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Research Article

EXPLORATION OF *PIPER BETLE* EXTRACT AS NATURAL ANTIOXIDANT IN SPENT HEN CHICKEN SAUSAGES

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ABSTRACT

Sausage is one of the popular comminuted meat products in western countries and now-a-days it is gaining popularity in India. Chicken meat sausage has wide acceptability among consumers in India as well as world. Lipid oxidation is major concern of meat industry and in sausage as fat percent is higher. *Piper betle* is natural antioxidant rich leaves with good phytochemicals, polyphenols compound. The current study was aimed to optimize the formulation of spent hen chicken sausages with addition of different levels of *Piper betle* leaves extracts and to study its effect on various quality attributes. Three different levels of *Piper betle* T-1: 0.5%, T-2: 1% and T-3: 1.5% along with control (without extract) were incorporated separately in spent hen chicken sausages and evaluated for changes in physico-chemical, textural and sensory analysis. On the basis of physico-chemical, sensory evaluation, instrumental color and texture analysis, incorporation with 1.5% *Piper betle* leaves extract were found most suitable for the development of spent hen chicken sausages with rich in natural bioactive phyto-extracts.

Keywords: Natural antioxidants, *Piper betle*, Leaves extract, Spent hen chicken sausage

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Poultry is one of the fastest growing sector of Indian livestock industry. Poultry meat is in high demand around the world since it is one of key source protein for human growth and development (Swain *et al.*, 2022). Poultry meat has a number of advantages, including enough nutrition, a delightful taste, a relatively low price, ease of availability, and acceptance by people from all worldwide (Singh *et al.*, 2021). According to several researcher reports, poultry play a vital role in the livestock revolution, contributing significantly to our economy while also providing employment to farmers (Wynn *et al.*, 2021). Introduction of cold storage facilities, global demands and momentum for processed or preserved meat foods is increasing day by days (Wagh *et al.*, 2015).

Meat occupies a unique position in the diet due to its enticing flavor, texture, and nutritional content. Despite modern slaughter and processed meat, the principal causes of meat deterioration during cold storage is due to lipid oxidation and microbiological growths (Kumar *et al.*, 2015) Alternate preservation techniques, such as hurdle technology, which has been proven to be particularly effective in controlling food borne pathogens and preserving food quality during storage (Wagh and Chatli, 2017). Sausage is a famous comminuted meat product in progressive countries, and becoming increasingly popular in India (Pearson and Gillette, 1996). But sausage having higher fat content and lipid oxidation (5 to 30 percent).

Medicinal Plants are rich in phenolic chemicals and also most abundant sources of natural antioxidant (Jagtap *et al.*, 2019b). Phytochemicals particularly polyphenols, having various properties like substantial free-radical scavenging action, lowering the risk of chronic disease and age-related neurological degeneration etc. (Miller *et al.*, 2000). The Piper aceae family belongs to the Piperales order, and the genus *Piper betle* has been generally known as Pan (Chakraborty and Shah, 2011). *Piper betle* leaves contain a higher concentration of bioactive compounds such as lutein, zeaxanthin, steroids, saponins and tannins than other plants (Wagh *et al.*, 2015). However, the literature on the use of *Piper betle* extract as a functional bioactive element in the meat system is almost silent.

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MATERIALS AND METHODS

Source of meat: The University Poultry Farm, Department of Livestock Production Management, Guru Angad Dev, and Veterinary Animal Sciences University, Ludhiana, provided spent hen chicken meat for research study. The animals were slaughtered in the experimental slaughter house of the Department of Livestock Products Technology according to standard protocol, with animal welfare and ethical considerations. Dressed carcasses were immediately brought to the laboratory and chilled at (4±1ºC) for 12-18 hours then being deboned physically. The boneless meat and fat were packed individually in 1 kg unit packs in low density polyethylene (LDPE) bags and then stored in a deep freezer at (-18±1ºC) until required.

