The Pharma Innovation

Lokendra Singh
Department of Livestock Products Technology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Surendra Kumar Yadav
Department of Livestock Products Technology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Karishma Rathore
Department of Veterinary Microbiology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Corresponding Author
Lokendra Singh
Department of Livestock Products Technology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Effect of curry leaves extract and powder incorporation in chicken patties on storage at refrigeration temperature

Lokendra Singh, Surendra Kumar Yadav and Karishma Rathore

Abstract
The present study was conducted on chicken patties to estimate the effect of curry leaves extract and powder incorporation in term of sensory quality (appearance, flavor, juiciness, tenderness and overall acceptability) of chicken patties on storage at refrigeration temperature. Different levels of curry leaves extract and powder were used like Control (Without curry leaves products), E_1 (1% Curry leaves extract), E_2 (2% Curry leaves extract), P_1 (0.4% Curry leaves powder) and P_2 (0.6% Curry leaves powder). The products were stored in clean, dry low density polyethylene bags at refrigeration temperature (4±1 ℃) and subjected to comparative studies of sensory quality at 0, 5th, 10th, 15th and 20th days of storage period. The statistical analysis of data revealed that the mean appearance scores of control and powder groups were non-significantly decreased with advancement of storage period. The mean flavour scores of all groups were non-significantly decreased with advancement of storage period upto 20 days of storage except for E_1 and P_2 group. The mean values for juiciness score of control, extract and P_2 groups were non-significantly decreased while E_2 group showed significant ($P< 0.05$) decrease with the advancement of storage period. The mean values for tenderness score of all groups were non-significantly decreased during the advancement of storage period except E_1, E_2 and P_2 groups. The extract groups showed slightly higher overall acceptability as compared to powder groups. The chicken patties could be successfully incorporated with extract and powder of curry leaves which were emperor upon its evaluation on the basis of sensory quality as compared to control product up to 20 days of storage period at refrigeration temperature. The chicken patties can be incorporated with 2% curry leaves extract and 0.6% powder for better results

Keywords: Curry leaves extract, curry leaves powder, chicken patties, sensory quality, storage

1. Introduction

Meat sector plays an important role in India as it not only provides meat and by-products for human consumption but also contributes towards sustainable livestock development and livelihood security for millions of men and women from weaker section. Major portion of meat from sheep, goat, pig and poultry is primarily used for domestic consumption in the form of hot meat (Guleria *et al*., 2015) [7]. Meat processing technology has developed a variety of convenience and value added products such as chicken patties, chicken pane, chicken nuggets, chicken meat balls, chicken burger and chicken frankfurter. Chicken meat products can be considered an important component in healthy diets (Jahan *et al*., 2004) [10], as they contain a higher proportion of polyunsaturated fatty acids compared with meat from other species (Berzaghi *et al*., 2005) [1], high nutritional value and distinct flavor (Patsias *et al*., 2008) [19]. Curry leaf (*Murraya koenigii*) is a popular leaf spice in India used in very small quantity for their distinct aroma as well as for preservation purposes due to the presence of volatile oil and their ability to improve digestion. Curry leaves are the good source of vitamin A, B, C, B_{12}, iron and folic acid. Fresh leaves of *Murraya koenigii* are a rich source of β-carotene (Rao *et al*., 2011) [21] and Calcium and therefore it is used in calcium deficiency and osteoporosis. Other than Ca^{+2} curry leaves are a rich source of minor constituents, such as K, Mg, P along with Fe, Mn, Se and Zn in trace amounts. A *Murraya koenigii* leaf contains different phytocompounds including alkaloids, flavonoids, furocoumarins, terpenoids and tannins. A few bioactive compounds such as mahanimbilyl acetate, girinimbilyl acetate and bicyclomahanimbiline have been isolated and reported to possess antimicrobial and antioxidant activity (Naczk and Shahidi, 2004) [15]. Two carbazole alkaloids namely mahanimbine and koenigine found in these leaves showed higher antioxidant activities (Ganesan *et al*., 2013) [6].

Addition of synthetic antioxidants such as propyl gallate, butylated hydroxyl anisole (BHA) and butylated hydroxyl toluene (BHT) have been used in the food industry to control lipid oxidation in foods. Use of these synthetic antioxidants has been potential health risk and toxicity (Nor *et al.,* 2008) [17]. Natural sources of antioxidants are considered to be safer than synthetic antioxidants (Brewer, 2011) [3]. The present research work was carried out as an attempt to utilize chicken meat for the preparation of patties, a value added product. In order to estimate the effect of curry leaves extract and powder incorporation in term of sensory quality of chicken patties on storage at refrigeration temperature. Different levels of curry leaves extract and powder are used for chicken patties preparation.

