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Effect of jackfruit powder on the physicochemical and sensory attributes of poultry meat cocktail nuggets*

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Abstract

The present study was designed to investigate the effect of jackfruit powder on the physicochemical characteristics, proximate composition and sensory attributes of cocktail nuggets containing 75 per cent chicken and 25 per cent duck meat. Jackfruit powder was added in cocktail nuggets at three different levels i.e., one, two and three per cent over and above the cocktail nuggets formulation and its effect was evaluated against control cocktail nuggets. There was no significant difference in emulsion pH values of control and jackfruit powder incorporated treatment samples. When compared to control nuggets, significant increase was noticed in the product pH of all the three treatment nuggets incorporated with jackfruit powder. No significant difference was observed in the water activity and cooking yield of treatment and control nuggets samples. No significant difference was observed in the moisture, fat, carbohydrate and calorie content of the jackfruit powder added treatments and control nuggets. Protein percentage of treatment samples were significantly lower than the control nuggets. Significantly higher ash content was observed for jackfruit powder incorporated treatment samples when compared to control samples. On sensory evaluation, no significant difference was observed for the appearance and flavour between control and the treatment samples. Functional cocktail nuggets containing three per cent jackfruit powder had significantly lower values for juiciness, texture, saltiness, mouth coating and overall acceptability when compared to other treatment and control samples. The addition of jackfruit powder in the nugget formulations was effective in sustaining the desired sensory attributes besides the nutritional benefits. Hence, acceptable functional cocktail nuggets can be made with the addition of jackfruit powder up to two per cent over and above the cocktail nuggets formulation without affecting the sensory attributes.

Keywords: *Cocktail nuggets, Jackfruit powder*

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The relationship between food and human health has been studied since time immemorial. The trends in production and consumption of food is closely related to human health and wellbeing. With the development of newer technologies, an increasing number of beneficial food products with added functional ingredients have gained an important place in the global market. Functional foods, can be defined as those foods that are fortified, enriched, or enhanced with bioactive ingredients that may reduce the risk of diseases and can provide added physiological benefits. Functional foods claim to improve health and help prevent certain diseases when combined with balanced diet and healthy lifestyle.

The consumption of jackfruit has increased due to its reported health benefits. Jackfruit is a rich source of various bioactive components which makes it a favorite subject for the scientific community. However it still remains underutilized in terms of production of value added food materials. The use of standardized meat products incorporated with jackfruit can be considered as a novel way for reaping the health benefit properties of the fruit.

Keeping in view all the above facts, the present study was envisaged to attempt the still inconclusive studies on utilization of jackfruit powder in the development of functional meat products. A study was designed to evaluate the effect of different levels of jackfruit powder on physicochemical properties, proximate composition and sensory profile of cocktail nuggets containing 75 per cent chicken and 25 per cent duck meat.

Materials and methods

Chicken and duck meat

Broiler chicken and duck each of 2.5 to 3 kg live body weight procured from the local market were humanely slaughtered and dressed under hygienic conditions at Meat Technology Unit, Mannuthy. The dressed carcasses were immediately chilled for around 24 hours and deboned. Deboned meat was aerobically packed in high density polyethylene (HDPE) bags, kept frozen and thawed at 4±1°C before the preparation of nuggets.

***Vegetable Oil*:** Refined sunflower oil (Sunrich) was used throughout the study.

Condiment: The condiment mixture was prepared as and when required by blending peeled and chopped onion and garlic (3:1 w/w) to the consistency of a fine paste.

Spice mixture: consists of coriander 22%, cumin seeds 16%, black pepper 20%, red chilli 7%, anise 5%, dry ginger 5%, turmeric 5%, cinnamon 5%, cardamom 5%, curry leaves 2%, clove 2%, nutmeg 3% and mace 3%.

Curing ingredients: Sodium chloride 1%, sugar0.3%, sodium-tri-polyphosphate 0.3%, sodium ascorbate 550 ppm and sodium nitrite 120 ppm.

