Original Research

Effect of Spent Hen Meat Emulsion and Ground Meat on Quality and Acceptability of Chicken Meat Cutlets

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Abstract

The study was aimed at comparing the physico-chemical characteristics, microbial profile and sensory acceptability of chicken meat cutlets prepared from spent hen meat emulsion and spent hen ground meat. Significantly (P<0.05) higher pH, breading pick up, moisture retention, product yield, water holding capacity, moisture and fat percentage were observed in spent hen meat emulsion cutlets as compared to spent hen ground meat cutlets. The product shrinkage value was significantly (P <0.05) higher in spent hen ground meat cutlets as compared to spent hen meat emulsion cutlets. No significant change was noticed in protein content and microbial counts between the spent hen meat emulsion and ground meat cutlets. All microbial counts were within the acceptable limits of cooked meat products. Spent hen meat emulsion based cutlets had significantly higher sensory scores as compared to the ground meat cutlets. The cutlets prepared by using spent hen meat emulsion were assessed as moderately to highly acceptable as compared to ground meat. Therefore, spent hen meat can be successfully used for value addition in the preparation of cutlets by using emulsion as well as ground spent hen meat.

Key words: Acceptability, Cutlets, Meat Emulsion, Quality, Spent Hen

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Introduction

Tremendous growth of poultry industry led to more availability of layers for meat at the end of their productive economic life. Meat from such spent birds is generally tough, dry and sinewy (Mediratta *et al.*, 2004). Meat from spent hen is tough and of poor functional and low quality characteristics and spent hen meat offers good scope for processing products, subject to successfully overcoming these limitations (Anna Anandh and Annal Villi, 2018). Development of further processed products from the spent hen meat would

be the most profitable way of utilization of this tough meat. Hence, there is a need to develop some convenience products from the meat of spent hen which could enhance the consumer acceptability. The demand for ready to eat and or ready to cook chicken meat products are gradually increasing because of their convenience. Meat cutlets are flat croquettes of minced meat and other ingredients like flours, pulses, shredded potato, condiments and spices and are often coated with bread crumbs. Cutlets are simple and a cost effective means of converting spent hen meat into value added convenience products. Meat homogenate or fine chopped meat is prepared by mixing or chopping with salt and phosphate. Fine chopped meat contains high levels of extracted myofibrillar proteins that will act as effective binder for water, fat and meat particles in cooked meat products (Singh *et al.,* 2015). The mincing of meat has profound effect on the quality attributes of the meat cutlets (Singh *et al.,* 2014). It increases the texture, juiciness and water binding ability of the meat and helps in the extraction of myofibrillar proteins (Pearson and Gillet, 1997 Khandagale *et al.,* 2009). In this perspective, it is necessary to evolve appropriate technology to convert the tough and less palatable spent hen poultry meat in to convenient, attractive and more acceptable ready to eat meat cutlets. Hence, a study was undertaken to develop and evaluate the acceptability of spent hen meat cutlets by using spent hen meat emulsion and ground spent hen meat.

Materials and Methods

Spent Hen Meat

White leghorn spent hens of about 74 weeks old were purchased from the local poultry farm. The birds were slaughtered following standard procedure, dressed hygienically and manually deboned. The deboned spent hen meat was cut into small chunks and frozen for 1-2 hr to ensure easy mincing. The spent hen meat chunks were minced through the meat mincer (Mado, Germany) for preparation of emulsion and ground batter.

Product Formulation and Treatments

The spent hen meat cutlet formulation consisted of 70 % spent hen meat emulsion / ground meat, 2.0 % salt, 1.5 % spice mix (aniseed – 10, black pepper – 10, caraway seed – 10, capsicum – 8, cardamom – 5, cinnamon – 4, clove – 1, coriander – 20, cumin seed – 22, turmeric 10 in percentage/weight), 3.0 % refined vegetable oil, 3.5 % refined wheat flour, 10% condiments mix (onion, garlic and ginger in the ratio of 10:2:1), 10% cooked shredded potato and 5.0 % ice flakes. Other ingredients were used in the cutlet preparation are whole liquid egg for coating, breadcrumb powder for enrobing and vegetable oil for deep fat frying as required.

