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Original Research Article

Production of Chicken Nuggets with Incorporation of Indian Gooseberry Extract and Powder

Harpreet Singh[1]*, Umesh S. Suradkar[2], Dinesh M. Chavhan[2], Ramesh Chand Jat[2] and Dhanraj Meena[2]

[1]Veterinary Surgeon - Animal Husbandry and Dairy Department, Haryana
[2]Department of Livestock Products Technology
College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur - India
**Corresponding author*

A B S T R A C T

The present meat industry is searching as well as demanding for natural preservatives to enhance the shelf life of diverse meat products. The present study includes the production of chicken nuggets with incorporation of Indian gooseberry. The tested ingredient was used in extract and powder form at same concentration of 1.5%. The product was prepared and stored in LDPE at 4±1ºC and studied on 0th, 5th, 10th and 15th day of storage period. The cooking yield of all the three groups was significantly differed (P<0.05), with the highest value of Powder group (95.235±0.104) than Control group (94.467±0.208) and lowest of Extract group (90.617±0.199). The moisture content of nuggets with Indian gooseberry extract (62.375±0.302) was found higher than Control (61.057±0.202). There was non-significant dissimilarities in protein content of treated groups as well as in control. The study revealed that the fat content for Control group was highest (11.173±0.067), while both treatment groups were not differing significantly. A significant difference (P<0.05) as well as inclined trend of pH value between 0th, 5th, 10th and 15th day of storage period was recorded. TBA values of chicken nuggets was significantly (P<0.05) differ with in all three samples on each studied day. The sensory characteristics of both the treatments were better than the control group throughout the studied period. Both the extract and powdered nuggets, pointed out lower bacterial as well as yeast and mold load during the studied period.

Keywords

Nuggets, Broiler, Indian Gooseberry, Sensory attributes, Storage stability

Introduction

Products of chicken meat are highly desirable, digestible, palatable and nutritious for all age groups population. Meat processing technology has development of variety of convenience and value added products such as chicken nuggets, chicken pane, chicken minced meat, chicken meat balls (kofta), chicken burger, chicken frankfurter and chicken luncheon. Nuggets are ready to eat or ready to cook product in addition the simple preparation makes it more demanding in consumers for a quick meal. The non-meat ingredients can also alter or improve the appearance, texture and palatability of finished product. A new product development is a constant challenge for both scientific and applied research. Optimizing key ingredients to generate the best formulation is essential in the design of new food product (Jousse, 2008).

According to recent consumer demands for low fat and high fibre of meat products, the incorporation of fruits and vegetables as non-meat ingredients in processed products is the possible solution due to their natural antioxidant activity, fibre and nutrient content (Yue, 2001).

The extract of amla (*Phyllanthus emblica*) can be utilize to enhance the nutritive value of the product as amla is well known for its nutritional qualities. It is one of the richest sources of vitamin C (200-900 mg per 100 g of edible portion) and also rich in polyphenols as well as minerals (Jain *et al.*, 2000). Indian Gooseberry has also been reported to possess antifungal, antibacterial and antiviral activities (Godbole and Pendse, 1960). Therefore, it can also be utilized to extend the shelf-life of meat products.

Materials and Methods

The broiler meat was procured from the local market of Vallabhnagar, Udaipur. Meat was manually deboned and stored at 4±1ºC in refrigerator until further use. The spice powder was mixed in the proportion of aniseed 12%, black pepper 8%, capsicum 11%, caraway seed 8%, cardamon 5%, cinnamon 5%, clove 2%, coriander 20%, cumin seed 20%, nutmeg 3%, small cardamom 1% and turmeric 5% (Ambadkar, 2002). The abbreviation used for Indian gooseberry extract group was E at 1.5% concentration, P for Indian gooseberry Powder at 1.5% concentration and C for control group. All the chemicals and media used in the study were of analytical grade and were procured from standard firms (Hi-media, India, SRL, India and Molychem, India).

The recipe used for nugget preparation was; lean meat 69%, ice flakes 11%, vegetable oil 10%, condiments 3.80%, refined wheat flour 2.70%, salt 1.50%, STPP 0.20%, Sugar 0.19% and Sodium nitrite 0.01%. Minced meat was replaced by Indian gooseberry extract and powder both at 1.5% levels.