Functional ingredient: jackfruit powder (Jackfruit 365, Eastern Condiments Pvt Ltd) purchased from local market of Thrissur, Kerala was used throughout the study.

Product formulation

The formulation of emulsion based cocktail nuggets was standardized by conducting several trials. The standardized formulation was used for the entire study (Table.1).

Preparation of chicken nuggets

Deboned broiler chicken was minced through a 9 mm grinder plate in a meat mincer (MADO primus Model MEW 613, Germany). The ground chicken was pre-blended with salt, sodium tripolyphosphate, sugar, and sodium ascorbate and sodium nitrite at the levels given in the Table 1 and kept under refrigeration for about 12 hours. The emulsion was prepared in a bowl chopper (MADO GARANT, Germany) by chopping the pre-blended chicken for 3-5 min with simultaneous addition of ice flakes. Beaten egg was added and chopped further for 1-2 min, followed by the addition of pre-chilled refined sunflower oil till it was evenly dispersed in the batter during chopping. Then, binders, corn flour and refined wheat flour (1.5%) each, soya powder (2%), condiments (4%)

Table 1 Formulary for the preparation of control and functional cocktail nuggets

Ingredients (%)	Control nuggets (%)	Functional cocktail nuggets
Ground chicken	50.625	50.625
Ground duck meat	16.875	16.875
Ice flakes	10	10
Vegetable oil (sunflower oil)	12	12
Condiments	4.0	4.0
Spice mix	1.7	1.7
Soya powder	2.0	2.0
Corn flour	1.5	1.5
Refined wheat flour	1.5	1.5
Salt	1.0	1.0
Sugar	0.3	0.3
Sodium tripolyphosphate	0.3	0.3
Sodium ascorbate	0.3	0.3
Sodium nitrite	120 ppm	120 ppm
Egg	3.33	3.33
Jackfruit powder	0.0	*

***jackfruit powder** was added over and above the quantity of the formulation at three different levels.

and spices mix (1.7%) as per formulary were added. Jackfruit powder was added with the mix and chopped till uniformly dispersed with desired consistency of the batter. The batter was taken and manually filled in stainless steel mould under hygienic condition. The mould covered with lid was steam cooked for 40 minutes to get properly cooked blocks. Chicken blocks so obtained were cooled and kept under refrigeration for 12-15 hours. These blocks were sliced into nuggets of size 1.5 cm x 1.5 cm x 1.5 cm. The product preparation procedure for different chicken nuggets formulations was uniform throughout the study.

Analytical procedures

Physico-chemical characteristics

pH

The pH of the chicken nuggets from all the treatments and control, before and after cooking was determined using a combined electrode digital pH meter (µ pH system 362, Systronics, India) as per procedure of Troutt *et al*. (1992).

Water activity (a_w)

For determination of a_w, the samples were cut into small pieces and filled in the sample cup up to the mark. The filled sample cup was kept in the measurement chamber of Lab swift a_w meter (Novasina, Switzerland). The readings were taken, when the stable a_w was on in the display.

Cooking yield percentage

The weights of meat loaves before and after cooking were recorded. Product yield was expressed in percentage.

$$\text{Product yield (\%)} = \frac{\text{weight of cooked meat block}}{\text{Weight of raw batter}} \times 100$$

Proximate analysis

The proximate composition of the chicken nuggets batter and products were determined by the standard procedure of AOAC (2016). Analyses were conducted in duplicate.

Moisture was determined by weight loss after 16 hours drying in a hot air over at

105°C. The fat content was determined in moisture free samples by an ether extraction procedure in an Automatic Solvent Extraction System (SOX plus, Model SCS 6, Pelican Equipments, Chennai, India). Moisture and fat free samples were used to estimate the protein and ash content. The protein content was determined by Block Digestion Method (KEL plus, Model KES 6L, Pelican Equipments, Chennai, India). Ash was determined by weight loss after 2 hours drying in muffle furnace (HF-electric furnace, Hindustan Furnance, Thrissur, Kerala) at 600°C. The amount of carbohydrate was calculated as 100 minus sum of the percentage of moisture, protein, fat and ash. The proximate composition was expressed in as-is-basis.