2. Materials and Methods
2.1 Procurement of raw material: The fresh broiler meat, condiment mixture (Onion, garlic and ginger), spice mix and Curry leaves were procured from the local market of the Vallabhnagar, Udaipur. Spice mix was prepared using the proportion of each ingredient according to Suradkar *et al.,* 2013 [23] with slight modifications. The curry leaves extract was prepared by the process suggested by Devatkal *et al.,* 2012 [4]. After drying, the leaves were grinded in a mixer (Lords, India; Model No.: Hummer-1200) to make a fine powder.

2.2 Preparation of chicken patties: Chicken patties were developed by procedure as described by Mehta *et al.,* (2011) [14]. Lean chicken meat was cut into small pieces and mined in meat mincer (SANCO, Model: SFP-56). To prepare meat emulsion pre weighed quantity of minced chicken meat, salt, nitrite, STPP and sugar were added and chopped for 2-3 minutes with slow addition of ice flakes. Refined vegetable oil was slowly incorporated while chopping till it was fully dispersed in meat batter. Condiment paste, dry spice mix and refined wheat flour were added. Chopping was continued till uniform distribution of all ingredients and desired consistency of emulsion was obtained. The emulsion was divided into five equal parts *viz.* C, E_1, E_2, P_1 and P_2. The control (C) was formulated without addition of curry leaves products and other treatments were prepared by addition of curry leaves extract at the level of 1% (E_1), 2% (E_2) and powder at 0.4% (P_1), 0.6% (P_2). Each patty was prepared from 75 gm of emulsion and molded into a patty shape of 75 mm diameter and 15 mm height. The molded raw patties were placed on cooking trays pre smeared with vegetable oil to avoid sticking and cooked in a preheated hot air oven at 150ºC for 10-20 mints. The internal temperature of patties was monitored by a probe thermometer. After attaining an internal temperature of 75±2˚C the patties were turned upside down for initial five minutes of cooking followed by re-turning upside down for final five minutes of cooking. The patties after cooling to room temperature were packed in LDPE film pouches and stored at 4±1ºC for the further studies.

2.3 Sensory Evaluation: The sensory quality of samples was evaluated using 9 point hedonic scale (Peryam and Pilgrim, 1957) [20] where 9 denoted very desirable and 1 denoted very undesirable. A sensory panel (semi trained) of five judges drawn from Staff of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur were evaluated the product for different quality attributes *viz*: appearance, flavor, juiciness, tenderness and overall acceptability.

2.4 Statistical analysis: Statistical analysis of the data was done using ANOVA technique according to the method described by Snedecor and Cochran (1989) [22].

3. Results and Discussion
To estimate the effect of Curry Leaves Extract and Powder incorporation in chicken patties, the sensory evaluation of each treatment group was conducted for appearance, flavour, juiciness, tenderness and overall acceptability scores by using 9 point hedonic scale at 0, 5th, 10th, 15th and 20th day of storage.

3.1 Effect of curry leaves extract and powder incorporation on appearance of chicken patties during storage period: The appearance scores for chicken patties at 0 to 20th days of storage period are presented in Table 1. The average mean scores offered for appearance on 0 day were 7.700±0.238, 7.650±0.171, 7.688±0.097, 7.050±0.194 and 7.000±0.245 for control, E_1, E_2, P_1 and P_2 respectively. The analysis of variance of mean score of appearance showed that P_1 and P_2 groups were significantly ($P< 0.05$) lowers than control group on 0 day. On 5th and 10th day of storage, the mean appearance score of P_2 was significantly ($P< 0.05$) lower as compared to control. On 15th day of storage mean values of powder groups were significantly ($P< 0.05$) differ from control group. This might be due to greenish color of the curry leaf powder which was less preferred by the panelists (Najeeb *et al.,* 2015) [16]. On 20th day of storage mean score of appearance of E_2, P_1 and P_2 were significantly ($P< 0.05$) differ from control group. The mean appearance scores of extract groups were significantly ($P< 0.05$) decreased on 20th day as compared to other days. The mean appearance scores of control and powder groups were non-significantly decreased with advancement of storage period. The chicken patties from all groups recorded a declining trend for appearance during storage period being highest for 0th day and lowest for 20th day. It might be due to oxidative rancidity as indicated by increased TBA and microbial counts with advancement in period of storage. At the end of storage period, the appearance scores were significantly ($P< 0.05$) lower than 0 day but were within the acceptable range as reported by the panelists. At the end of storage period mean value of P_2 group was lowest among all products during storage period.

