RESEARCH ARTICLE
Open Access

Journal of Veterinary and Animal Sciences
ISSN (Print): 0971-0701, (Online): 2582-0605
https://doi.org/10.51966/jvas.2023.54.4.898-906

Effect of different millet flours on the physico-chemical characteristics, proximate composition and sensory characteristics of enrobed chicken nuggets#

V.V. Akhila [1], T. Sathu [2], B. Sunil *[3], A. Irshad [4], R. Geetha [5], V.C. Hridhya [1], J.K. Anjitha [1] and M. Manasa [1]

Department of Livestock Products Technology
College of Veterinary and Animal Sciences, Mannuthy, Thrissur-680651
Kerala Veterinary and Animal Sciences University, Pookode, Wayanad
Kerala, India

Citation: Akhila, V.V., Sathu, T., Sunil, B., Irshad, A., Geetha, R., Hridhya, V.C., Anjitha, J.K. and Manasa, M. 2023. Effect of different millet flours on the physico-chemical characteristics, proximate composition and sensory characteristics of enrobed chicken nuggets.
J. Vet. Anim. Sci. **54**(4):898-906
DOI: https://doi.org/10.51966/jvas.2023.54.4.898-906

Received: 13.11.2023 *Accepted: 23.03.2023* *Published: 31.12.2023*

Abstract

A study was conducted to analyse the effect of different millet flours viz., finger millet flour, pearl millet flour and foxtail millet flour on physic-chemical characteristics, proximate composition and sensory characteristics of enrobed chicken nuggets. Refined wheat flour in the control nuggets was completely replaced by 3.5 per cent each finger millet flour in T_1, pearl millet flour in T_2 and foxtail millet flour in T_3 and the treatment nuggets were subjected to different stages of enrobing. Nuggets incorporated with millets had better nutritive value than control chicken nuggets. On the basis of physico-chemical characteristics, proximate composition and sensory analysis, T_2 enrobed chicken nuggets incorporated with 3.5 per cent pearl millet flour was found to be the best formulation.

Keywords: *Enrobed chicken nuggets, finger millet, pearl millet, foxtail millet*

#*Part of MVSc thesis submitted to Kerala Veterinary and Animal Sciences University, Pookode, Wayanad, Kerala*

1. *MVSc. Scholar*
2. *Associate professor*
3. *Professor and Head, Department of Veterinary Public Health, College of Veterinary and Animal Sciences, Mannuthy*
4. *Assistant professor*
5. *Associate Professor, Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy*

**Corresponding author: sathu@kvasu.ac.in, Ph.9447293042*

The value addition of meat using improved processing techniques, undoubtedly have a positive impact on the economy, consumer convenience and it provides employment opportunity. A larger variety of tasty and practical products are also becoming more popular with change in lifestyle of people. Nowadays there is increasing demand for ready-to-eat to ready-to-cook products and such products are called as 'convenience products' (Ann *et al.,* 2022) Customers generally are health conscious and are found to favour foods that fulfill their requirements for dietary fibre, antioxidants, vitamins and minerals. One such technique for value addition of meat products is enrobing. (Ahmed *et al.,* 2007) Enrobing/ edible coating is a process in which food materials are coated with edible coating materials in the form of batter and breading (Suderman, 1983). Coating by battering and breading enhances characteristics of food products such as appearance, flavour, crispiness and texture and also improves their shelf life. Enrobing of a product helps to retain its juiciness during frying and hence such products are more relished by consumers. It also acts as a barrier for gases, water vapour and to some extent to microbes, thus increasing the storage stability (Kondaiah, 2004).

Nuggets are emulsified or ground products made out of minced meat with salt, spices, curing ingredients and binders. Majority of processed meat products utilise refined wheat flour as a binder, which lacks dietary fibre, despite having a high binding value and is therefore undesirable amongst individuals who are concerned about their health. Replacement of refined wheat flour with some cereal flours will effectively increase the nutritional value such as increased dietary fibre content, protein etc. and also satisfy the needs of health conscious consumer community (Reddy *et al.,* 2017).

Millets are nutritious grains that are high in minerals, vital fatty acids, dietary fibre and protein. Epidemiological studies have reported that regular intake of whole grain cereals and their products can reduce the risk of cardiovascular diseases, type II diabetes, gastrointestinal cancers and a range of other disorders (McKeown *et al.,* 2002). Millets contribute to antioxidant activity with phytates, polyphenols and tannins present in it having an important role in aging and metabolic diseases (Bravo, 1998). Millet based foods can act as potential prebiotic and probiotics with certain health benefits. Millets are gluten free and can be effectively used to replace wheat flour or refined wheat flour in the diet of consumers allergic to gluten. In India millets are mainly utilised as feed for pet birds and the major reasons for the decrease in consumption are the lack of awareness of nutritional benefits, lack of processing technologies and inconveniences in food preparation(Saini *et al.,* 2021) The objective of this study was to develop and standardise enrobed chicken nuggets incorporated with different millet flours.