Calorific Value

Total calories content of chicken nuggets were arrived at as per FAO (2002) on wet matter basis.

Calories from fat = fat per cent × 9
Calories from protein = protein per cent × 4
Calories form carbohydrate = carbohydrate per cent × 4.
Total calories (kcal/100g) = (fat% x 9) + (protein% x 4) + (carbohydrate % x 4).

Organoleptic evaluation

Sensory attributes of the chicken nuggets were assessed organoleptically using 8 point Hedonic scale score card (AMSA, 1983) with the help of seven semi-trained taste panellists drawn from the Department of Livestock Products Technology, Mannuthy, Thrissur. The nuggets were shallow fried in sunflower oil and served warm to the panellists with code numbers to the samples. The average of the individual scores was taken as the score for the particular attribute.

Statistical analysis

The experiment was replicated four times and the data obtained for physico-chemical and sensory evaluation of different products were statistically analyzed as per Snedecor and Cochran (1994) by one-way ANOVA and Kruskal-Wallis test using SPSS software version 24.

Result and Discussion

The results of physico-chemical characteristics of the functional cocktail nuggets incorporated with different levels of jackfruit powder (one, two and three per cent) are presented in Table 1.

There was no significant difference in emulsion pH values of control (6.80 ± 0.03) and functional cocktail nuggets with three levels of jackfruit powder *viz*. 1 per cent (6.77 ± 0.02), 2 per cent (6.78 ± 0.02) and 3 per cent (6.77± 0.02). When compared to control nuggets, significant ($p< 0.001$) increase was noticed in the product pH of all the three treatment nuggets incorporated with jackfruit powder. Similar to this, Kumar *et al*. (2010) reported a higher pH for the chicken nuggets incorporated with soya hull flour when compared to control nuggets and this increase in pH was correlated to higher pH of the soya hull flour.

No significant difference was observed in the water activity and cooking yield of functional cocktail nuggets containing different levels of jackfruit powder and control nuggets samples. However, Verma *et al*. (2012) stated a marked decline in cooking yield with increase in level of incorporation of chick pea hull flour in low salt chicken nuggets.

Proximate composition and calorie content

The proximate composition of the cocktail nuggets incorporated with different levels of jackfruit powder is shown in Table 2.

There was no significant difference in the moisture, fat, carbohydrate and calorie content among the treatment and control samples. The addition of jack fruit powder had no effect on the moisture, fat, carbohydrate and calorie content content of cocktail nuggets. This was in accordance with Dzudie *et al.* (2002) who observed no significant difference in the moisture and fat content of 2.5 per cent common bean flour incorporated beef sausages in comparison to control sausages.

Protein percentage of treatment samples were significantly ($P<0.001$) lower

Table 2. Effect of jackfruit powder on the physico-chemical characteristics, proximate composition and calorie content of the cocktail nuggets

Parameters	C	T_1	T_2	T_3	F-value (p-value)
Emulsion pH	6.80 ± 0.03	6.77 ± 0.02	6.78 ± 0.02	6.77 ± 0.02	0.274^{ns}(0.843)
Product pH	6.82 ± 0.02^{b}	6.85 ± 0.01^{a}	6.87 ± 0.01^{a}	6.85 ± 0.01^{a}	4.511^{*}(0.014)
Water activity	0.92 ± 0.00	0.92 ± 0.00	0.92 ±0.00	0.93± 0.00	1.728^{ns}(0.193)
Cooking yield (%)	97.76 ± 0.54	98.21 ± 0.24	97.77 ± 0.33	97.88 ± 0.31	0.334^{ns}(0.801)
Moisture (%)	60.79 ± 0.38	60.84 ± 0.42	60.00 ± 0.50	59.78 ± 0.29	1.800^{*}(0.180)
Protein (%)	18.00 ± 0.31^{a}	16.17 ± 0.16^{b}	16.30 ± 0.23^{b}	16.60 ± 0.19^{b}	13.586^{*}(<0.001)
Fat (%)	12.48 ± 0.54	12.31 ± 0.72	12.88 ± 0.42	12.55 ± 0.74	0.151^{*}(0.928)
Carbohydrate (%)	7.06 ± 0.62	8.86 ± 0.95	8.96 ± 0.53	9.20 ± 0.78	1.778^{ns}(0.184)
Ash (%)	1.66 ± 0.02^{b}	1.82 ± 0.02^{a}	1.86 ± 0.02^{a}	1.87 ± 0.02^{a}	19.737^{*}(<0.001)
Calorie (kcal/100 g)	212.62 ± 2.69	210.89 ± 2.22	216. 10 ±3.77	216.12± 3.31	0.889^{ns}(0.464)