Meat emulsion for nuggets was prepared in bowl chopper. Chicken nuggets were prepared from emulsion according to the method of Nag (1994) with slight modification.

Emulsion stability of product was determined as per procedure described by Baliga and Madaiah (1970) with slight modifications. For determination of the pH, the sample was blended with distilled water, five times the weight of the sample to get uniform suspension and the pH was recorded by immersing the electrode of pH meter (SANCO, SAN-151S) into aliquot of the sample, till the value became stable as per the method described by Trout *et al.*, (1992). Moisture, Protein and Fat were determined as per AOAC (1995) method.

Thiobarbituric acid (TBA) value was estimated as per procedure given by Witte *et al.*, (1970). Microbiological Analysis was done according to APHA (1984). Ten gram of sample was homogenized with 90 ml of sterile normal saline solution and serial dilutions were prepared. The samples were analyzed for total plate count, yeast and mold count and coliform count by the use of specific media (Table 3). The sensory quality of samples was evaluated using 9 point descriptive scale (Peryam and Pilgrim, 1957). A panel of seven members was made including faculty and post-graduate students to test sensory attributes.

Statistical analysis of the data obtained was done using ANOVA technique as per method described by Snedecor and Cochran (1989).

Results and Discussion

Physico-chemical Properties: The mean emulsion stability value of P group (95.633±0.162) was higher than C (93.167±0.183) and the lowest E group (91.362±0.124), which were significantly differ from each other. The findings were close proximity to Bawa *et al.,* (1998), also reported significantly (P<0.05) higher emulsion stability in mustard flour (powder) treated meat emulsion (Table 1).

The cooking yield of all the three groups was significantly differed from each other with the highest value of P group (95.235±0.104) than C group (94.467±0.208) and lowest of E group (90.617±0.199).

Moisture: The moisture content of nuggets with Indian gooseberry extract (62.375±0.302) was found to be highest than C group (61.057±0.202) and the lowest powder treated nuggets (59.760±0.113), which differed significantly from each other. Grigelmo-Miguel *et al.,* (1999) reported higher water content in meat products incorporated with fruit fibre.

Protein: The protein percentage of nuggets with treatments shows lower values than control group. Result indicated that there was a non-significant difference for protein content in different treatments as well as in control. Similar results of lower protein content of treated groups were recorded by Jorge and Daniel (2015), in chicken nuggets replaced by pea fibre than the control group.

Fat: The study revealed that the fat content for C group was highest (11.173±0.067) and for E was lowest (10.725±0.050) while both treatment groups were not differ significantly. The lower fat contents of Indian gooseberry treated groups were might be due to lower fat percentage of amla extract and powder than broiler meat.

pH: The mean pH values for both treatment groups were lower than C group during whole storage period. The pH of powder group was lower than extract group, presented in table 2. A significant difference (P<0.05), as well as inclined trend of pH value between 0^{th}, 5^{th}, 10^{th} and 15^{th} day of storage period and within treatments was noted. The lower values of pH of all treated groups might be due to the acidic pH of Indian gooseberry fruit *i.e.* 2.80 – 3.10.

Table.1 Effect of incorporation of Indian gooseberry extract and powder on physico-chemical values of chicken nuggets (Mean ± SE)

Treatments/ Particulars	C	E	P
Emulsion Stability (%)	93.167^{b}±0.183	91.362^{c}±0.124	95.633^{a}±0.162
Cooking Yield (%)	94.467^{b}±0.208	90.617^{c}±0.199	95.235^{a}±0.104
Moisture (%)	61.057^{b}±0.202	62.375^{a}±0.302	59.760^{c}±0.113
Protein (%)	19.483^{a}±0.135	19.158^{a}±0.086	19.112^{a}±0.085
Fat (%)	11.173^{a}±0.067	10.725^{ab}±0.050	10.778^{ab}±0.082

[n=6, Mean bearing a common superscripts (small letters) in row do not differ significantly (P<0.05). C= control, E= 1.5% IG extract and P= 1.5% IG powder]

