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Effect of Incorporation of Potato on the Quality of Restructured Spent Hen Meat Blocks

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ABSTRACT

The aim of this study was to evaluate the effect of incorporation of potato (*Solanum tuberosum*) on the physico-chemical and sensory quality of restructured spent hen meat blocks. Three levels of potato (boiled and mashed) *viz.* 8%, 12% and 16% were incorporated by replacing the lean meat in pre-standardized restructured spent hen meat blocks formulation. A significant increase ($P<0.05$) in the pH of restructured spent hen meat blocks with increase in the level of potato was observed. The protein, fat and ash percentage of restructured spent hen meat blocks declined significantly ($P<0.05$) with incorporation of potato as compared to control. Moisture to protein ratio of all three treatments were significantly higher ($P<0.05$) than control. Mean sensory scores of restructured spent hen meat blocks incorporated with different levels of potato for general appearance and texture were comparable to control. Potato incorporation at 12% level found to be optimum for preparation of restructured spent hen meat blocks.

Key words : *Spent hen, Restructured meat blocks, Potato, Physico-chemical properties, Sensory attributes*

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INTRODUCTION

Restructured meat products comprises of meat which is partially or completely disassembled and then reformed into same or in a different form (Pearson and Gillett 1996). Restructuring is a processing technique used for developing convenience products with texture in between intact steak and comminuted product. Enhancing quality of restructured meat products may provide notable economic benefits, maximum value by creating palatable, convenient, nutritious, value added products from low cost raw material. Potato (*Solanum tuberosum*) has been widely accepted throughout the world as a staple food and is available in many forms. As a percentage of total starch, potato starch has the highest resistant starch concentration (Bednar *et al*.2001). Starch is widely used as a functional ingredient, (Mikulikova *et al*. 2008) especially in foods containing high dietary fiber levels. Gurikar (2007) studied the effect of potato on the quality of restructured pork blocks. Sharma *et al.* (2014) reported utilization of potato and pea flour in restructured mutton chops. Resistant starch has received much attention for both its potential health benefits (similar to soluble fiber) and functional properties. Among its desirable physico-chemical properties are swelling capacity, viscosity, gel formation and water-binding capacity which make it useful in a variety of food (Fuentes-Zaragoza *et al*. 2010).

Considering the associated economy and functionality, the present study was undertaken to evaluate the effect of incorporation of potato and standardize the optimum incorporation level of potato in restructured spent hen meat blocks.

MATERIALS AND METHODS

Preparation of restructured spent hen meat blocks (RSHMB): Spent spent hens (White Leghorn) were procured from CARI, Izatnagar, Bareilly dressed and deboned manually in the experimental abattoir of Division of LPT, IVRI, Bareilly. Deboned meat was packaged in clean polyethylene bags and frozen at 18 °C until use. Analaytical and food grade chemicals were procured from Qualigens, Mercks, BDH and S.D. fine. Refined salt (Tata Chemicals Ltd., Mumbai), refined wheat flour (maida), potato, onion and garlic were procured from local market. To prepare condiment, onion and garlic were peeled off, cut into small pieces and homogenized in a mixer in 3:1 ratio to obtain a fine paste. Spices were prepared in laboratory as per pre-standardized formulation.

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Table 1: Formulation of restructured spent hen meat blocks

Ingredients	Percentage (w/w)
Spent hen meat	78.4
Ice	10.0
Table salt	1.8
Sodium tri polyphosphate	0.3
Refined wheat flour (maida)	5.0
Condiments	3.0
Dry spices	1.5
Sodium nitrite	150 ppm

Product preparation: Potato (boiled and mashed) was incorporated at the levels of 8, 12 and 16% by replacing the lean meat in pre-standardized restructured spent hen meat blocks formulation. Spent hen meat was cut manually into 1-1.5 cm^2 small chunks and massaged in paddle mixer (HOBART, Model: N50G) initially at low speed. Thereafter, it was massaged along with salt, sodium tripolyphosphate and sodium nitrite at medium speed which facilitated the extraction of protein. Then, ice, spice mix, condiments, refined wheat flour and potato were added one by one and massaged so that the tacky exudate was formed. The mix was unloaded from the mixer, weighed, stuffed into aluminum moulds and kept in steam cooker and cooked for 50 min without pressure. Cooked meat blocks were removed from moulds after cooling down to room temperature and cut into uniform slices of 7 mm width with food slicer (Electrolux H 300).

Product yield: The product yield was calculated and expressed as percentage by the following formula:

$$\text{Product yield (\%)} = \frac{\text{Weight of cooked restructured spent hen meat block}}{\text{Weight of raw dough}} \times 100$$

pH: 10 gm of sample was homogenized with 50 ml of distilled water using Ultra Turrax tissue homogenizer (T-25 Germany) for about a minute. The pH of the meat suspension was recorded by immersing the combined glass electrode of digital pH meter (Elico India L1 127).

Proximate composition: Moisture, protein, crude fat and ash contents of restructured spent hen meat blocks were determined by standard procedures of Association of Official Analytical Chemist (AOAC 1995).

Moisture: Protein ratio: Moisture: Protein ratio of restructured spent hen meat blocks was determined from the derived values.

Shear force value: Shear force value was determined as per Berry and Stiffler (1981). Force required for shearing of 1 cm square block was measured in Kg/cm^2 by Warner-Bratzler Shear Press (81031307 GR Elec. MFG. Co. USA).

Sensory evaluation: A sensory panel consisting of scientists and post graduate student of Division of Livestock Products Technology, IVRI participated in the sensory evaluation of restructured spent hen meat blocks. The restructured spent hen meat blocks were cut into slices of 7 mm thickness and evaluated for sensory attributes *viz.* general appearance, flavour, juiciness, texture, binding and overall acceptability using 8-point descriptive scale (Keeton 1983), where 8 = excellent and 1 = extremely poor. Plain water was provided to rinse the mouth between the samples.