** Significant at 0.01 level; * significant at 0.05 level; ns non- significant at 0.05 level
Means with same superscripts in a row does not differ significantly (P >0.05)
C – Control (nuggets with 75% chicken meat, 25% duck meat without jackfruit powder)
T_1 – Treatment 1 (C+1 % jackfruit powder)
T_2 – Treatment 2 (C +2 % jackfruit powder)
T_3 – Treatment 3 (C +3 % jackfruit powder)

Table 3. Effect of jackfruit powder on the sensory attributes of the cocktail nuggets

Attributes	C	T_1	T_2	T_3	χ^2-value (p-value)
Appearance	7.04±0.11	7.25±0.07	7.16 ± 0.05	7.12± 0.09	2.516^{ns} (0.472)
Flavor	6.88 ± 0.11	7.12±0.09	6.95 ± 0.1	6.82± 0.08	6.379^{ns} (0.095)
Juiciness	6.98 ± 0.1^{a}	7.13 ± 0.07^{a}	6.99 ± 0.09^{a}	6.74 ± 0.09^{b}	9.960* (0.019)
Texture	6.90 ± 0.1^{a}	7.11 ± 0.08^{a}	7.02 ± 0.1^{a}	6.56 ± 0.1^{b}	15.205* (0.002)
Saltiness	7.00 ± 0.12^{a}	7.05 ± 0.10^{a}	6.94 ± 0.11^{a}	6.64 ± 0.09^{b}	10.908* (0.012)
Mouth coating	6.89 ± 0.1^{a}	7.16 ± 0.05^{a}	6.94 ± 0.1^{a}	6.60 ± 0.09^{b}	20.950** (<0.001)
Overall acceptability	6.97 ± 0.08^{a}	7.26 ± 0.06^{a}	7.02 ± 0.09^{a}	6.70 ± 0.09^{b}	19.418** (<0.001)

** Significant at 0.01 level; * significant at 0.05 level; ns non- significant at 0.05 level
Mean with same superscripts in a row does not differ significantly (P >0.05)
C – Control (nuggets with 75% chicken meat, 25% duck meat without jackfruit powder)
T_1 – Treatment 1 (C+1 % jackfruit powder)
T_2 – Treatment 2 (C +2 % jackfruit powder)
T_3 – Treatment 3 (C +3 % jackfruit powder)

than the control nuggets. This might be due to reduction in meat content by the over addition of jackfruit powder that incorporate carbohydrates in the treatment nuggets at the expense of protein content. Similar to this, Sathu (2014) observed significant reduction in protein content of functional chicken nuggets incorporated with oat flour when compared to control chicken nuggets.

Significantly (P<0.001) higher ash content was observed for jackfruit powder

incorporated treatment samples when compared to control samples. This can be attributed to higher mineral content of jackfruit powder. Similar to the present findings Elgasim and Al-Wesali (2000) noticed significant increase in the ash content of beef patties when incorporated with 20 per cent samh (*Mesembryanthemum forsskalei Hochst*) flour.

