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## Effect of Indian gooseberry extract incorporation in chicken nuggets on storage at refrigeration temperature

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### Abstract

The present study was conducted on chicken nuggets to estimate the effect of incorporation of Indian gooseberry extract on sensory quality (appearance, flavor, juiciness, tenderness and overall acceptability) of chicken nuggets during storage at refrigeration temperature. Different levels of Indian gooseberry extract were used like Control (Without Indian gooseberry extract), E<sub>1</sub> (0.5% Indian gooseberry extract), E<sub>2</sub> (1% Indian gooseberry extract), E<sub>3</sub> (1.5% Indian gooseberry extract). The products were stored in clean, dry low density polyethylene bags at refrigeration temperature (4±1 °C) and subjected to comparative studies of sensory quality at 0, 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> days of storage period. The statistical analysis of data revealed that the scores for all sensory parameters of chicken nuggets showed a decreasing trend with advancement of storage period. The scores for overall acceptability of nuggets were found in following manner: E<sub>2</sub> > E<sub>3</sub> > E<sub>1</sub> > C. The nuggets from broiler meat could be successfully incorporated with extract of Indian gooseberry which was organoleptically tastier and more stable than the control recipe up to 15 days of storage period at refrigeration temperature. The chicken nuggets could be incorporated with 1% Indian gooseberry extract for optimum results. The Indian gooseberry (amla) which is abundantly grown in Rajasthan can be utilized as an organic and natural preservative for preparation of chicken nuggets.

**Keywords:** Indian gooseberry extract, chicken nuggets, sensory quality, storage

### 1. Introduction

Poultry meat is categorized as white meat and from nutritional angle it is considered superior and healthier due to its good fat profile i.e. low saturated fatty acids and high unsaturated fatty acids. Chicken meat is an important source of protein, minerals, essential vitamins and essential poly unsaturated fatty acids (PUFAs), especially the omega-3 fatty acids, (Ashgar *et al.*, 1990) [2]. Products of chicken meat are highly desirable, digestible, palatable and nutritious for all age groups population. Chicken nuggets occupy a predominant place worldwide due to their characteristics flavour and pronounced chewy texture (Muthulakshmi, 2010) [8]. 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. But it is most vulnerable towards deterioration owing to short shelf-life. The meat industry has been searching for the use of fibres, minerals or bioactive compounds in meat products as food additives and ingredients that can enhance the nutritional quality and lowers fat level. The incorporation of fruits and vegetables as non-meat ingredients in processed meat products is the possible solution to the recent consumer demands for low fat and high fibre meat products due to their natural antioxidant activity, fibre and nutrient content (Yue, 2001) [14]. Amla or Indian gooseberry is used due to its astonishing properties including antimicrobial, antioxidant, anticancer, anti-ageing, anti-inflammatory, antipyretic, antisclerotic, analgesics, antiulcerogenic, antidiabetic, blood purifier, diuretic and many more, as reported by a number of scientists in their work. Zaki *et al.* (2014) [15] reported that due to amazing remedial properties, Indian gooseberry is among the most extensively used drugs of Unani (Greeco-Arab) system of medicine and it is also described as a tonic for heart and brain. Indian Gooseberry, reported to possess antifungal, antibacterial and antiviral activities (Godbole and Pendse, 1960) [4]. Therefore, it can also be utilized to prolong the shelf-life of meat products. The extract of amla (*Phyllanthus emblica*) can be utilize to enhance nutritive value of the product. It is rich in polyphenols, minerals and is regarded as one of the richest source of vitamin C (200-900 mg per 100 g of edible portion) (Jain and Akhurdiya, 2000) [6].

The present research work was carried out as an attempt to utilize chicken meat for the preparation of nuggets, a value added product. In order to estimate the effect of incorporation of Indian gooseberry extract on sensory quality of chicken nuggets during storage at refrigeration temperature. Different levels of Indian gooseberry extract are incorporated in chicken nuggets.

**2. Materials and Methods**

**2.1 Procurement of raw material**

The fresh broiler meat, condiment mixture (Onion, garlic and ginger), spice mix and Indian gooseberry were procured from the local market of the Vallabhnagar, Udaipur. Spice mix was prepared using the proportion of each ingredient according to suggested by Ambadkar (2002) [1].

**2.2 Preparation of chicken nuggets**

Chicken nuggets were developed by procedure as described by Nag (1994) [9] with slight modification. The chicken nuggets were packed aerobically in clean - dry LDPE bags after cooling, sealed and stored at refrigeration temperature (4±1°C).

**2.3 Sensory Evaluation**

The sensory quality of samples was evaluated using 9 point hedonic scale (Peryam and Pilgrim, 1957) [12] where 9 denoted very desirable and 1 denoted very undesirable. A sensory panel 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) [13].