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Preparation of Spent Hen Meat Emulsion

The spent hen meat was manually cut into hen meat chunks and then minced through mincer using 5 mm plate. For emulsion preparation salt (50 % of the total salt used) was added to the minced spent hen meat. The materials were chopped for about 2 min with a bowl chopper (Scharffen, Germany). After addition of ice flakes it was chopped again for 1–2 min. Refined vegetable oil was added slowly and chopping was continued till the oil was completely dispersed in the batter and chopping continued for 2 min to give a fine viscous emulsion.

Preparation Ground Meat Batter

The spent hen meat was manually cut into hen meat chunks and then coarse ground in a meat mincer with a kidney plate (0.95 cm diameter). The ground meat was then mixed with salt (50 % of the total salt used) in a blender at medium speed for 2 min. After addition of vegetable oil and ice flakes, it was blended again until a tacky exudate was formed.

Product Preparation

Condiments were fried along with salt (remaining 50 % of the salt used) and spice mix. Spent hen meat emulsion / ground spent hen meat, fried condiments, cooked shredded potato and binders were blended in a blender for 2 min. About 80 g of blended batter was molded into oval shaped cutlets using an aluminium mould (10 cm length, 5 cm breadth and 1 cm height) and kept chilled until further battering and breading. Whole liquid egg was whipped in a wide mouthed container, chilled and the cutlets were dipped until a uniform coating was formed. The battered cutlets were rolled over the breadcrumb powder until a uniform coating of breading material was formed on the surface. Cutlets were deep fat fried in refined vegetable oil until a golden brown colour developed on the surface and a product core temperature of 80 ± 2 °C was attained. The cutlets were aerobically packed in LDPE bags and were used for analysis of various physico – chemical characteristics and sensory parameters.

Analytical Procedures

The pH was determined by using a digital pH meter (Century Instruments Ltd., Mumbai, India). According to the procedure explained by Trout *et al*. (1992) by dipping the combined glass electrode of a digital pH meter in the slurry of cutlets with distilled water. Percentage of breading pickup was calculated (Hsia *et al.*, 1992) using the following formula:

$$\text{Breading pickup} = \frac{\text{Weight of cutlets after breading} - \text{weight before breading}}{\textit{Weight of cutlets before breeding}} \times 100$$

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Shrinkage of the products was calculated using the formula given by El-Magoli *et al.* (1996) with suitable modification, i.e. the diameter of the fried cutlets was represented by the average length and breadth of the oval shaped cutlets. Product yield was expressed as a percentage after recording the weights of raw and fried cutlets. Moisture (%) of the cooked sample was used to calculate moisture retention (%) which represent the amount of moisture retained in the cooked per 100 gm of the raw sample. The value was calculated by using the formula:

$$\text{Moisture retention (\%)} = \frac{\text{\% cooking yield} \times \text{\% moisture in cooked product}}{100}$$

(as described by El-Magoli *et al.*,1996).

The water holding capacity (WHC) was determined as described by Wardlaw *et al.* (1973) with slight modification by mixing 20 gm of meat batter with 30 ml of 0.6 M NaCl in centrifuge tube and was stirred for 1 min. The tube was then kept at refrigerated temperature (4 ± 1°C) for 15 min, stirred again and centrifuged at 5000 rpm for 10 min. The supernatant was measured and amount of water retained by samples was expressed as WHC in percentage. Moisture (oven drying), protein (Kjeldahal) and fat (Soxhlet ether extract) contents of the products were determined as per AOAC (1995).

Microbial Analysis

Total plate, coliform and yeast and mold counts of cutlet samples were determined by the methods described by APHA (1984). Readymade media (Hi-media Laboratory Pvt. Ltd., Mumbai, India) was used for microbial count. Preparation of samples and serial dilutions were done near the flame in a horizontal laminar flow cabinet which was pre sterilized by ultraviolet irradiation (Yarco Sales Pvt. Ltd., Mumbai, India) observing all possible aseptic precautions. Tenfold dilution of each samples were prepared aseptically by blending 10 g of sample with 90 ml of 0.1% sterile peptone water with a pre sterilized blender. Plating medium was prepared and autoclaved at 15 lb pressure for 15 min before plating. The plates were incubated at 30 ± 1°C for 48 h for total plate count (TPC). Coliform count was done using double layer violet red bile agar and plates were incubated at 37 ± 1°C for 48 h. Acidified potato dextrose agar (pH 3.5) was used for enumeration of yeast and mold with incubation at 25 ± 1°C for 5 days. After incubation, the plates showing 30 – 300 colonies were counted. The average number of colonies for each species was expressed as log10 cfu / g sample.