3.2 Effect of curry leaves extract and powder incorporation on flavour of chicken patties during storage period: The mean scores for flavour of all five groups during the 20 days study were are presented in Table 2. The mean values of flavour score on 0 day are 7.000±0.548, 7.400±0.082, 7.500±0.057, 7.075±0.390 and 6.900±0.465 for control, E_1, E_2, P_1 and P_2 respectively. The flavour scores of chicken patties were non-significantly differed among each treatment groups on 0, 5th, 10th and 20thday of storage at refrigeration temperature. Only on 15th day the mean value of P_2 group was significantly ($P< 0.05$) differ from control group. The mean flavour scores of all groups were non-significantly decreased with advancement of storage period upto 20 days of storage except for E_1 and P_2 group. In E_1 group the flavour score was significantly ($P< 0.05$) decrease on 20th day whereas in P_2 group the significant decrease was found after 10th day of storage. The results of storage study for flavour were in agreement with Huda *et al.,* (2014) [8] who observed significant ($P< 0.05$) decrease in flavour scores

during storage of chicken nuggets. A progressive decrease in flavour scores of control and different curry leaves products with an increase in storage time might be due to increased lipid oxidation resulting in malonaldehyde formation, liberation of free fatty acid and increased microbial load (Kumar and Sharma, 2004, Gadekar *et al.,* 2009) [12, 5].

3.3 Effect of curry leaves extract and powder incorporation on juiciness of chicken patties during storage period:
Data related to juiciness attribute for different treatment groups of chicken patties are shown in Table 3. The average scores offered for juiciness on 0 day for control, E_1, E_2, P_1 and P_2 were 7.200±0.476, 7.405±0.292, 7.375±0.131, 6.935±0.315 and 6.900±0.129. The results indicated that there were no significant difference among control and treated products on 0 day. On 10th day of storage, the mean values for P_2 group was significantly ($P< 0.05$) differ from control group. On 20th day of storage, the mean values of juiciness for powder groups and E_1 were significantly ($P< 0.05$) differ from control group. The mean values for juiciness score of control, extract groups and P_2 were non-significantly decreased during the advancement of storage period while E_2 group showed significant ($P< 0.05$) decrease with the advancement of storage period. The overall study revealed that the patties products of all groups showed a declining trend for juiciness during the storage being highest for 0 day and lowest for 20th days. It could be attributed to the material used for packaging *i.e.,* low density polyethylene which has poor moisture barrier that might have caused loss of moisture from the products during storage (Bhat *et al.,* 2011; Mehta *et al.,* 2013) [2, 13]. The results of storage study for juiciness were in agreement with Huda *et al.,* (2014) [8] who observed decrease in juiciness scores during storage of chicken nuggets.

3.4 Effect of curry leaves extract and powder incorporation on tenderness of chicken patties during storage period:
The tenderness scores for chicken patties on 0 to 20th days of storage period are presented in Table 4. The mean values score for tenderness of all five groups *viz.* control, E_1, E_2, P_1 and P_2 were 7.460±0.252, 7.680±0.174, 7.620±0.235, 7.300±0.418 and 7.150± 0.171 on 0 day respectively. The mean tenderness scores on 0, 5th, 10th and 20th days were non-significantly differ from each other. On 15th day the mean values of E_2 group only were significantly ($P< 0.05$) differ compared to control group. The mean values for tenderness score of all groups were non-significantly decreased during the advancement of storage period except E_1, E_2 and P_2 groups. The mean values of tenderness scores of E_1, E_2 and P_2 groups were significantly ($P< 0.05$) decreased with the advancement of storage period. A gradual decrease in tenderness might be due to loss of moisture and fat during

storage (Mehta *et al.,* 2013). The similar results of declined tenderness were recorded by Kumar (2007) [11] during the storage of chicken nuggets incorporated with clove powder and ground mustard. The findings were similar to those of Patil (2000) [18], who also presented a decline in tenderness values of meat products in refrigerated storage.