Statistical Analysis: The data obtained from three replications were analyzed statistically for analysis of variance (ANOVA), Duncan's multiple range test and least significance difference test using SPSS 16.0 software package developed as per the procedure of Snedecor and Cochran (1995).

RESULTS AND DISCUSSION

Physico-chemical properties: The physico-chemical properties of control and potato incorporated restructured spent hen meat blocks (RSHMB) are presented in Table 2. There was marginal increase in the product yield of RSHMB with increase in the level of potato. Higher level of potato increases starch content in the mix, which contributes to increase in gelatinizing property on heating and can thereby increase the product yield. The findings are in accordance with those of Malav *et al*. (2012) who also reported increase in yield of meat block with increase in the potato content. There was a significant increase ($P<0.05$) in the pH of RSHMB with increase in the level of potato. The pH of RSHMB at 12 and 16% levels was significantly higher than control and comparable with 8% level. Increase in pH of RSHMB with increase in the level of potato might be attributed to the formation of new cross linkages along with free acidic group from meat proteins (Mittal and Blaisdell 1982). Moisture percentage of RSHMB increased with increase in level of potato incorporation. Increase in starch level with potato might have caused higher moisture retention in the product due to water binding property of starch. Berry and Wergin (1993) also found that modified potato starch in ground patties improved cooking yield and moisture retention. The protein and fat percentage of RSHMB declined significantly ($P<0.05$) at all levels of incorporation of potato as compared to control. It could be due to the replacement of lean meat in the

formulation with equal percentage of potato which is low in protein and fat. Significant decrease in protein and fat content was also reported by Sen and Sharma (1996), Saleh and Ahmed (1998) and Devatkal *et al.* (2004) due to addition of potato in chicken loaves, beef patties and buffalo meat loaves respectively.

Table 2: Effect of potato incorporation on physico-chemical properties of restructured spent hen meat blocks (Mean±S.E.)*

Parameters	Control	Levels of Potato (% w/w)		
		8	12	16
Product yield (%)	91.90± 0.54	92.22± 0.46	92.52± 0.38	92.95± 0.33
Product pH	6.25^{b}± 0.005	6.26^{ab}± 0.007	6.27^{a}± 0.008	6.28^{a}± 0.02
Moisture (%)	71.38± 0.17	71.71± 0.20	72.00± 0.30	72.09± 0.55
Protein (%)	18.46^{a}± 0.15	16.97^{b}± 0.18	16.18^{c}± 0.19	15.48^{d}± 0.17
Fat (%)	2.96^{a}± 0.04	2.75^{b}± 0.05	2.63^{c}± 0.05	2.52^{d}± 0.05
Ash (%)	2.89^{a}± 0.04	2.47^{b}± 0.08	2.36^{bc}± 0.09	2.20^{c}± 0.03
Moisture : Protein ratio	3.86^{a}± 0.03	4.22^{b}± 0.05	4.45^{c}± 0.06	4.66^{d}± 0.08
Shear force value (Kg/cm^2)	0.48 ± 0.03	0.45± 0.02	0.43± 0.01	0.42± 0.01

*Mean±S.E. with different superscripts in a row differ significantly (P<0.05)
(Product yield) = 3, n_2 (Physico-chemical parameters) = 6, n_3 (SFV) = 21 for each treatment

Moisture to protein ratio of all three treatments were significantly higher (P<0.01) than control. Gradual and non-significant decline (P>0.05) in shear force values was observed with increase in the level of potato incorporation. It could be due to reduction in compactness because of poor consolidation associated with increased moisture content that allowed the shear blade to pass with ease.

Sensory evaluation: Mean sensory scores of RSHMB for general appearance and texture were comparable to control, although there was declining trend (P>0.05) with gradual increase in level of potato. Sensory score for the flavour at 16% potato level was significantly lower (P<0.05) than that of control. However, flavour score of product with 12% potato was comparable to other treatments and control. Decrease in flavour scores might be due to the dilution of meaty flavour with increase in level of potato. Ruban *et al.* (2008) have also reported decrease in juiciness at higher levels of potato flour incorporation in pork sausages.

Cost of production: The production cost per kg of restructured spent hen meat blocks incorporated with 12% potato (Rs. 197.37) was reduced by 28/kg as compared to control (Rs. 225.57).

It could be concluded from the study that the potato could be incorporated at 12% level for preparation of acceptable quality restructured spent hen meat blocks.

Table 3: Effect of potato incorporation on sensory attributes of restructured spent hen meat blocks (Mean±S.E.)*

Parameters	Control	Levels of Potato (% w/w)		
		8	12	16
General appearance	7.07 ± 0.07	7.01± 0.05	7.00± 0.07	6.90± 0.09
Flavour	7.09^{a}± 0.03	7.05^{a}± 0.05	6.99^{ab}± 0.06	6.88^{b}± 0.05
Texture	7.08± 0.06	7.06± 0.05	7.00± 0.06	6.97± 0.09
Binding	7.13^{a}± 0.04	7.09^{ab}± 0.04	7.03^{ab}± 0.06	6.96^{b}± 0.07
Juiciness	7.11^{a}±0.03	7.09^{ab}±0.05	7.07^{ab}± 0.04	6.94^{b}± 0.07
Overall acceptability	7.12^{a}± 0.04	7.06^{ab}± 0.05	7.05^{ab}± 0.05	6.94^{b}± 0.06

*Mean ± S.E. with different superscripts in a row differ significantly (P<0.05);n = 21 for each treatment

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