Sensory Evaluation

The spent hen meat cutlets were served to an experienced panel. The sensory attributes appearance, flavour, juiciness, texture, binding and overall acceptability was evaluated on eight point descriptive scale as

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suggested by Keeton (1983). The sensory score of 8 was extremely desirable, whereas a score of 1 was extremely undesirable.

Statistical Analysis

The data generated from four trials for each experiment was analyzed following standard procedures (Snedecor and Cochran, 1989) for comparing the means and to determine the effect of treatment (P<0.05).

Results and Discussion

Physico–chemical Characteristics

The mean pH of spent hen meat emulsion cutlets was significantly (P<0.05) higher compared to the ground spent hen meat cutlets (Table 1). Singh *et al.* (2015) also reported that increased level of meat emulsion in spent hen meat cutlet increases the pH of the cooked product. Similar observations were also reported by Eyas *et al.* (2007) in buffalo meat cutlets.

Table 1: Effect of spent hen meat emulsion and ground spent hen meat on physico-chemical parameters of chicken meat cutlets

Physico-chemical Parameters*	Spent Hen Meat Emulsion Cutlets	Ground Spent Hen Meat Cutlets	Overall Mean ± SE
pH	6.30 ± 0.08^{a}	6.10 ± 0.10^{b}	6.20 ± 0.10
Beadings pick up (%)	12.68 ± 0.18^{a}	10.80 ± 0.14^{b}	11.74 ± 0.16
Product shrinkage (%)	1.39 ± 0.15^{a}	3.14 ± 0.11^{b}	2.27 ± 0.13
Moisture retention (%)	59.34 ± 0.10^{a}	49.86 ± 0.14^{b}	54.60 ± 0.12
Product yield (%)	90.88 ± 0.12^{a}	88.38 ± 0.12^{b}	89.64 ± 0.12
Water Holding Capacity (%)	42.98 ± 0.14^{a}	35.54 ± 0.11^{b}	39.26 ± 0.13
Moisture (%)	65.30 ± 0.08^{a}	56.25 ± 0.10^{b}	60.78 ± 0.10
Protein (%)	23.92 ± 0.10	23.86 ± 0.12	23.90 ± 0.11
Fat (%)	9.86 ± 0.14^{a}	10.17 ± 0.16^{b}	10.02 ± 0.15^{b}

**Number of observations = 4; Means bearing same superscripts (lowercase letters) row-wise do not differ significantly (P< 0.05).*

The breading pickup was significantly (P<0.05) higher for spent hen meat emulsion cutlet as compared to ground spent hen meat cutlet. Breading pickup is largely influenced by the batter viscosity and viscosity is key to obtaining the desired coating pickup and adhesiveness. Viscous emulsion provide adhesion in the form of a good binding surface to which breading materials can attach that could be increased the beading pickup in spent hen meat emulsion cutlets as compared to ground spent hen meat cutlets. The product yield of spent hen meat emulsion cutlets and ground spent hen meat cutlets differ significantly, but the yield was significantly lower in ground spent hen meat cutlets. The low product yield of ground spent hen meat cutlets might be due to its higher particle size and low levels of extraction of protein (Anjaneyulu *et al.,* 1989). Higher product yield of spent hen meat emulsion cutlets might be due to the effect of grinding. Fine chopping increases water binding capacity that could be increased the product yield which is in agreement

