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G Karthikeyan
M. Tech Scholar, Department of Poultry Technology, College of Poultry Production and Management, TANUVAS, Hosur, Tamil Nadu, India

Dr. K Rajendrakumar
Assistant Professor, Department of Poultry Technology, College of Poultry Production and Management, TANUVAS, Hosur, Tamil Nadu, India

Dr. ST Selvan
Dean, College of Poultry Production and Management, TANUVAS, Hosur, Tamil Nadu, India

Dr. D Jayanthi
Professor and Head, Department of Poultry Technology, College of Poultry Production and Management, TANUVAS, Hosur, Tamil Nadu, India

Corresponding Author:
Dr. K Rajendrakumar
Assistant Professor, Department of Poultry Technology, College of Poultry Production and Management, TANUVAS, Hosur, Tamil Nadu, India

Effect of butter in enhancing spreadability and sensory attributes of meat spread under refrigerated storage

G Karthikeyan, Dr. K Rajendrakumar, Dr. ST Selvan and Dr. D Jayanthi

Abstract
The utilization of spent broiler breeder hen meat in value-added products is gaining interest due to its cost-effectiveness and potential for waste reduction in the poultry industry. This study was conducted to evaluate the effect of butter on enhancing the spreadability and sensory attributes of meat spread during a refrigerated storage period of 28 days. The meat spread was prepared in three treatment groups with varying levels of butter: T_1 (0 per cent butter), T_2 (3 per cent butter) and T_3 (5 per cent butter). The spreadability and sensory attributes of each formulation were analyzed over the 28-day storage period. The spreadability of the meat spread with 5 per cent butter significantly increased ($p < 0.01$), followed by 3 per cent butter, compared to the control group throughout the storage period. During the refrigerated storage condition, sensory attributes of meat spread with 5 per cent butter increased significantly ($p < 0.01$) when compared to the control group. Both spreadability and sensory attributes decreased as the storage duration progressed. The inclusion of butter improves the spreadability and sensory quality of meat spread prepared from broiler breeder spent hens.

Keywords: Broiler breeder spent hen, meat spread, spreadability, sensory quality

1. Introduction
The meat processing industry in India is steadily growing, driven by urbanization, quality consciousness and changing food habits. Processing meat into value-added products can yield a profit margin of 15 to 20 per cent for meat processors, compared to the 4 to 5 per cent profit margin from selling fresh meat (Muthukumar *et al*., 2021) [7]. Spent hen meat has been utilized primarily for chicken soups and emulsified products. Therefore, additional usages were to be developed to increase the value of spent hen meat (Mishra *et al*., 2015) [6].
Spreadable products are convenient snacks designed to be spread on or sandwiched in a base like bread. These products enhance the flavour and texture of food, which might otherwise be bland. While many spreadable products like cheese spread, mayonnaise, jam, and jelly are common in the Indian market, spreadable meat products are not yet widely popular among Indian consumers. (Kumar *et al*, 2015b) [2]. The global meat snacks market is growing due to factors, such as the demand for low-calorie, high-protein foods with increasing health and fitness awareness among consumers. Chicken meat, which meets many of these requirements, could be an excellent base for spreadable meat products, adding a new dimension to convenience foods. Poultry meat is a widely accepted consumer product due to its cost effectiveness, nutritional quality, universal availability and lack of religious restrictions (Khanam *et al.*, 2020) [11].
Butter, a fat-rich dairy product obtained from churning cream, is well-regarded for its distinctive aroma and flavour and it is commonly used to enhance the texture and sensory profile of various foods (Mudgil and Barak, 2020) [4]. In meat spreads, the addition of butter plays a critical role in determining spreadability and sensory characteristics. This study aims to evaluate the impact of different levels of butter (0 per cent, 3 per cent and 5 per cent) on the spreadability and sensory quality of broiler breeder spent hen meat spread over a refrigerated (5 ± 1 °C) storage period of 28 days.