**3. Results and Discussion**

To estimate the effect of Indian gooseberry 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, 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> day of storage.

**3.1 Effect of incorporation of Indian gooseberry extract on appearance of chicken nuggets during storage period**

Table 1 representing the mean scores of appearance of chicken nuggets for 0<sup>th</sup>, 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> days of storage period. The score was highest for E<sub>3</sub> group (5.933±0.247) whereas E<sub>1</sub> (5.333±0.153) resulted lowest on 15<sup>th</sup> day of storage period. The chicken nuggets of all groups showed a declining trend for appearance during the storage period being highest for 0<sup>th</sup> day and lowest for 15<sup>th</sup> day. The scores differed significantly (P<0.05) only between 10<sup>th</sup> and 15<sup>th</sup> day of nuggets storage for all four groups. The result of storage study for appearance were similar to Naveen and Mendiratta (2001) [10], who reported significant (P<0.05) decrease in appearance score of chicken boti kabab during storage. The possible reason might be surface drying or lipid oxidation causing non enzymatic browning in the product (Chemam *et al.*, 1995) [3]. Control and extract treated groups were upto desirable level upto 15<sup>th</sup> day

**Table 1:** Effect of incorporation of Indian gooseberry extract on appearance score (Mean±SE) of chicken nuggets during storage period

Treatment / Days	Control	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
0 <sup>th</sup>	<sup>A</sup> 7.611 <sup>a</sup> ±0.168	<sup>A</sup> 6.833 <sup>c</sup> ±0.333	<sup>A</sup> 7.833 <sup>a</sup> ±0.200	<sup>A</sup> 7.917 <sup>a</sup> ±0.200
5 <sup>th</sup>	<sup>AB</sup> 7.167 <sup>ab</sup> ±0.166	<sup>A</sup> 6.832 <sup>c</sup> ±0.307	<sup>A</sup> 7.417 <sup>a</sup> ±0.271	<sup>AB</sup> 7.583 <sup>ab</sup> ±0.166
10 <sup>th</sup>	<sup>B</sup> 6.583 <sup>a</sup> ±0.348	<sup>A</sup> 6.500 <sup>ab</sup> ±0.348	<sup>B</sup> 6.555 <sup>ab</sup> ±0.306	<sup>B</sup> 7.125 <sup>a</sup> ±0.256
15 <sup>th</sup>	<sup>C</sup> 5.667 <sup>a</sup> ±0.247	<sup>B</sup> 5.333 <sup>ab</sup> ±0.247	<sup>C</sup> 5.417 <sup>a</sup> ±0.300	<sup>C</sup> 5.933 <sup>a</sup> ±0.247

Mean in row bearing a common superscripts (capital letters) do not differ significantly (P<0.05).  
 Mean in column bearing a common superscripts (small letters) do not differ significantly (P<0.05).  
 Control: Without Indian gooseberry extract  
 E<sub>1</sub>: 0.5% Indian gooseberry extract  
 E<sub>2</sub>: 1% Indian gooseberry extract  
 E<sub>3</sub>: 1.5% Indian gooseberry extract

**3.2 Effect of incorporation of Indian gooseberry extract on flavour of chicken nuggets during storage period**

The mean scores for flavour of chicken nuggets treated with Indian gooseberry extract are presented in Table 2. On 15<sup>th</sup> day of storage, flavour scores for C, E<sub>1</sub>, E<sub>2</sub> and E<sub>3</sub> were 5.417±0.200, 5.333±0.247, 6.167±0.380 and 5.667±0.210 respectively. The chicken nuggets from all groups recorded a

declining trend for flavor during storage period being highest for 0<sup>th</sup> day and lowest for 15<sup>th</sup> day. It might be due to oxidative rancidity as indicated by increased TBA and microbial counts with advancement in period of storage. The results of storage study for flavour were in agreement with Huda *et al.*, (2014) [5] who observed significant (P<0.05) decrease in flavour scores during storage of chicken nuggets.

**Table 2:** Effect of incorporation of Indian gooseberry extract on flavour score (Mean±SE) of chicken nuggets during storage period