Materials and methods

The experiment was conducted to evaluate the quality attributes of enrobed chicken nuggets incorporated with different millets. The acceptable level of incorporation of refined flour (3.5 %) in control chicken nuggets was standardised after preliminary pilot studies. Refined flour in control chicken nuggets was completely replaced with millet powder *viz.,* finger millet- *ragi*, pearl millet-*bajra,* foxtail millet -Italian millet/*thina*

Preparation of enrobed chicken nuggets

The ingredients used for preparation of nuggets are enlisted in the table 1.The minced chicken meat was blended with curing ingredients. After blending, the mix was added with ice flakes and mixed in a planetary mixer (ITALYA Mixer, Model: VFM10A, India) until the mixture was homogenised completely. Pre chilled refined sunflower oil was added then and blended well until it was evenly dispersed. This was followed by the addition of binders which were blended well. The condiments and spice mix were added at last and mixed well until all the ingredients were uniformly dispersed. The batter was filled in a greased stainless-steel mould under hygienic conditions and covered with lid followed by steam cooking for one hour. After cooking chicken blocks were cooled at room temperature and then kept under refrigeration (4±1°C) for 12-15 hours, and later these blocks were sliced into nuggets. The nuggets were subjected to various stages

of enrobing (one and half pass) like pre-dusting with pre-dust mixture which comprised of corn flour (62.5 %) and spice mix (37.5 %) followed by battering and breading with ingredients as mentioned in tables 2 and 3, respectively. The following treatments were included in the trial.

C_1: Control enrobed chicken nugget (without incorporating millet)

T_1: C_1+ 3.5 % finger millet (without refined wheat flour)

T_2: C_1+3.5 % pearl millet (without refined wheat flour)

T_3: C_1+3.5 % foxtail millet (without refined wheat flour)

Table 1. Formulary for the preparation of control enrobed chicken nuggets

Ingredients in percentage	Control
Deboned chicken meat	68.8
Refined sunflower oil	10
Ice flakes	10
Refined flour	3.5
Condiments	2.5
Isolated soya protein	2
Spice mix	1.5
Salt	1
Sugar	0.3
Sodium tri polyphosphate	0.3
Gelatin	0.1

Table 2. Formulation of enrobing batter

Ingredients	Quantity (in percentage)
Potato flour	60
Refined wheat flour	15
Egg albumen	5
Corn flour	4
Isolated soya protein	4
Whole milk powder	4
Ice flakes	4
Condiments	2
Spice mix	1.5
Salt	0.5
Lukewarm water	100 mL

Table 3. Formulation for breading

Ingredients	Quantity (in percentage)
Bread crumbs	48.5
Crushed corn flakes	48.5
Turmeric powder	2
Dry mango powder	1

pH

The pH of the enrobed chicken nugget was determined using a digital pH meter according to AOAC (2016). Ten grams of sample was mixed with 50 mL distilled water and homogenised. The pH was measured by using the combined electrode digital pH meter (μ pH system 362, Systronics, India).

Cooking yield percentage

The weights of raw meat batter and cooked meat blocks were recorded. Cooking yield was expressed in percentage.

cooking yield = (weight of cooked meat block / weight of raw batter)*100

Dimension shrinkage

The dimension shrinkage was determined as per Ahmed *et al.* (2007). The length, breadth and height of enrobed nuggets before and after frying were recorded. Dimension shrinkage was expressed in percentage.

$$\text{Dimension shrinkage (\%)} = \frac{\text{(Raw enrobed nugget length - Fried enrobed nugget length) + (Raw enrobed nugget breadth - Fried enrobed nugget breadth) + (Raw enrobed nugget height - Fried enrobed nugget height)}}{\text{(Raw enrobed nugget length + Raw enrobed nugget breadth + Raw enrobed nugget height)}} \times 100$$

Coating/enrobing parameters

The coating parameters evaluated include coating / batter pickup, adhesion degree, frying loss and fat uptake.

Coating / batter pickup

The coating / batter pickup were measured by the method described by Hsia *et al*. (1992) and expressed in percentage.

$$\text{Coating / batter pickup (\%)} = \frac{\text{Weight of enrobed chicken nuggets} - \text{Weight of the chicken nuggets before enrobing}}{\text{Weight of the chicken nuggets before enrobing}} \times 100$$

Frying loss

The frying loss were measured by the method described by Hsia *et al*. (1992) and expressed in percentage.

$$\text{Frying loss (\%)} = \frac{\text{Weight of enrobed chicken nuggets before frying} - \text{Weight of enrobed chicken nuggets after frying}}{\text{Weight of enrobed chicken nuggets before frying}} \times 100$$

Proximate composition

Enrobed chicken nuggets were assessed for proximate composition *viz.,* moisture, protein and fat contents on the day of preparation as per AOAC (2016). The proximate principles were expressed as percentages. The experiments were replicated six times.