3.5 Effect of curry leaves extract and powder incorporation on overall acceptability of chicken patties during storage period:
The overall acceptability scores for chicken patties on 0 to 20th days of storage period are presented in Table 5. The extract groups showed slightly higher overall acceptability as compared to control and powder groups. The mean scores for extract groups were significantly ($P< 0.05$) decreased on 20th day compared to other days and P_2 group showed significant ($P< 0.05$) decrease after 15th days of storage period. The slight decrease was also found in overall acceptability scores of control and P_1 group but the differences were non-significant. The sensory scores of each group for overall acceptability showed a declining trend with increase in storage period. In extract and P_2 groups, the overall acceptability scores of chicken patties significantly ($P< 0.05$) declined at subsequent storage intervals. On 0, 5th and 10th days of storage the mean values of different treatments and control group showed non-significant differences among each other. On 15th days of storage the overall acceptability scores of extract and powder groups were non-significantly different as compared with control. The mean values of P_2 were significantly ($P< 0.05$) differ from control group on 20th day of storage at refrigeration temperature. The progressive reduction in overall acceptability scores with an increase in storage period was a resultant of decreased values of other sensory attributes. Increased lipid oxidation, protein degradation and some bland flavour due to fat degradation are mainly responsible for lower overall acceptability scores (Mehta *et al.,* 2013) [13]. The reduction in sensory scores of stored product might be due to free radicals formed in lipid oxidation process can oxidize haem pigments to metmyoglobin which cause the discolouration of product during storage, oxidative fading and moisture loss (Indumathi and Reddy, 2015) [9].

4. Conclusion
On the basis of the results obtained in the experiment, it is concluded that the chicken patties could be successfully incorporated with extract and powder of curry leaves which were emperor upon its evaluation on the basis sensory quality as compared to control product upto 20 days of storage period at refrigeration temperature. The curry leaves products shows better antibacterial and preservative properties as compared to control. The chicken patties can be incorporated with 2% curry leaves extract and 0.6% powder for better results.

Table 1: Effect of curry leaves extract and powder incorporation on appearance score (mean±SE) of chicken patties during storage period

Treatment / Days	Control	E_1	E_2	P_1	P_2
0th	7.700^a±0.238	^{A}7.650^a±0.171	^{A}7.688^a±0.097	7.050^b±0.194	7.000^b±0.245
5th	7.550^{ab}±0.299	^{A}7.565^a±0.281	^{AB}7.480^{ab}±0.186	6.775^{bc}±0.384	6.540^c±0.232
10th	7.330^{ab}±0.170	^{A}7.500^a±0.058	^{AB}7.400^a±0.200	6.725^{bc}±0.149	6.113^c±0.341
15th	7.245^a±0.093	^{A}7.315^a±0.179	^{BC}7.000^{ab}±0.271	6.510^{bc}±0.244	6.038^c±0.313
20th	6.950^a±0.287	^{B}6.665^{ab}±0.170	^{C}6.550^b±0.253	6.100^c±0.261	5.625^d±0.312

Mean in row bearing a common superscripts (small letters) do not differ significantly ($P< 0.05$).
Mean in column bearing a common superscripts (capital letters) do not differ significantly ($P< 0.05$).
Control: Without curry leaves products
E_1: 1% Curry leaves extract, P_1: 0.4% Curry leaves powder
E_2: 2% Curry leaves extract, P_2: 0.6% Curry leaves powder

Table 2: Effect of curry leaves extract and powder incorporation on flavour score (mean±SE) of chicken patties during storage period

Treatment / Days	Control	E₁	E₂	P₁	P₂
0th	7.000±0.548	^{A}7.400±0.082	7.500±0.057	7.075±0.390	^{A}6.900±0.465
5th	6.890±0.127	^{A}7.350±0.206	7.375±0.165	6.800±0.337	^{A}6.825±0.175
10th	6.888±0.233	^{A}7.345±0.458	7.350±0.379	6.700^b±0.100	^{AB}6.625±0.025
15th	6.855^a±0.182	^{A}7.115^a±0.165	7.175^a±0.354	6.525^{ab}±0.293	^{B}5.900^b±0.252
20th	6.505±0.207	^{B}6.260±0.167	6.500±0.204	5.935±0.251	^{B}5.875±0.229

Mean in row bearing a common superscripts (small letters) do not differ significantly (*P< 0.05*).
Mean in column bearing a common superscripts (capital letters) do not differ significantly (*P< 0.05*).
Control: Without curry leaves products
E₁: 1% Curry leaves extract, P₁: 0.4% Curry leaves powder
E₂: 2% Curry leaves extract, P₂: 0.6% Curry leaves powder