Spice mix: All of the spices for the spice mixes were purchased in a local market in Ludhiana, Punjab. After removing foreign materials, the spices were oven dried for 2 hours at 45±2ºC. The components were mechanically ground and sieved through a fine mesh (Inalsa, New Delhi,

India). To make a spice mix, the different spice powders were blended in a standard ratio (Table 1).

Condiments: Onion, ginger, and garlic were used to make the condiment paste. The onion, ginger, and garlic outermost layers were peeled and cut into small pieces, and a fine condiment paste was formed by blending onion, ginger, and garlic in a 3:1:1 ratio in a grinder (Inalsa, Wonder maxie plus, Delhi, India) with use an appropriate blade.

Salt, tetra sodium polyphosphate and sodium nitrite: Table salt (Tata Chemicals Ltd., Mumbai, India), STPP (Hi-media Laboratories Pvt. Ltd., Mumbai, India), and sodium nitrite (Central Drug House Pvt. Ltd., New Delhi, India) were utilized in this study. For aerobic packing, low density polyethylene (LDPE 100-120 gauge) bags with a volume of 1 kg were utilized.

Preparation of spent hen meat sausages: Partially thawed spent hen flesh was chopped into small cubes and double minced in a meat mincer with a 4 mm plate (Mado Eskimo Mew-714, Mado, Germany). A bowl chopper was used to make the meat emulsion (Seydelmann K20, Ras, Germany). A pre-weighed amount of minced chicken, salt, sodium tri-polyphosphate, and sodium nitrite were added (as shown in Table 2), followed by 2-3 minutes of chopping. After adding the ice flakes, it was chopped for another 2 minutes. While cutting, the refined vegetable oil was progressively mixed until it was thoroughly dispersed in the batters. Other included ingredients are condiment paste, dry spice mix, refined wheat flour etc. Chopping was continued until all of the components were evenly dispersed and the emulsion had reached the desired consistency.

A stainless-steel container was filled with around 2 kg of meat emulsion. Natural casings were utilized for sausage filling. The uncooked spent hen chicken sausages were cooked for 30 minutes in a hot air oven at 115°C (until an internal core temperature of 72°C was reached). The prepared cooked sausages were then allowed to cool to room temperature before being packaged and stored in the refrigerator. After substituting the lean meat in the pre-standardized spent hen chicken sausages formulation, three different amounts of *Piper betle* leaves (PBL) extract were added individually in chicken sausage: 0.5%, 1.0% and 1.5%.

On the aspect of physico-chemical parameters (pH, cooking yield), instrumental color analysis, texture profile analysis and sensory evaluation of spent hen chicken sausages incorporating three different levels of PBL were all investigated. Table 3 and Fig. 1, shows the results of physico-chemical characteristics, instrumental color analysis, texture profile analysis, and sensory evaluation of cooked spent hen chicken sausages containing three different levels of *Piper betle* leaves (PBL) extract.

Cooking yield: Before and after cooking, the weight of each sausage was recorded. By dividing the cooked product weight by the raw uncooked weight and multiplying by 100, the cooking yield was calculated.

Color Analysis: Incorporation of PBL non-significantly affected the lightness (L^*) and yellowness value (b^*) of spent hen chicken sausages.

Texture Profile: All instrumental texture studies were performed at room temperature on samples (precooked or cooked sausages). For each replication, two repeated measurements were done and mean values were presented for each treatment. Texture profile analysis (TPA) of sausages was studied (Bourne, 1978; Brennan and Bourne, 1994).

Sensory Analysis: A panel of seven professional panelists assessed the meat product on the basis of several aspects such as meat product (spent hen chicken sausage) colour and appearance, flavour, juiciness, texture, and general acceptability on an 8-point hedonic scale, with 8 denoting "very desired" and 1 denoting "highly unfavorable" (Seman *et al.*, 1987). Meat product (spent hen chicken sausage) sensory samples were prepared with codes and served warm to expert panelists. Between each sample, water was offered for mouth rinse.