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with the findings of Beuschel *et al*. (1992) and Singh *et al.* (2014). Lin and Keeton (1994) reported increased product yield in precooked meat products by use of coarse grinding. Increased protein extractability, which resulted in greater solubilisation of muscle proteins, might have caused the increased product yield (Xargayo & Lagares, 1992). Moisture retention values were significantly (P<0.05) higher for spent hen meat emulsion cutlets as compared to ground spent hen meat cutlets. Coagulation and thermal shrinkage of collagen fibres in connective tissue might have contributed to decreased moisture retention value in ground spent hen meat cutlets. Trout and Schmidt (1984) also demonstrated the ability of meat to absorb water in the raw state, but it was not retained when the meat was cooked. Cutlets prepared from spent hen meat emulsion had high water holding capacity value as compared to those prepared from ground spent hen meat. Increased water holding capacity values were primarily due to moisture loss (Raharjo *et al.*, 1995). Moisture content of spent hen meat emulsion and ground spent hen meat cutlets differ significantly. No significant difference was noticed in protein content of spent hen meat emulsion and ground spent hen meat cutlets. The fat content was significantly (P<0.05) higher for spent hen meat emulsion cutlets as compared to ground spent hen meat cutlets.

Microbial Characteristics

Increased microbial counts were observed in ground spent hen meat cutlets as compared to spent hen meat emulsion cutlets. However, there was no significant difference between spent hen meat emulsion cutlets and ground spent hen meat cutlets and the microbial counts were within the standard stipulated for cooked meat products (Jay, 1996).

Table 2: Effect of spent hen meat emulsion and ground spent hen meat on microbial profile of chicken meat cutlets

Microbial Profile (Log_{10} Cfu/G)**	Spent Hen Meat Emulsion Cutlets	Ground Spent Hen Meat Cutlets	Overall Mean ± SE
Total plate count	1.80± 0.12	1.82± 0.15	1.81± 0.14
Coliform count	0.72± 0.14	0.78± 0.08	0.75± 0.12
Yeast and mould count	0.64± 0.16	0.68± 0.14	0.66± 0.15

Number of observations = 4; Means bearing same superscripts row- wise do not differ significantly (P < 0.05).

Sensory Characteristics

The sensory attributes scores for appearance, flavour, juiciness, texture, binding and overall acceptability were generally higher for spent hen meat emulsion cutlet as compared to ground spent hen meat cutlets (Table 3). Between treatments, the sensory attributes of appearance, flavor, juiciness, texture, binding and overall acceptability were significantly (P<0.05) higher for spent hen meat emulsion cutlets than ground spent hen meat cutlets. The lower sensory scores for ground spent hen meat cutlets as compared to spent hen meat emulsion cutlets are due to poor functional and binding properties of spent hen meat.

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Table 3: Effect of spent hen meat emulsion and ground spent hen meat on sensory attributes of chicken meat cutlets

Sensory Attributes***	Spent Hen Meat Emulsion Cutlets	Ground Spent Hen Meat Cutlets	Overall Mean ± SE
Appearance	7.7± 0.05[a]	7.1± 0.05[b]	7.4± 0.05
Flavour	7.4± 0.02[a]	7.0± 0.04[b]	7.2± 0.03
Juiciness	7.6± 0.04[a]	7.2± 0.02[b]	7.4± 0.04
Texture	7.8± 0.04[a]	7.2± 0.04[b]	7.5± 0.04
Binding	7.6± 0.04[a]	6.8± 0.04[b]	7.2± 0.04
Overall acceptability	7.7± 0.04[a]	7.0± 0.04[b]	7.4± 0.04

****Number of observations = 28; Sensory attributes of spent hen meat cutlets were evaluated on an 8-point descriptive scale (wherein, 1 = extremely undesirable; 8 = extremely desirable); Means bearing same superscripts (lowercase letters) row-wise do not differ significantly (P< 0.05).*

Poor appearance, binding and cohesiveness of the particles results in crumbling and breakage of the product (Sparado and Keeton, 1996). Textures of the cutlets were significantly improved by the incorporation of meat emulsion (Eyas *et al.*, 2007; Singh *et al.*, 2015). It is documented that spent hen meat emulsion improves the cohesion of particles (Corriera and Mittal, 1991). Incorporation of spent hen meat emulsion significantly improved overall palatability of cooked meat products (Eyas *et al.*, 2007; Singh *et al.*, 2015; Anna Anand and Annal Villi, 2018).

Conclusion

The cutlets prepared by spent hen meat emulsion were assessed as moderately to highly acceptable, whereas the cutlets prepared by ground spent hen meat were rated as moderately acceptable. Therefore, spent hen meat can be successfully used for value addition in the preparation of meat cutlets by using spent hen meat emulsion as well as ground spent hen meat.

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