Table 3: Effect of curry leaves extract and powder incorporation on juiciness score (mean±SE) of chicken patties during storage period

Treatments / Days	Control	E₁	E₂	P₁	P₂
0th	7.200±0.476	7.405±0.292	7.375±0.131	^{A}6.935±0.315	6.900±0.129
5th	7.000±0.216	7.320±0.196	7.320±0.330	^{A}6.925±0.259	6.720±0.394
10th	7.000^a±0.216	7.250^a±0.065	7.250^a±0.096	^{A}6.795^{ab}±0.228	6.420^b±0.341
15th	6.905±0.130	7.245±0.514	7.150±0.459	^{AB}6.345±0.170	6.315±0.179
20th	6.590^a±0.302	6.180^{bc}±0.225	6.325^{ab}±0.193	^{B}5.925^c±0.179	5.890^c±0.239

Mean in row bearing a common superscripts (small letters) do not differ significantly (*P< 0.05*).
Mean in column bearing a common superscripts (capital letters) do not differ significantly (*P< 0.05*).
Control: Without curry leaves products
E₁: 1% Curry leaves extract, P₁: 0.4% Curry leaves powder
E₂: 2% Curry leaves extract, P₂: 0.6% Curry leaves powder

Table 4: Effect of curry leaves extract and powder incorporation on tenderness score (mean±SE) of chicken patties during storage period

Treatment / Days	Control	E₁	E₂	P₁	P₂
0th	7.460±0.252	^{A}7.680±0.174	^{A}7.620±0.235	7.300±0.418	^{A}7.150±0.171
5th	7.430±0.087	^{A}7.635±0.281	^{A}7.525±0.335	7.125±0.287	^{A}7.135±0.381
10th	7.350±0.359	^{A}7.345±0.289	^{A}7.525±0.125	6.980±0.286	^{AB}6.660±0.326
15th	6.880^{bc}±0.071	^{A}7.255^{ab}±0.095	^{A}7.225^a±0.278	6.725^c±0.170	^{AB}6.510^c±0.240
20th	6.670±0.379	^{B}6.215±0.197	^{B}6.400±0.280	6.340±0.224	^{B}5.975±0.210

Mean in row bearing a common superscripts (small letters) do not differ significantly (*P< 0.05*).
Mean in column bearing a common superscripts (capital letters) do not differ significantly (*P< 0.05*).
Control: Without curry leaves products
E₁: 1% Curry leaves extract, P₁: 0.4% Curry leaves powder
E₂: 2% Curry leaves extract, P₂: 0.6% Curry leaves powder

Table 5: Effect of curry leaves extract and powder incorporation on overall acceptability score (mean±SE) of chicken patties during storage period

Treatment / Days	Control	E₁	E₂	P₁	P₂
0th	7.388±0.385	^{A}7.470±0.050	^{A}7.650±0.149	7.138±0.284	^{A}7.045±0.286
5th	7.265±0.147	^{A}7.433±0.310	^{A}7.525±0.120	7.090±0.350	^{AB}6.890±0.136
10th	7.245±0.127	^{A}7.405±0.194	^{A}7.425±0.318	6.785±0.226	^{AB}6.638±0.267
15th	6.950^{ab}±0.119	^{A}7.375^a±0.137	^{AB}6.850^{ab}±0.405	6.620^b±0.119	^{BC}6.305^b±0.282
20th	6.660^a±0.272	^{B}6.333^a±0.244	^{B}6.285^{ab}±0.278	6.260^{ab}±0.321	^{C}5.903^b±0.248

Mean in row bearing a common superscripts (small letters) do not differ significantly (*P< 0.05*).
Mean in column bearing a common superscripts (capital letters) do not differ significantly (*P< 0.05*).
Control: Without curry leaves products
E₁: 1% Curry leaves extract, P₁: 0.4% Curry leaves powder
E₂: 2% Curry leaves extract, P₂: 0.6% Curry leaves powder