Table.2 Effect of incorporation of Indian gooseberry extract and powder on pH and TBA values of chicken nuggets during storage period. (Mean ± SE)

Days/ Treatments	0	5	10	15
	pH			
C	$^{D}6.213^{a}\pm0.004$	$^{C}6.247^{a}\pm0.004$	$^{B}6.297^{a}\pm0.004$	$^{A}6.547^{a}\pm0.023$
E	$^{D}6.075^{b}\pm0.006$	$^{C}6.112^{b}\pm0.010$	$^{B}6.158^{b}\pm0.014$	$^{A}6.380^{b}\pm0.028$
P	$^{C}5.332^{c}\pm0.026$	$^{BC}5.392^{c}\pm0.024$	$^{B}5.472^{c}\pm0.040$	$^{A}5.737^{c}\pm0.049$
	TBA			
C	$^{D}0.409^{a}\pm0.010$	$^{C}0.510^{a}\pm0.010$	$^{B}0.779^{b}\pm0.011$	$^{A}1.188^{a}\pm.013$
E	$^{D}0.315^{a}\pm0.008$	$^{C}0.448^{b}\pm0.011$	$^{B}0.676^{c}\pm0.011$	$^{A}0.964^{b}\pm0.019$
P	$^{D}0.403^{a}\pm0.007$	$^{C}0.504^{a}\pm0.010$	$^{B}0.825^{a}\pm0.009$	$^{A}1.109^{a}\pm0.015$

[n=6, Mean bearing a common superscripts (small letters) in columns and (capital letters) in rows do not differ significantly (P<0.05). C= control, E= 1.5% IG extract and P= 1.5% IG powder]

Table.3 Effect of Indian gooseberry extract and powder on Total Plate and Yeast & Mold Count during storage period of chicken nuggets (Mean ± SE)

Days/ Treatments	0th Day	5th Day	10th Day	15th Day
	Total Pate Count			
C	$^{D}1.920^{a}\pm0.098$	$^{C}2.256^{a}\pm0.059$	$^{B}3.700^{a}\pm0.025$	$^{A}4.038^{a}\pm0.027$
E	$^{D}1.797^{a}\pm0.070$	$^{C}2.024^{c}\pm0.101$	$^{B}3.550^{b}\pm0.063$	$^{A}3.922^{c}\pm0.066$
P	$^{D}1.852^{a}\pm0.121$	$^{C}2.136^{b}\pm0.103$	$^{B}3.606^{b}\pm0.070$	$^{A}3.972^{b}\pm0.041$
	Yeast & Mold			
C	ND	ND	$^{B}1.410^{a}\pm0.128$	$^{A}2.018^{a}\pm0.057$
E	ND	ND	ND	$^{A}1.813^{b}\pm0.813$
P	ND	ND	ND	$^{A}1.715^{b}\pm0.164$

[n=6, Mean bearing a common superscripts (small letters) in columns and (capital letters) in rows do not differ significantly (P<0.05). C= control, E= 1.5% IG extract and P= 1.5% IG powder]

Table.4 Effect of Indian gooseberry extract and powder on Sensory scores of chicken nuggets during storage period (Mean ± SE)

