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Effect of incorporation of various toppings in spent hen meat chips#

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Abstract

Spent hens are by-products of the egg industry and it has poor tenderness and less juiciness due to high cross-linking collagen content. Chips are popular snacks throughout the world due to their easy preparation and savoury flavour. Incorporation of spent hen meat in chips can provide a complete nutritious snack. The addition of toppings in spent hen meat snacks would give a unique taste and enhance the acceptance of consumers. The study was undertaken in the Department of Livestock Products Technology to analyse the effect of two different toppings namely, tandoori (T_1) and chicken chip topping (T_2) in spent hen chips for their physico-chemical, proximate, colour and sensory attributes. A higher pH value was found for control without toppings while water activity value was found significantly ($p<0.001$) higher for T_1. Significant ($p<0.001$) difference was found for lightness (L) between control and treatments. Redness (a*) and yellowness (b*) were found highest for T_1. The highest sensory score for all sensory parameters was found for T_2. Thus, chicken chips with 50 per cent spent hen meat dusted with five per cent chicken chip topping was highly accepted by the consumers due to its uniqueness in taste.*

Keywords: *Spent hen meat, chips, toppings*

Spent hens are usually the hens that have finished their laying cycle. Spent hen meat is considered high in cholesterol and fat and has many poor qualities such as low tenderness due to high cross-linking collage content and less juiciness (Sarkar *et al*., 2020). Even though these disadvantages are present, spent hen meat has a high protein with omega-3-fatty acids which adds to the health benefits (Lee *et al*., 2003). Spent hen meat is currently utilised for the preparation of stews and soups but it can be economically utilised in other products as well. According to

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Kumar *et al*. (2019) chips are one of the most popular and widely recognised snack foods in the world, owing to their ease of preparation and savoury flavour. Snacks are food items that may be stored in simple packing materials and consumed in tiny amounts, making them suitable for both the working class and children. Snacks, such as chips, are typically made up of cereal flours, oil, salt, spices, and condiments, all of which are high in carbohydrates and poor in protein, vitamins and minerals. Spent hen meat can be easily be incorporated in chips to provide a complete and nutritious snack. Toppings are generally incorporated in chips to give them a different flavour than plain chips and to attract customers. According to Hanify (2001), toppings are blended to give the finished product a unique colour and flavour, as well as boost its customer appeal. There is very little research found in the development of spent hen meat chips with addition of toppings. Taking this into consideration, a study was conducted to develop spent hen meat chips with the incorporation of various toppings and to assess their effects on proximate, physico-chemical, colour and sensory attributes of the chips.

Materials and methods

Source of ingredients

The spent chicken was obtained from the local market and scientifically slaughtered and dressed in hygienic conditions at Meat Technology Unit (MTU), Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Thrissur. The dressed carcasses were stored at -23±1°C until use. The dressed carcasses were deboned and minced twice with a 4mm plate in mincer (MADO primus Model MEW 613, Germany). The control flour mix was prepared by standardised combinations of rice flour, wheat flour, tapioca flour, black gram flour and potato starch. Rice flour, wheat flour, black gram flour and tapioca flour were obtained from the local market and potato starch from Angel Starch and Food Pvt. Ltd., Erode. Various additional ingredients were also added over and above the control flour mix. Texturised soya protein, salt, baking powder, butter and egg were obtained from the local market. The spice mixture was prepared by spices (pepper, chilli powder, nutmeg, mace, fennel seed, coriander powder and turmeric powder) procured from the local market. Different toppings for incorporation on chicken chips were procured from Plant Lipids Pvt. Ltd., Kolencherry, Kerala, India. Refined sunflower oil (Fortune) obtained from the local market was used for frying during the complete study.