RESULTS AND DISCUSSION

pH: The pH values of spent hen chicken sausages showed a non-significant decreasing trend as with increasing level of incorporation among the treatment products along with the control with the increasing incorporation level of *Piper betle* leaves (PBL) extract in the formulation. This might be due to inherent acidity of the added phyto-extract, as pH of the extracts was 4.8 (Jagtap *et al.*, 2019a). The variations in pH values of spent hen chicken sausages were found non-significant among treatments and control.

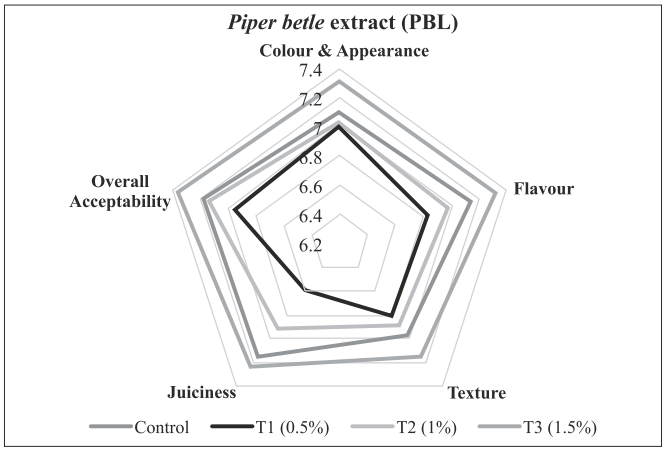
Cooking yield: The values of spent hen chicken sausages cooking yield were comparable for all the treatment and the control product. The cooking yield of meat product i.e. spent hen chicken sausages, only except control group (without Extract), phyto-extract incorporated T-1: 0.5%, T-2: 1.0% and T-3: 1.5% shows comparative higher cooking yield in spent hen chicken sausages. Meat researcher, Fang *et al.* (2019) observed similar findings in cooking yield after incorporation of sugarcane fibre in chicken sausage. Cooking yield of all the treatment products was slightly higher than control product which is reflective in the emulsion stability of the respective

Table 1. Composition of spice mixture

Name of ingredients	Percentage (w/w)
Aniseed (*Soanf*)	10.00
Black pepper (*Kali mirch*)	10.00
Caraway seeds (*Ajwain*)	10.00
Capsicum (*Mirch powder*)	8.00
Cardamom dry (*Badi Elaichi*)	5.00
Bay leaves (*Tejpata*)	2.00
Cinnamon (*Dalchini*)	5.00
Cloves (*Laung*)	5.00
Coriander (*Dhania*)	18.00
Cumin seeds (*Zeera*)	15.00
Mace (*Javitri*)	1.00
Nutmeg (*Jaifal*)	2.00
Dry Ginger Powder (*Soanth*)	8.00
Cardamom (*Choti Elaichi*)	1.00
Total	100

Table 2. Formulations of the spent hen chicken sausages

S. No.	Ingredients	Percentage (w/w)
1.	Spent hen meat	78
2.	Ice/Chilled water	5
3.	Vegetable oil	3
4.	Condiments	3
5.	Salt	1.5
6.	Refined wheat flour	3.5
7.	Dry spices	1.5
8.	STPP	0.2
9.	Sugar	0.25
10.	Nitrite	100 ppm
11.	Egg	5
12.	Chicken fat	5



Fig, 1. Effect of three different levels of *Piper betle* leaves extract (PBL) Sensory analysis of spent hen chicken sausages (C-without PBL, T1-0.5%, T2-1% and T3-1.5%)

treatments. Slightly higher cooking yield were found in T-3 samples followed by T-2 and least in T-1 and control (Table 3).

Color Analysis: Incorporation of PBL non-significantly affected the lightness (*L**) and yellowness value (*b**) of spent hen chicken sausages. However, there was significant increase in redness values in spent hen chicken sausages incorporated with 1.5% PBL.