Treatment / Days	Control	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
0 <sup>th</sup>	<sup>A</sup> 7.458 <sup>a</sup> ±0.060	<sup>A</sup> 7.167 <sup>a</sup> ±0.097	<sup>A</sup> 7.417 <sup>a</sup> ±0.333	<sup>A</sup> 7.333 <sup>a</sup> ±0.200
5 <sup>th</sup>	<sup>AB</sup> 7.167 <sup>a</sup> ±0.333	<sup>A</sup> 6.917 <sup>a</sup> ±0.271	<sup>A</sup> 7.333 <sup>a</sup> ±0.271	<sup>A</sup> 7.333 <sup>a</sup> ±0.333
10 <sup>th</sup>	<sup>B</sup> 6.417 <sup>ab</sup> ±0.348	<sup>A</sup> 6.833 <sup>ab</sup> ±0.348	<sup>AB</sup> 7.125 <sup>a</sup> ±0.195	<sup>B</sup> 6.337 <sup>bc</sup> ±0.389
15 <sup>th</sup>	<sup>C</sup> 5.417 <sup>ab</sup> ±0.200	<sup>B</sup> 5.333 <sup>c</sup> ±0.247	<sup>B</sup> 6.167 <sup>a</sup> ±0.380	<sup>B</sup> 5.667 <sup>ab</sup> ±0.210

Mean in row bearing a common superscripts (capital letters) do not differ significantly (P<0.05).  
 Mean in column bearing a common superscripts (small letters) do not differ significantly (P<0.05).  
 Control: Without Indian gooseberry extract  
 E<sub>1</sub>: 0.5% Indian gooseberry extract  
 E<sub>2</sub>: 1% Indian gooseberry extract  
 E<sub>3</sub>: 1.5% Indian gooseberry extract

### 3.3 Effect of incorporation of Indian gooseberry extract on juiciness of chicken nuggets during storage period

The juiciness scores for nuggets up to 15 days of storage period are presented in Table 3. The juiciness scores for all treatment groups were higher than C up to 15<sup>th</sup> day. All the

groups of nuggets indicated a declined trend of juiciness scores throughout the storage period. The results of storage study for juiciness were in agreement with Huda *et al.*, (2014) [5] who observed significant ( $P<0.05$ ) decrease in juiciness scores during storage of chicken nuggets.

**Table 3:** Effect of incorporation of Indian gooseberry extract on juiciness score (Mean±SE) of chicken nuggets during storage period

Treatment / Days	Control	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
0 <sup>th</sup>	<sup>A</sup> 7.077 <sup>a</sup> ±0.240	<sup>A</sup> 7.417 <sup>a</sup> ±0.200	<sup>A</sup> 7.417 <sup>a</sup> ±0.210	<sup>A</sup> 7.250 <sup>a</sup> ±0.307
5 <sup>th</sup>	<sup>AB</sup> 6.417 <sup>a</sup> ±0.395	<sup>B</sup> 6.667 <sup>a</sup> ±0.333	<sup>B</sup> 6.625 <sup>a</sup> ±0.210	<sup>A</sup> 7.167 <sup>a</sup> ±0.339
10 <sup>th</sup>	<sup>B</sup> 5.883 <sup>c</sup> ±0.348	<sup>B</sup> 6.583 <sup>ab</sup> ±0.171	<sup>B</sup> 6.500 <sup>ab</sup> ±0.386	<sup>B</sup> 6.167 <sup>bc</sup> ±0.332
15 <sup>th</sup>	<sup>C</sup> 4.333 <sup>c</sup> ±0.333	<sup>C</sup> 4.917 <sup>bc</sup> ±0.271	<sup>C</sup> 4.750 <sup>bc</sup> ±0.402	<sup>C</sup> 4.750 <sup>bc</sup> ±0.249

Mean in row bearing a common superscripts (capital letters) do not differ significantly ( $P<0.05$ ).

Mean in column bearing a common superscripts (small letters) do not differ significantly ( $P<0.05$ ).

Control: Without Indian gooseberry extract

E<sub>1</sub>: 0.5% Indian gooseberry extract

E<sub>2</sub>: 1% Indian gooseberry extract

E<sub>3</sub>: 1.5% Indian gooseberry extract

### 3.4 Effect of incorporation of Indian gooseberry extract on tenderness of chicken nuggets during storage period

The tenderness scores for nuggets up to 15 days of storage period are presented in Table 4. Only E<sub>2</sub> and E<sub>3</sub> were scored neither desirable nor undesirable level, on 15<sup>th</sup> day while, control scored lowest at level of moderately undesirable. Different test groups of chicken nuggets revealed significant

difference ( $P<0.05$ ) only between 10<sup>th</sup> and 15<sup>th</sup> day only due to the effect of interaction between treatment and storage period. The overall score indicated a decline trend for tenderness. The similar results of declined tenderness were recorded by Kumar (2007) [7] during the storage of chicken nuggets incorporated with clove powder and ground mustard.