2. Material and Methods

2.1 Preparation of Meat Spread

A series of preliminary experimental trials were conducted to standardize the ingredients and processing conditions for the preparation of chicken meat spread, based on the method described by Kumar *et al.* (2015a) [1]. Broiler breeder spent hens, aged 64 weeks, weighing between 5 to 5.5 kg were slaughtered, deboned and trimmed of all visible fat and connective tissue under standard processing conditions. The meat was cut into smaller chunks and minced using a 4 mm plate in a meat mincer, after which it was conditioned at 5 ± 1°C for 24 hours. Following conditioning, the minced meat was divided into three treatment groups: T_1 (control, without butter), T_2 (with 3 per cent butter) and T_3 (with 5 per cent butter). The meat was then blended with various ingredients (Table 2) such as salt, spice mix (Table 1), condensed milk, condiments (onion and garlic), oil, tomato extract, vinegar, corn flour and water to form a uniform batter. The batter was steam-cooked under pressure for 15 minutes to achieve an internal temperature of 80 ± 2°C, followed by braising for an additional 10 minutes. Butter was incorporated according to each treatment group prior to grinding. The mixture was then finely ground in a mixer for approximately 3 minutes to achieve a smooth, paste-like consistency. The prepared meat spread was packed into sterilized, food-grade, airtight PET containers and stored under refrigerated temperature (5 ± 1 °C) for 28 days to assess the spreadability and sensory attributes. One-way ANOVA was used to analyze the data and mean values were expressed with standard error (Snedecor and Cochran., 1995) [10].

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

2.2 Spreadability

The spreadability of the meat spread was evaluated using the method described by Bachhav and Patravale (2009) [3]. A 0.5-gram sample of meat spread was weighed and placed within a pre-marked 1 cm diameter circle on a glass plate. After placing an upper glass plate, a 500-gram weight was applied for 5 minutes. The increase in diameter resulting from the spreading of the meat spread was then measured.

Table 2: Formulation for meat spread

S. No	Ingredients	Percentage (w/w)		
		T_1 Control	T_2 3 per cent Butter	T_3 5 per cent Butter
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	Butter	0	3	5
12	Water	33	30	28
Total		100	100	100

2.3 Sensory Evaluation

The sensory attributes were evaluated by a semi-trained taste panel from the College of Poultry Production and Management, Hosur-635110. The assessment was conducted using a nine-point hedonic scale (Keeton, 1983) [5] with slight modification, the scorecard with "9" indicating extremely desirable and "1" indicating extremely poor.

3. Results and Discussion

3.1 Spreadability

The mean (± S.E.) spreadability (cm) values of the meat spread is presented in Table 3. The treatment group T_3 (5 per cent butter) had significantly higher ($p < 0.01$) spreadability values than T_2 (3 per cent butter) and T_1 (without butter) on the 0^{th}, 7^{th}, 14^{th}, 21^{st} and 28^{th} day of refrigerated storage condition. The treatment group T_1 recorded a significant ($p < 0.01$) decrease in spreadability values among all treatments. The spreadability values of each treatment group decreased significantly ($p < 0.01$) from day 0 to 28 days of storage. Further, the overall mean spreadability (cm) value was highest in T_3 followed by T_2 and T_1. The observed spreadability values of this study concur with findings of Raziuddin *et al.* (2022) [8], who found that the spreadability values of goat meat spread with 5 per cent butter increased significantly ($p < 0.01$) followed by 3 per cent butter. Similarly, Raziuddin *et al.* (2021) [9] also found that the spreadability values of goat meat spread with 5 per cent honey increased significantly ($p < 0.01$) than the control and 3 per cent honey.

Table 3: Mean ± S.E. spreadability values of the meat spread during refrigerated storage (5±1 °C) upto 28 days

Storage days	T_1	T_2	T_3
0	$3.07^{cV} \pm 0.02$	$4.10^{bV} \pm 0.03$	$4.45^{aV} \pm 0.02$
7	$2.86^{cW} \pm 0.02$	$3.86^{bW} \pm 0.02$	$4.25^{aW} \pm 0.022$
14	$2.65^{cX} \pm 0.03$	$3.483^{bX} \pm 0.05$	$3.86^{aX} \pm 0.03$
21	$2.30^{cY} \pm 0.02$	$3.13^{bY} \pm 0.03$	$3.48^{aY} \pm 0.04$
28	$2.10^{cZ} \pm 0.25$	$2.88^{bZ} \pm 0.02$	$3.18^{aZ} \pm 0.05$
Overall Mean	2.60 ± 0.06	3.49 ± 0.08	3.84 ± 0.08

(n=6), T_1: Control, T_2: Meat spread with 3 per cent butter, T_3: Meat spread with 5 per cent butter

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

3.2 Sensory attributes

The mean (± S.E.) scores for sensory attributes of the meat spread during refrigerated storage from day 0 to day 28 are presented in Table 4.