Preparation of spent hen meat chips

The standardised formulation of spent hen meat chips is given in Table 1. Preparation of spent hen meat chips are illustrated in Fig. 1-4. Various preliminary trials were conducted by utilizing different levels of spent hen, different flours and additional ingredients to standardise the formulation of spent hen meat chips. Flours, spent hen meat and additional ingredients except egg were weighed as per formulation and mixed in a planetary mixer (ITALYA Mixer, Model: VFM10A, India) for 10 minutes until the mixture is homogenised completely. The egg was weighed according to the formulation and beaten completely. The beaten egg was later on added to the homogenised mixture in the planetary mixer and again operated for five minutes until it homogenises completely. Water was added at five per cent level of the dough mix to give it proper consistency for it to be extruded out. The batter was kneaded for 15 minutes and then extruded in a pasta extruder (Dolly GB, Italy) which is fitted with a ribbon-shaped sieve. The extruded raw chips were then cut to a size of 2 cm and then deep fried at temperature of 170°C for 1 minute and 30 seconds in electric single fryer (Toastmaster model no. E-DZ-4L). Fried chips were than incorporated with two types of toppings namely, tandoori (T_1) and chicken chip topping (T_2) by dusting the toppings over the chips. Four per cent for T_1 and five per cent for T_2 of the weight of fried chips was finalised respectively after various preliminary trials. After this, the chips were cooled at room temperature and were packed in polyethylene/aluminum/polyamide laminated pouches. These laminated pouches were aerobically sealed using Sepack Continuous sealer (Sevana, Cochin, India) and stored at ambient temperature (37±2□) in a dry place.

Table 1. Formulary for preparation of spent hen meat chips

Ingredients	Composition (%)
Spent hen meat	50
. Control Flour Mix	
Rice flour	2
Wheat flour	8
Tapioca flour	5.5
Black gram flour	5.5
Potato starch	29
. Additional Ingredients*	
Texturised soya protein	3
Spice mix	1.7
Salt	1.5
Egg	7
Butter	2
Baking powder	1

*Additional ingredients were added over and above the control flour mix formulation.

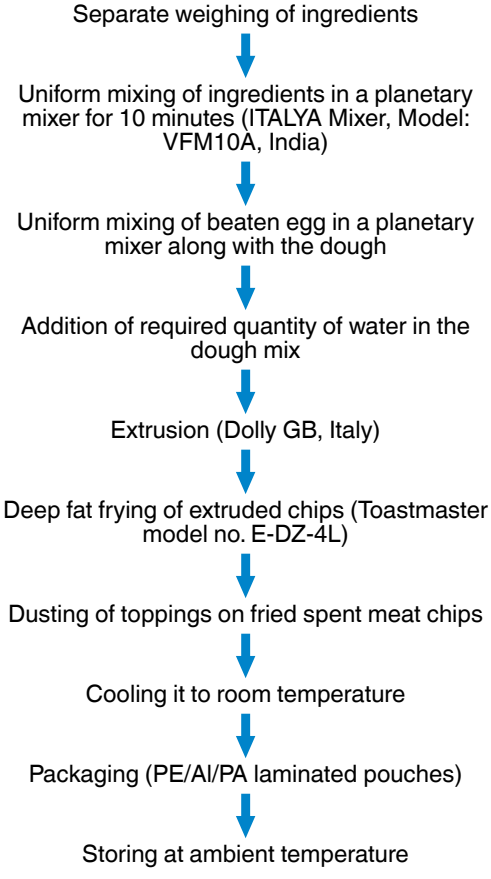

Fig. 1. Flowchart for preparation of spent hen meat chips

Fig. 2. Raw extruded spent hen meat chips

Fig. 3. Fried spent hen meat chips dusted with toppings

Fig. 4. Standardised spent hen meat chips in laminated pouches

Cooking yield

The weight of the extruded raw chips and the weight of the extruded fried chips were noted as per Berry *et al*. (1992). The cooking yield was stated as percentage. The percentage of cooking yield was calculated as follows:

$$\text{Cooking yield (\%)} = \frac{\text{Weight of extruded fried chips (g)}}{\text{Weight of extruded raw chips (g)}} \times 100$$

pH

The pH of the chips was determined using a digital pH meter according to AOAC (2016). Ten grams of sample was mixed with 50 ml distilled water and homogenised. The pH of the homogenate was measured by immersing the combined electrode digital meter in it (μ pH system 362, Systronics, India).

Water activity (a_w)

Water activity was carried out as per Carbonell *et al.* (2005) wherein, the chip samples were crushed evenly and were put in the sample cup up to the mark. The filled sample cup was placed in the Labswift a_w meter's measuring chamber (Novasina, Switzerland). When the reading was stable, water activity value was noted down.