Texture Profile: The results for the texture profile parameters of spent hen chicken sausages incorporated with three different levels extracts of PBL (*Piper betle*) presented in Table 3. Non-significant differences in all texture profile parameters (Hardness, Stringiness, Chewiness, Gumminess and Resilience) in PBL (*Piper betle* leaves) extract treated spent hen chicken sausages. All treatment groups of springiness values increased non-

Table 3. Effect of different levels of *Piper betle* leaves extract (PBL) on the physico-chemical, color, texture parameters and sensory analysis of spent hen chicken sausages

Parameters	C	T-1 (0.5%)	T-2 (1.0%)	T-3 (1.5%)
		Physio-chemical		
pH	6.17±0.03	6.15±0.02	6.14±0.02	6.12±0.01
Cooking yield	86.85±0.52	86.16±0.51	86.94±0.32	86.96±0.94
		Color Parameters		
Lightness (*L**)	50.15±0.18	50.19±0.93^{A}	50.25±0.73	50.33±0.55
Redness (*a**)	10.42±0.64^{A}	10.45±0.39^{A}	10.48±0.82^{A}	10.85±0.57^{B}
Yellowness (*b**)	9.67±0.65	9.59±0.39	9.61±0.28	9.63±0.23
		Texture Profile		
Hardness (N)	26.51±0.08	26.54±0.11	26.56±0.12	26.58±0.13
Springiness (mm)	13.35±0.62	13.37±0.21	13.38±0.28	13.41±0.28
Stringiness (mm)	18.40±2.16	18.42±2.47	18.43±2.53	18.46±0.60
Chewiness (J)	275.84±0.60	275.81±0.19	275.86±0.64	275.90±0.57
Gumminess (N)	7.51±0.59^{B}	7.53±0.75^{B}	7.54±0.24^{B}	6.58±0.65^{A}
Resilience	1.64±0.09	1.65±0.44	1.65±0.17	1.67±0.55

n=6, C: Without extracts, T-1: *Piper betle* leaves extract (0.1%), T-2: *Piper betle* leaves extract (0.25%), T-3: *Piper betle* leaves extract (0.5%) *Mean ± SE. with superscripts row wise (Capital alphabets) differ significantly ($p<0.05$).

significantly (P > 0.05), it's because of more moisture retention of the product with the incorporation of natural antioxidant incorporation extracts of (*Piper betle* leaves) PBL (Wagh and Chatli, 2017).

Sensory Analysis: Meat product Score card (Hedonic scale) showed results, on the basis of various parameters like Appearance, Color, Odor and Taste etc. for meat product (Spent hen chicken meat sausages). Expert Sensory panelist's observational result values are shown in Table 3 and Fig. 1. In the control sample (No Extract) and phyto-extract incorporated T-1: 0.5%, T-2: 1.0% and T-3: 1.5%. The flavor scores of T-1 were significantly lower (P > 0.05) than control and T-2 but the flavor score for the T-3 was significantly higher other treated spent hen chicken sausages including control. The juiciness and texture scores of T-1 and T-2 were significantly lower (P<0.05) than control but the score for the T-3 was detected as the highest to control and other treatment products.

The overall acceptability scores for all the treatment products were significantly lower (P<0.05) than control except T-3 which is the reflective of scores of other sensory parameters. But the overall acceptability scores for the T-3 was higher than the very good (7.0) sensory rating. Meat scientist (Kumar *et al.*, 2015) observed similar findings. Here was substantial difference in appearance score in between T-3 and control. The value for appearance score of T-3 was significantly higher (P<0.05) than control. PBL 1.5% additions in spent hen chicken sausages sensory attribute, color, flavor, juiciness, overall acceptability, associated with chicken sausages.

CONCLUSIONS

Meat industry is now shifting in search of natural additives like natural preservatives and antioxidants. In view of global scenario, the present research was planned and executed. Research based findings of physico-chemical analysis, instrumental color, texture profile, sensory analysis and overall acceptability, 1.5% incorporation level of *Piper betle* leaves extract (PBL) out of studied levels found to be most suitable for the developed spent hen chicken sausages. This developed spent hen chicken sausages can be further possibilities to use as a functional meat product. Such research initiatives used to produce novel meat products as well set up a new healthy functional food market that will definitely boost the economic as well as health status of public consumer.

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