Moisture

Approximately 20 grams of sample were taken in a Petri dish and was kept in a hot air oven set at 100 ± 2 ^{0}C for 16 to 18 hours. The weight of the dried sample was taken after cooling in a desiccator. The difference in the weight before drying and after drying was the moisture content of the sample and it was expressed as percentage of the enrobed chicken nuggets.

$$\text{Moisture (\%)} = \frac{W2-W3}{W2-W1} \times 100$$

W1= Weight of empty dish

W2= Weight of dish +fresh sample

W3= Weight of dish + dried sample

Fat content

About two grams of moisture free samples were used for estimation of fat content. These samples were extracted with petroleum ether (boiling range 60 – 80 ^{0}C) using Soxhlet solvent extraction system (SOX plus, Model SCS 6, Pelican Equipments, Chennai) for a period of 1.5 hours. Ether extract obtained was dried to a constant weight at 100 ^{0}C, cooled and weighed. Fat content on dry matter basis was expressed as percentage of the enrobed chicken nuggets

$$\text{Fat (\%)} = \frac{W2 - W1}{W3} \times 100$$

W1= Weight of empty oil flask

W2= Weight of oil flask + fat

W3= Weight of sample taken

Protein content

As per AOAC (2016) copper catalyst Kjeldahl method was used for the determination of protein content of the sample. Analysis was carried out in Kel Plus nitrogen estimation system (Pelican Equipment's, India). The total nitrogen estimated was converted to per cent of protein by multiplying with the constant.

Protein per cent = Nitrogen (%) × 6.25

Total ash

Total mineral content of the sample was determined by its ash contents. As per AOAC (2016), two grams of the samples were placed in a porcelain crucible and kept in a muffle furnace at 600 ^{0}C for two hours. Then the sample was transferred to a desiccator, allowed to cool and weight was taken immediately. The resultant weight was the total mineral content of the sample.

Sensory evaluation

Sensory evaluations were carried out using semi-trained panel consisting of seven panellists drawn from the Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur using an eight point Hedonic score card (Biswas *et al.*, 2003). The enrobed chicken nuggets was analysed for appearance and colour, flavour, texture, juiciness, crispiness, oiliness and overall acceptability. Uniform samples of each category of enrobed chicken nuggets were taken and deep fried in oil fryer (Toastmaster model no. E-DZ-4L) at 170°C for 4- 5 minutes. Sensory analysis was done by semi-trained panellist using eight-point

Hedonic scale. Plain water was provided to rinse the mouth between the samples. The average individual scores was considered as score for a particular attribute.

Result and discussion

Physico-chemical properties

The effect of different millet flours on the physico-chemical characteristics of enrobed chicken nuggets is presented in table 4.

The pH of the control and treatment samples differed ($p< 0.05$) significantly. The highest value was for T_3 (6.20±0.01) and the lowest for T_2 (6.12±0.02). According to Para and Ganguly (2015) pH of the chicken nuggets incorporated with pearl millet flour differed significantly from the control and highest pH was noted for nuggets with higher per cent of incorporation. Reddy *et al.* (2017) observed that functional chevon sausages incorporated with different levels of foxtail millet flour had increased pH value in both raw and cooked sausages when compared to the control sample. The difference in the pH of treatment samples when compared to control might be due to the incorporation of millet flour into the nuggets.

The cooking yield percentage of the millet incorporated nuggets differed ($p< 0.05$) significantly. Significant difference was noted between C_1 and T_3 and there was no significant difference between T_1 and T_2. These results were not in accordance with the findings of Para and Ganguly (2015) where cooking yield of the pearl millet flour incorporated nuggets was higher with increase in the level of incorporation of millet flour. Adzitey *et al.* (2021) also reported that roasted pearl millet flour incorporated beef sausages showed decrease in their cooking loss as the per cent of inclusion of millet flour increased. However, Silpa *et al.* (2020) observed no significant difference between cooking yield of functional cocktail nuggets containing different levels of jackfruit powder and control nuggets samples.

Batter pickup is the increase in the weight of substrate due to coating of batter and breading. There was no significant difference in batter pickup percentage, even though the highest value was for control (48.51± 5.72) and the least for T_2 (44.62 ± 3.79). This might be due to the same composition of the enrobing batter used for different treatments. This result was not in accordance with the findings of Hauzoukim *et al.* (2019) where they studied the effect of three different batters containing different aquatic polymers for coating of fish products. Batter pickup was higher for the batter containing fish gelatin followed by chitosan and alginate and least for the control without any hydrocolloids.