Days/ Treatments	0th Day	5th Day	10th Day	15th Day
	Appearance			
C	$^{A}7.611^{a}\pm0.168$	$^{AB}7.167^{ab}\pm0.166$	$^{B}6.583^{b}\pm0.348$	$^{C}5.667^{ab}\pm0.247$
E	$^{A}7.917^{a}\pm0.200$	$^{AB}7.583^{a}\pm0.166$	$^{B}7.125^{a}\pm0.256$	$^{C}5.933^{a}\pm0.247$
P	$^{A}6.917^{b}\pm0.326$	$^{A}6.417^{b}\pm0.271$	$^{B}5.083^{c}\pm0.102$	$^{C}3.583^{b}\pm0.153$
	Flavour			
C	$^{A}7.458^{a}\pm0.060$	$^{AB}7.167^{a}\pm0.333$	$^{B}6.417^{a}\pm0.348$	$^{C}5.417^{a}\pm0.200$
E	$^{A}7.333^{a}\pm0.200$	$^{A}7.333^{a}\pm0.333$	$^{B}6.337^{a}\pm0.389$	$^{B}5.667^{a}\pm0.210$
P	$^{A}7.373^{a}\pm0.333$	$^{A}7.083^{a}\pm0.374$	$^{B}5.125^{b}\pm0.195$	$^{C}4.083^{b}\pm0.351$
	Juiceness			
C	$^{A}7.077^{a}\pm0.240$	$^{AB}6.417^{a}\pm0.395$	$^{B}5.883^{b}\pm0.348$	$^{C}4.333^{b}\pm0.333$
E	$^{A}7.250^{a}\pm0.307$	$^{A}7.167^{a}\pm0.339$	$^{B}6.167^{b}\pm0.332$	$^{C}4.750^{b}\pm0.249$
P	$^{A}7.833^{a}\pm0.333$	$^{AB}7.333^{a}\pm0.200$	$^{A}7.000^{a}\pm0.256$	$^{B}6.083^{a}\pm0.326$
	Tenderness			
C	$^{A}7.345^{a}\pm0.195$	$^{A}6.667^{a}\pm0.333$	$^{A}6.333^{ab}\pm0.195$	$^{B}4.333^{b}\pm0.166$
E	$^{A}7.417^{a}\pm0.166$	$^{AB}7.167^{a}\pm0.396$	$^{B}6.500^{a}\pm0.386$	$^{C}5.067^{a}\pm0.333$
P	$^{A}6.917^{ab}\pm0.307$	$^{A}6.833^{a}\pm0.271$	$^{B}5.333^{b}\pm0.306$	$^{C}3.750^{c}\pm0.170$
	Overall Acceptability			
C	$^{A}7.430^{a}\pm0.092$	$^{AB}7.083^{a}\pm0.271$	$^{B}6.500^{a}\pm0.256$	$^{C}4.833^{b}\pm0.210$
E	$^{A}7.417^{a}\pm0.200$	$^{A}7.333^{a}\pm0.357$	$^{A}6.667^{a}\pm0.195$	$^{B}5.500^{a}\pm0.300$
P	$^{A}6.917^{a}\pm0.210$	$^{A}6.667^{b}\pm0.271$	$^{B}5.375^{b}\pm0.195$	$^{C}3.883^{c}\pm0.166$

[n=6, Mean bearing a common superscripts (small letters) in columns and (capital letters) in rows do not differ significantly (P<0.05). C= control, E= 1.5% IG extract and P= 1.5% IG powder]

TBA: In storage study, TBA value of each group showed increasing trend with advancement of storage period. In all groups, highest value of TBA was found at 15th day and lowest on 0th day. TBA values of chicken nuggets was significantly (P<0.05) differ with in all three samples on each studied day as presented in table 2.

Sensory Attributes: All the sensory attributes for chicken nuggets including appearance, flavour, juiciness, tenderness and overall acceptability are presented in table 4. All the chicken nuggets revealed a decline trend with the enhancement of storage period. The similar results of declined sensory attributes for chicken nuggets were also recorded by Panwar (2013).

Table 4 clearly indicated that during both the years, percent disease incidence was 34.1 and 32.2 respectively. The mean PDI of all treatments (biofertilizer) was significantly reduced as compared to control. The maximum PDI, among treatment of 15.85 percent and 12.8 percent was recorded in recommended doses of fertilizer and Vermicompost respectively. Minimum PDI of 5.5 and 6.8 was observed in FYM and RDF + FYM. Maximum increase in yield was recorded in FYM and RDF + FYM. After the application of biofertilizer, maximum yield (7.86 q/ha) and % disease incidence over control was observed for FYM (5.5%) followed by RDF+ FYM and least yield and % disease over control by RDF followed by Vermicompost. Evaluation of seven amendments of biofertilizers for management of disease under field conditions revealed that maximum yield (q/ha) and minimum % disease incidence was recorded in FYM (7.862 and 5.5) followed by RDF+ FYM (7.234 and 6.8) whereas low yield coupled with low percent disease incidence was recorded in RDF (5.717 and 15.8). Effect of organic manures and biofertilizers in control of diseases caused by *A. alternata* have been reported in different (Jayathilake *et al.*, 2002; Mughrabi, 2006).

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