The appearance scores for the meat spread were significantly higher ($p < 0.01$) in T_3 (5 percent butter) compared to T_1 (control) throughout the storage period. T_3 recorded the highest appearance scores among all treatment groups, followed by T_2 (3 percent butter), with T_1 (control) having the lowest appearance score. The texture scores for the meat spread were significantly higher in T_3 (5 percent butter) and T_2 (3 percent butter) compared to T_1 on 0th, 7th, 14th and 21st days of storage. No significant differences were observed between treatment groups on 28th day of storage. The flavour scores of the meat spread decreased significantly in T_1 compared to T_2 (3 percent butter) and T_3 (5 percent butter) on day 0. T_3 (5 percent butter) and T_2 (3 percent butter) had significantly higher ($p < 0.01$) flavour scores than T_1 (control) on 7th, 14th and 21st days of storage. On 28th day, no significant differences were observed between the treatment groups. The juiciness scores for the meat spread were significantly higher ($p < 0.01$) in T_3 (5 percent butter) compared to the other treatment groups, followed by T_2 (3 percent butter) and T_1 (control) on 0th, 7th, 14th and 28th days of storage. T_1 had the lowest juiciness score among all treatment groups. No significant differences in juiciness scores were observed between the treatment groups T_2 and T_3 on 21st day of storage

Table 4: Mean ± S.E. scores of sensory attributes of the meat spread during refrigerated storage (5±1°C) upto 28 days

Sensory attributes	Treatments	0	7	14	21	28	Overall mean
Appearance	T_1	$7.01^{bW} \pm 0.04$	$6.91^{bWX \pm} 0.04$	$6.88^{bWX} \pm 0.05$	$6.80^{bX} \pm 0.03$	$6.6^{bY} \pm 0.03$	6.84 ± 0.03
	T_2	$7.23^{abW} \pm 0.06$	$7.06^{aX} \pm 0.02$	$6.95^{abXY} \pm 0.01$	$6.83^{bYZ} \pm 0.01$	$6.78^{aZ} \pm 0.02$	6.79 ± 0.03
	T_3	$7.33^{aW} \pm 0.05$	$7.15^{aX} \pm 0.01$	$7.01^{aY} \pm 0.02$	$6.96^{aY} \pm 0.01$	$6.83^{aZ} \pm 0.03$	7.06 ± 0.03
Texture	T_1	$6.83^{bW} \pm 0.02$	$6.75^{bWX} \pm 0.05$	$6.53^{cX} \pm 0.01$	$6.15^{bY} \pm 0.05$	$5.63^{aZ} \pm 0.10$	6.38 ± 0.08
	T_2	$7.10^{aW} \pm 0.07$	$6.95^{bW} \pm 0.05$	$6.66^{bX} \pm 0.04$	$6.30^{abY} \pm 0.01$	$5.78^{aZ} \pm 0.08$	6.55 ± 0.09
	T_3	$7.23^{aW} \pm 0.06$	$7.23^{aW} \pm 0.07$	$6.96^{aX} \pm 0.02$	$6.46^{aY} \pm 0.04$	$5.91^{aZ} \pm 0.10$	6.76 ± 0.09
Flavour	T_1	$6.81^{bW} \pm 0.06$	$6.73^{bW} \pm 0.04$	$6.33^{bX} \pm 0.04$	$6.00^{bY} \pm 0.01$	$5.35^{aZ} \pm 0.03$	6.24 ± 0.10
	T_2	$7.19^{abW} \pm 0.08$	$7.06^{aW} \pm 0.04$	$6.86^{aW} \pm 0.04$	$6.5^{aX} \pm 0.08$	$5.51^{aY} \pm 0.13$	6.62 ± 0.11
	T_3	$7.45^{aW} \pm 0.11$	$7.26^{aW} \pm 0.10$	$6.86^{aX} \pm 0.01$	$6.41^{aY} \pm 0.04$	$5.58^{aZ} \pm 0.11$	6.71 ± 0.12
Juiciness	T_1	$6.85^{cV} \pm 0.01$	$6.78^{cV} \pm 0.07$	$6.41^{cW} \pm 0.03$	$6.01^{bX} \pm 0.03$	$5.46^{cY} \pm 0.02$	6.30 ± 0.09
	T_2	$7.61^{bV} \pm 0.08$	$7.53^{bV} \pm 0.02$	$6.93^{bW} \pm 0.02$	$6.73^{aW} \pm 0.06$	$6.01^{bX} \pm 0.04$	6.96 ± 0.11
	T_3	$7.96^{aV} \pm 0.04$	$7.78^{aW} \pm 0.05$	$7.36^{aX} \pm 0.06$	$6.84^{aY} \pm 0.06$	$6.20^{aZ} \pm 0.03$	7.23 ± 0.12
Mouth coating	T_1	$6.15^{bW} \pm 0.04$	$5.96^{bW} \pm 0.04$	$5.68^{bX} \pm 0.02$	$5.25^{bY} \pm 0.03$	$4.76^{bZ} \pm 0.09$	5.56 ± 0.09
	T_2	$7.08^{aW} \pm 0.04$	$7.03^{aW} \pm 0.02$	$6.76^{aW} \pm 0.04$	$6.35^{aX} \pm 0.08$	$5.65^{aX} \pm 0.16$	6.57 ± 0.16
	T_3	$7.50^{aW} \pm 0.16$	$7.31^{aW} \pm 0.15$	$7.03^{aWX} \pm 0.13$	$6.51^{aXY} \pm 0.13$	$6.11^{aX} \pm 0.06$	6.89 ± 0.11
Overall acceptability	T_1	$7.31^{cV} \pm 0.05$	$7.05^{cW} \pm 0.00$	$6.36^{cX} \pm 0.01$	$5.75^{bY} \pm 0.07$	$4.30^{bZ} \pm 0.03$	6.15 ± 0.20
	T_2	$7.61^{bcV} \pm 0.02$	$7.29^{bW} \pm 0.00$	$6.90^{bX} \pm 0.00$	$6.21^{aY} \pm 0.02$	$5.30^{aZ} \pm 0.03$	6.66 ± 0.15
	T_3	$7.90^{aV} \pm 0.03$	$7.52^{aW} \pm 0.03$	$7.11^{aX} \pm 0.02$	$6.36^{aY} \pm 0.06$	$5.41^{aZ} \pm 0.04$	6.86 ± 0.16

