spreadable product through the incorporation of honey at levels of 3 and 5 per cent, resulting in improved sensory quality. Although a progressive decline in sensory scores was observed during the 28-day refrigerated storage period, the formulations containing 3 and 5 per cent honey remained organoleptically acceptable up to 21 days. These results indicate that honey contributes significantly to enhancing the overall quality and acceptability of spent hen meat spread.

#### Conflict of Interest

Not available

#### Financial Support

Not available

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