Hunter colour (L*a*b*)

Technique by Page *et al.* (2001) was used to determine the colour of the control as well as standardized chips objectively using Hunter Lab Mini Scan XE Plus Spectrophotometer (Hunter Lab, Virginia, USA) with diffuse illumination. The instrument was set to measure Hunter L* a* and b* using illuminant 45/0 and 10° standard observer with an aperture size of 2.54 cm. It was calibrated using black and white calibration tiles before starting the measurement and colorimeter score recorded with 'L*' of black equals zero and 'L*' of white equals 100, 'a*' of lower numbers equals more green (less red), higher numbers equal more red (less green) and 'b*' of lower numbers equals more blue (less yellow), higher numbers equal yellow (less blue). The colour coordinates L* (lightness), a* (redness) and b* (yellowness) of the samples were measured thrice, and mean values were taken.

Proximate composition

Control and flavoured chips were assessed for their proximate composition *i.e.*, moisture, protein, fat on the day of preparation as per procedure by AOAC (2016). The proximate principles were expressed as percentages.

Sensory evaluation

Sensory evaluation of control and flavoured chips was carried out by minimum of seven semi-trained panelists drawn from the Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur using an eight-point Hedonic scorecard (Defreitas and Molins, 1988). The chips were analysed for appearance and colour, flavour, crispiness, meat flavour intensity, oiliness, aftertaste and overall acceptability. Uniform samples of each category of snacks were taken and served to the panelists with a code number and scorecard and asked to rate using eight-point Hedonic scale. The average individual scores were considered as the scores for a particular attribute.

Results and discussion

Control (C) included spent hen meat chips without the inclusion of any toppings. Two toppings namely, tandoori topping and chicken chip topping were utilised for the study. Various preliminary trials were conducted to standardise the levels of incorporation of the toppings. Four per cent and five per cent of the weight of fried chips were finalised for tandoori topping (T_1) and chicken chip topping (T_2), respectively. The samples were evaluated for their physico-chemical, proximate, colour and sensory attributes. The best treatment was selected based on the sensory attributes.

Physico-chemical properties

The physico-chemical properties were presented in table 2 for control and treatments. Control and treatment chips did not show any significant ($p<0.001$) differences in cooking yield. The incorporation of toppings

thus did not affect cooking yield. There was high significant (p<0.001) difference found for pH between control and the treatments. According to Gonzalez and Hanninen (2011), the pH of chicken meat seasoned with various seasonings ranged from 5.91 to 5.99, while the pH of control was 6.65 to 6.71. The high pH for control may be due to the absence of toppings incorporated in the chips. Water activity was found highest for T_1 as compared to C and T_2. Water activity for all the samples was found in the range of 0.48 to 0.50 while, Charoen *et al*. (2015) observed that the water activity of barbecue-flavoured grey oyster mushroom crisps was 0.308. The incorporation of various toppings might have resulted in a change in water activity value for different treatments.

Colour (L*a*b* values)

The effect of various toppings on the colour values of control and treatments is depicted in table 2. There were high significant (p<0.001) differences found for lightness (L*) value between the control and treatments. The highest lightness (L*) value for control may be due to the absence of toppings in control chips. Highly significant (p<0.001) redness (a*) and yellowness (b*) value was found for T_1 as compared to the other samples. The findings were consistent with Mckee *et al*. (2001), who discovered that meat and seasoning interaction had an effect on puff lightness (L*) when chicken meat was coated with chile seasoning. The chile seasoning incorporation also had a good influence on redness (a*) and yellowness (b*). The incorporation of toppings in spent hen chips may be the major reason for the colour value differences.

Proximate composition

The impact of various toppings on the proximate composition of control and treatments is stated in Table 2. The moisture content was found in the range of 3.36-3.57 for control and treatments. No significant (p<0.001) difference was seen between control and treatments for fat, protein and moisture content. The results showed that toppings incorporation did not lead to any changes in the proximate composition of the spent hen meat chips.

Sensory evaluation

The effect of various toppings incorporated in spent hen meat chips on sensory evaluation is shown in table 3. High significant (p<0.001) difference was seen for appearance and colour, flavour, oiliness, after taste and overall acceptability between the samples. The range for appearance and colour was from 6.64-7.37. There was high significant difference between treatments and C for flavour score. Oiliness value was found in the range of 6.33-7.35. Treatment T_2 (7.36±0.13) was found to have the highest after taste value. Treatments score for overall acceptability score did not show any significant (p<0.001) differences.