5. References

1. Berzaghi P, Dalle Zotte A, Jansson LM, Andrighetto I. Near infrared reflectance spectroscopy as a method to predict chemical composition of breast meat and discriminate between different n-3 feeding sources. Poult. Sci. 2005;84:128-136.
2. Bhat ZF, Pathak V, Bukhari SAA, Anmad SR, Bhat H. Quality changes in chevon herrisa (meat based product) during refrigerated storage. Int. J Meat Sci. 2011;1(1):52-61.
3. Brewer MS. Natural antioxidants: sources, compounds, mechanisms of action, and potential applications. Comprehensive Review in Food Sci. Food Safety. 2011;10:221-247.
4. Devatkal SK, Thorat PR, Manjunatha M, Anurag RK. Comparative antioxidant effect of curry leaves, fenugreek leaves and butylated hydroxytoluene in raw chicken patties. J Food Sci. Technol. 2012;49(6):781-785.
5. Gadekar YP, Anjaneyulu ASR, Thomas R, Mendiratta SK, Kondaiah N. Quality change in soup from deboned chicken frames at refrigerated (4±1 °C) and frozen (-18±1 °C) storage. Int. J Food Sci. Technol. 2009;44:1763-1769.
6. Ganesan P, Phaiphan A, Murugan Y, Baharin BS. Comparison study of bioactive compounds in curry and coriander leaves: An update. J Chem. Pharma. Res.

2013;5:590-594.

7. Guleria P, Kumari S, Khan A, Dangi N. Present scenario of Indian meat industry- A review. Int. J Enhanced Res. Sci. Tech. Engineering. 2015;4:2319-7463.

8. Huda BA, Shahnaz P, Sajad AR, Rehana A, Hassan M. Effect of incorporation of apple pomace on the physicochemical, sensory and textural properties of mutton nuggets. Int. J Advanced Res. 2014;2(4):974-983.

9. Indumathi J, Reddy BO. Effect of different natural antioxidant extracts on the shelf life of functional chicken meat nuggets. Int. J Advanced Res. 2015;3(6):820-828.

10. Jahan K, Paterson A, Spickett CM. Fatty acid composition, antioxidants and lipid oxidation in chicken breasts from different production regimes. Int. J Food Sci. Technol. 2004;39:443-453.

11. Kumar D. Physico-chemical, sensory and microbiological study of chicken nuggets prepared from spent hen meat using clove powder and ground mustard as phyto-preservaties. M.V.Sc Thesis, Pantnagar, Uttarakhand, 2007.

12. Kumar M, Sharma BD. Quality and storage stability of low-fat pork patties containing barley flour as fat substitute. J Food Sci. Technol. 2004;41:496-502.

13. Mehta N, Ahlawat SS, Sharma DP, Yadav S, Arora D. Sensory attributes of chicken meat rolls and patties incorporated with the combination levels of rice bran and psyllium husk. J Ani. Res. 2013;3(2):179-185.

14. Mehta N, Sharma BD, Kumar P. Standardization of the level of sunflower oil in the development of the low-fat chicken meat patties. J Ani. Research. 2011;1:15-20.

15. Naczk M, Shahidi F. Extraction and analysis of phenolics in food. J. Chromatography. 2004;A1054:95-111.

16. Najeeb AP, Mandal PK, Pal UK. Efficacy of leaves (Drumstick, mint and Curry leaves) powder as natural preservatives in restructured chicken blocks. J Food Sci. Technol. 2015;52(5):3129-3133.

17. Nor FM, Mohamed S, Idris NA, Ismail R. Antioxidative properties of *Pandanus amaryllifolius* leaf extracts in accelerated oxidation and deep frying studies. Food Chem. 2008;110:319-327.

18. Patil GS. Quality of chicken patties incorporated with different milk proteins. M. V. Sc. Thesis, Livestock Product Technology, IVRI Izatnagar, 2000.

19. Patsias A, Badeka AV, Savvaidis IN, Kontominas MG. Combined effect of freeze chilling and MAP on quality parameters of raw chicken fillets. Food Micro. 2008;25:575-581.

20. Peryam DR, Pilgrim FJ. Hedonic scale method of measuring food preferences. Food Technol, 1957, 9-14.

21. Rao BRR, Rajput DK, Mallavarapu GR. Chemical diversity in curry leaf (*Murraya koenigii*) essential oils. Food Chem. 2011;126:989-994.

22. Snedecor GW, Cochran WJ. Statistical methods, 8th ed. Lowa state university press, Amer, lowa, USA, 1989.

23. Suradkar US, Bumla NA, Maria A, Sofi AH, Wani SA. Comparative quality of chicken nuggets prepared from broiler, spent hen and combination meats. Int. J Food Nutrition Safety. 2013;3(3):119-126.