(n = 12), T_1: Control, T_2: Meat spread with 3 per cent butter, T_3: Meat spread with 5 per cent butter
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

The mouth coating scores for the meat spread were significantly higher in T_3 (5 percent butter) and T_2 (3 percent butter) than in T_1 (control), with no significant differences observed between T_3 and T_2 throughout the storage period. The overall acceptability scores for the meat spread were significantly higher ($p < 0.01$) in T_3 (5 percent butter), followed by T_2 (3 percent butter) and T_1 (control) on 0th, 7th and 14th days of storage. On 21st and 28th days of refrigerated storage, T_3 and T_2 had significantly higher overall acceptability scores than T_1.

The scores of sensory attributes such as appearance, juiciness, texture, flavour, mouth coating and overall acceptability decreased moderately within each treatment group as storage days progressed from 0 to 28 days.

Kumar *et al.* (2015a) [1] who found that overall acceptability scores of steam-cooked spent hen meat spread on 0th day and 21st day under refrigerated storage were 7.14 and 6.72, which decreased significantly ($p < 0.05$) as the storage days progressed. Similarly, Kumar *et al.* (2015b) [2] also found that the sensory scores for appearance, flavour, spreadability, texture and overall acceptability of a ready-to-eat meat spread developed from spent hens under refrigerated storage decreased significantly ($p < 0.05$) as the storage days progressed. Concurrently Raziuddin *et al.* (2022) [8] found that goat meat spread containing 3 per cent of butter had significantly ($p < 0.01$) higher sensory scores for appearance, flavour and overall acceptability compared to the goat meat spread containing 0, 1 and 5 per cent butter. The sensory scores indicated that highly significant ($p < 0.01$) differences between the control and treatment groups in appearance, flavour and overall acceptability.

4. Conclusion

Spent broiler breeder meat can be effectively utilized to prepare a spreadable meat product incorporating 3 and 5 per cent butter to enhance its spreadability and sensory attributes. Although sensory scores gradually declined over the 28-day refrigerated storage period, the meat spread with 3 and 5 per cent butter remained acceptable up to 21 days based on sensory evaluation. The addition of 5 per cent butter consistently maintained higher quality. These findings suggest that butter plays a key role in improving the overall quality and appeal of spent hen meat spread.

Conflict of Interest
Not available

Financial Support
Not available

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