**Table 4:** Effect of incorporation of Indian gooseberry extract on tenderness score (Mean ± SE) of chicken nuggets during storage period

Treatment / Days	Control	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
0 <sup>th</sup>	<sup>A</sup> 7.345 <sup>a</sup> ±0.195	<sup>A</sup> 7.883 <sup>a</sup> ±0.271	<sup>A</sup> 7.167 <sup>a</sup> ±0.307	<sup>A</sup> 7.417 <sup>a</sup> ±0.166
5 <sup>th</sup>	<sup>A</sup> 6.667 <sup>a</sup> ±0.333	<sup>A</sup> 6.917 <sup>a</sup> ±0.271	<sup>A</sup> 7.167 <sup>a</sup> ±0.408	<sup>AB</sup> 7.167 <sup>a</sup> ±0.396
10 <sup>th</sup>	<sup>A</sup> 6.333 <sup>ab</sup> ±0.195	<sup>A</sup> 6.833 <sup>a</sup> ±0.348	<sup>A</sup> 6.875 <sup>a</sup> ±0.256	<sup>B</sup> 6.500 <sup>ab</sup> ±0.386
15 <sup>th</sup>	<sup>B</sup> 4.333 <sup>bcd</sup> ±0.166	<sup>B</sup> 4.667 <sup>abc</sup> ±0.307	<sup>B</sup> 5.417 <sup>a</sup> ±0.351	<sup>C</sup> 5.067 <sup>ab</sup> ±0.333

Mean in row bearing a common superscripts (capital letters) do not differ significantly ( $P<0.05$ ).

Mean in column bearing a common superscripts (small letters) do not differ significantly ( $P<0.05$ ).

Control: Without Indian gooseberry extract

E<sub>1</sub>: 0.5% Indian gooseberry extract

E<sub>2</sub>: 1% Indian gooseberry extract

E<sub>3</sub>: 1.5% Indian gooseberry extract

### 3.5 Effect of incorporation of Indian gooseberry extract on overall acceptability of chicken nuggets during storage period

The overall acceptability scores for nuggets up to 15<sup>th</sup> days of storage period are presented in Table 5. The score of acceptability for all three treatments of extract were superior to the control one on 15<sup>th</sup> day of storage period. The score for E<sub>2</sub> (6.083±0.300) was highest whereas for control

(4.833±0.166) was lowest on 15<sup>th</sup> day of storage. Control obtained scores lesser than the desirable level. The study revealed that there was significant variation ( $P<0.05$ ) in the mean values between 10<sup>th</sup> and 15<sup>th</sup> day storage of period for all four groups. The present findings are corroborated with the observations of Patil (2000) [11]. The similar declined trend was observed for chicken patties with regards to overall acceptability scores with the progress of storage period.

**Table 5:** Effect of incorporation of Indian gooseberry extract on overall acceptability score (Mean±SE) of chicken nuggets during storage period

Treatment / Days	Control	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
0 <sup>th</sup>	<sup>A</sup> 7.430 <sup>a</sup> ±0.092	<sup>A</sup> 7.333 <sup>a</sup> ±0.333	<sup>A</sup> 7.625 <sup>a</sup> ±0.200	<sup>A</sup> 7.417 <sup>a</sup> ±0.200
5 <sup>th</sup>	<sup>AB</sup> 7.083 <sup>a</sup> ±0.271	<sup>A</sup> 7.083 <sup>a</sup> ±0.204	<sup>A</sup> 7.417 <sup>a</sup> ±0.376	<sup>A</sup> 7.333 <sup>a</sup> ±0.357
10 <sup>th</sup>	<sup>B</sup> 6.500 <sup>b</sup> ±0.256	<sup>A</sup> 6.666 <sup>b</sup> ±0.350	<sup>A</sup> 7.583 <sup>a</sup> ±0.195	<sup>A</sup> 6.667 <sup>b</sup> ±0.195
15 <sup>th</sup>	<sup>C</sup> 4.833 <sup>bc</sup> ±0.210	<sup>B</sup> 5.083 <sup>bc</sup> ±0.204	<sup>B</sup> 6.083 <sup>a</sup> ±0.300	<sup>B</sup> 5.500 <sup>a</sup> ±0.300

Mean in row bearing a common superscripts (capital letters) do not differ significantly ( $P<0.05$ ).

Mean in column bearing a common superscripts (small letters) do not differ significantly ( $P<0.05$ ).

Control: Without Indian gooseberry extract

E<sub>1</sub>: 0.5% Indian gooseberry extract

E<sub>2</sub>: 1% Indian gooseberry extract

E<sub>3</sub>: 1.5% Indian gooseberry extract

## 4. Conclusion

On the basis of the results obtained in the experiment, it is concluded that the nuggets from broiler meat could be successfully incorporated with extract of Indian gooseberry

which are organoleptically tastier and more stable than the control recipe up to 15 days of storage period at refrigeration temperature. The chicken nuggets could be incorporated with 1% Indian gooseberry extract for optimum results. The Indian

gooseberry (amla) which is abundantly grown in Rajasthan can be utilized as an organic and natural preservative for preparation of chicken nuggets.

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