Table 2. Physico-chemical, colour, proximate composition parameters of spent hen chips

Parameters	C	T_1	T_2	F - Value	p-Value
Cooking yield (%)	75.96±0.1	76.14±0.1	76.29±0.07	3.077^{ns}	0.076
pH	$6.40±0.005^{a}$	$6.28±0.01^{b}$	$6.30±0.01^{b}$	45.13^{**}	<0.001
Water activity (a_w)	$0.49±0.002^{b}$	$0.50±0.001^{a}$	$0.48±0.001^{c}$	20.17^{**}	<0.001
L*	$47.63±0.09^{a}$	$44.42±0.06^{c}$	$46.92±0.05^{b}$	522.87^{**}	<0.001
a*	$15.15±0.05^{c}$	$18.98±0.03^{a}$	$16.06±0.08^{b}$	992.92^{**}	<0.001
b*	$35.74±0.17^{c}$	$40.12±0.09^{a}$	$37.98±0.08^{b}$	300.42^{**}	<0.001
Moisture (%)	3.36±0.05	3.57±0.06	3.48±0.08	2.27^{ns}	0.138
Protein (%)	18.32±0.08	18.27±0.08	18.28±0.12	2.73^{ns}	0.932
Fat (%)	28.45±0.02	28.51±0.01	28.48±0.01	0.071^{ns}	0.097

** significant at 1% level, ns- non significant, means with same superscript have no significant difference between them. The values are expressed as their Mean ± Standard error. (Number of observations = 6)

C = Control (Spent hen meat chips without the addition of toppings)

T_1 = C + four per cent tandoori topping

T_2 = C + five per cent chicken chips topping

L* - Lightness

a* - Redness

b* - Yellowness

Table 3. Effect of various toppings on spent hen chips

Parameters	C	T_1	T_2	Chi-square – Value	p-Value
Appearance and colour	6.64±0.17^{b}	7.31±0.13^{a}	7.37±0.12^{a}	15.5**	<0.001
Flavour	6.33±0.15^{b}	7.25±0.12^{a}	7.47±0.14^{a}	23.48**	<0.001
Crispiness	7.18±0.10	7.09±0.15	7.54±0.14	6.48^{ns}	0.154
Meat flavour intensity	6.83±0.10	6.83±0.10	6.84±0.13	0.35^{ns}	0.837
Oiliness	6.33±0.21^{b}	6.57±0.16^{b}	7.35±0.14^{a}	13.84**	<0.001
After taste	6.43±0.16^{b}	7.06±0.13^{ab}	7.36±0.13^{a}	17.73**	<0.001
Overall acceptability	6.57±0.11^{b}	7.21±0.12^{a}	7.64±0.10^{a}	25.35**	<0.001

**- significant at 1% level, ns- non significant, means with same superscript have no significant difference between them. The values are expressed as their Mean ± Standard error. (Number of observations = 24) Based on eight-point hedonic scales. 1- extremely low and 8- extremely high

C = Control (Spent hen meat chips without the addition of toppings)

T_1 = C + four per cent tandoori topping

T_2 = C + five per cent chicken chips topping

Highest sensory score was found for T_2 for all the sensory attributes. The higher sensory score for T_2 could be due to better acceptance of the topping by the panelist. There were no significant differences found for the parameters like meat flavour intensity and crispiness among the samples. Tarko *et al*. (2010) observed that the taste of apple chips was increased by the aroma of vanilla. When compared to control, Charoen *et al*. (2015) found that eight per cent barbeque flavoured grey oyster mushroom chips had the greatest sensory scores.

Conclusion

The different toppings incorporated in spent hen meat chips showed different effects on the chips. Tandoori topping chips were having a comparatively high red colour as compared to the other samples. The overall sensory score was highest for spent hen chips with five per cent chicken chip topping. There was no significant difference found in the case of overall acceptability hence, both toppings can be successfully used to provide a unique taste to the consumers.

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Conflict of interest

The authors declare that they have no conflict of interest.

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