Organoleptic evaluation

A meat product recognized as a food and consumed with satisfaction, depends extensively on its sensory parameters. The organoleptic qualities of functional cocktail nuggets incorporated with jack fruit powder and control nuggets was evaluated using eight point Hedonic scale. The results are presented in Table 3.

There was no significant difference for appearance and colour and flavour between control and the treatments containing jackfruit powder. Functional cocktail nuggets containing three per cent jackfruit powder had significantly lower values for juiciness, texture, saltiness, mouth coating and overall acceptability when compared to other treatment and control samples. Prinyawiwatkul *et al*. (1997) reported comparable sensory scores for overall acceptability, texture and flavour of the treatment nuggets containing mixture of 2.5 per cent each of fermented cowpea and peanut flours and unfortified control chicken nuggets. Banerjee *et al*. (2012) noticed comparable scores for all the sensory attributes for functional chicken nuggets containing broccoli powder extract and control nuggets sample.

Conclusion

Result of the experiment indicated that, jackfruit powder at three per cent level imparted significant flour taste which had considerable adverse effect on the flavour, juiciness, texture and also overall acceptability. Among all the treatments, two per cent jackfruit powder incorporated cocktail nuggets had sensory scores that was comparable to one per cent jackfruit powder incorporated cocktail nuggets and control chicken nuggets samples. Thus, functional cocktail nuggets with high acceptability and nutritive value could be prepared by incorporating jackfruit powder up to two per cent in the formulation without affecting the sensory attributes. The incorporation of jackfruit powder which is endowed with numerous nutritional and health values, in the emulsion based poultry meat cocktail nuggets would definitely enrich the functional value of the product.

References

AMSA, 1983. Guidelines of sensory, physical and chemical measurements in ground beef. *Recip. Meat Conf. Proc.* **36***:221-228.*

AOAC, 2016. Meat and meat products. *Official methods of analysis of official analytical chemists*. (20th Ed.). AOAC, Rockville, International, Maryland, USA.

Banerjee, R., Verma, A.K., Das, A.K., Rajkumar, V., Shewalkar, A.A. and Narkhede, H.P. 2012. Antioxidant effects of broccoli powder extract in goat meat nuggets. *Meat Sci.* **91**(2):179-184.

Dzudie, T., Scher, J. and Hardy, J. 2002. Common bean flour as an extender in beef sausages. *J. Food Engng.* **52**(2):143-147.

Elgasim, E.A. and Al-Wesali, M.S. 2000. Water activity and Hunter colour values of beef patties extended with Samh (*Mesembryanthemum forsskalei Hochst*) flour. *Food Chem.***69** (2):181-185.

Kumar, V., Biswas, A.K., Sahoo, J., Chatli, M.K. and Devatkal, S.K. 2010. Quality evaluation of chicken nuggets formulated with green banana and soybean hulls flours. *Ind. J. Poult. Sci*. **45**(3): 330-335.

Prinyawiwatkul, W., McWatters, K.H., Beuchat, L.R. and Phillips, R.D.1997. Physicochemical and sensory properties of chicken nuggets extended with fermented cowpea and peanut flours. *J. Agric. Food Chem*. **45**(5):1891-1899.

Sathu, T. 2014. Development and evaluation of functional chicken nuggets. *Ph.D.*

Thesis, Kerala Veterinary and Animal Sciences University, Pookode. 159p.

Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods*. Eighth edition. The Iowa state university press, Ames, Iowa, USA.

Troutt, E.S., Hunt, M.C., Johnson, D.E., Claus, J.R., Kastner, C.L. and Kroff, D.H. 1992. Characteristics of low fat ground beef containing texture modifying ingredients. *J. Food Sci.* **57**(1): 19-24.

Verma, A.K., Banerjee, R. and Sharma, B.D., 2012. Quality of low fat chicken nuggets: effect of sodium chloride replacement and added chickpea (Cicer arietinum L.) hull flour. *Asian-Aust*. *J. Ani*. *Sci.* **25** (2): 291. ■