Frying loss is the reduction in the weight of sample when it is subjected to deep fat frying. The value of frying loss percentage ranged from 5.23 to 5.72. No significant difference was found

Table 4. Effect of different millet flours on the physico-chemical characteristics of enrobed chicken nuggets

Parameters	C_1	T_1	T_2	T_3	F value (p-value)
pH	6.13±0.02 ^{ab}	6.18±0.02^{bc}	6.12±0.02 ^{a}	6.20±0.01 ^{c}	4.241 (0.014) *
Cooking yield (%) (nuggets)	94.15 ± 0.18 ^{a}	92.79±0.59 ^{bc}	93.12 ± 0.09 ^{ab}	91.81±0.29 ^{c}	7.659 (0.004)*
Batter pickup (%)	48.51± 0.72	46.52 ± 4.06	44.62 ± 3.79	46.62± 0.82	0.218 (0.882) ^{ns}
Frying loss (%)	5.72 ± 1.44	5.27 ± 0.63	5.23± 0.91	5.38 ± 0.59	0.058 (0.982) ^{ns}
Dimension shrinkage (%)	7.24±0.41	6.76±0.31	7.26±0.39	6.78±0.31	0.600 (0.617) ^{ns}

*significant at 0.05 level; ns – non- significant at 0.05 level
Means with same superscript have no significant difference between them
The values are expressed as their mean ± standard error
Number of observations = 8

between control and treatments. This might be due to the effect of same enrobing batter used for all treatments. However Xavier *et al.* (2017) observed that frying loss was significantly lower for enrobed fish sticks which contained chitosan in the enrobing batter when compared to that of control without any hydrocolloid in the enrobing batter.

Similarly, there was no significant difference between control enrobed nuggets and treatments for dimension shrinkage (%). This also might be due to the same enrobing batter used for coating all treatments. This was in accordance with the results of Ahmed *et al.,* (2007) where they found out that dimension shrinkage of the enrobed buffalo meat cutlet was significantly lower than non enrobed control cutlets.

Proximate composition

The proximate composition of the control enrobed chicken nuggets and the treatments with added millet flour has no significant difference regarding their proximate composition (Table 5).

The moisture percentage of the control and the treatment samples did not differ significantly. The value of moisture per cent ranged from 40.52 to 42.07 and the highest value was recorded for T_3 (42.07±0.49) and the lowest for T_2 (40.52 ±0.86). Lukman *et al.,* (2009) studied the proximate composition of commercial chicken nuggets and the moisture content was within the range of 40.83 to 56.51 per cent. Similarly, protein per cent did not differ between the control and the treatment samples. The highest observed value for protein per cent was 21.08 ± 2.02 (T_3) and the lowest was 19.56 ± 1.56 (control).

The higher protein content of millet incorporated nuggets might be due to the higher protein content of millet flours when compared to that of refined wheat flour. Among millet incorporated nuggets higher protein content of foxtail millet incorporated nuggets might be due to its higher protein content. Gopalan *et al.* (2004) reported that foxtail millet contained 12.3 g protein per 100 g whereas it was 10.96 g for pearl millet and 7.16 g for finger millet. This was in accordance with result of Pavan *et al.* (2019) who stated that finger millet incorporated nuggets had higher protein content when compared to arrowroot powder incorporated nuggets and control nuggets.

The fat per cent of control and the treatment samples did not differ significantly. The lowest value was noted for T_3 followed by control and T_1 and the highest value was recorded for T_2. This might be due to the higher fat content of pearl millet. Gopalan *et al.* (2004) reported that pearl millet contained 5.43 g fat per 100 g whereas foxtail millet contained 4.3 g and finger millet had 1.92 g. Significant decrease in fat and protein percentages of chicken nuggets supplemented with green gram paste by replacement of meat was reported by Reddy *et al.* (2022).

The total ash per cent was lower for the control when compared to the treatments and among treatments the value was higher for T_2. The higher total ash per cent of treatment samples

Table 5. Effect of different millet flours on the proximate composition of enrobed chicken nuggets

Treatment	C_1	T_1	T_2	T_3	F value (p-value)
Moisture (%)	41.73 ± 0.54	40.64 ± 0.22	40.52 ± 0.86	42.07 ± 0.49	1.77 (0.175) ^{ns}
Protein (%)	19.56 ± 1.56	20.29 ± 1.11	20.10 ± 0.82	21.08 ± 2.02	0.187 (0.904) ^{ns}
Fat (%)	17.67± 0.62	18.24 ± 0.39	18.28 ± 0.87	16.91 ± 0.67	0.946 (0.432) ^{ns}
Total ash (%)	1.75±0.08	2.06±0.13	2.10±0.13	1.76±0.07	3.408 (0.074) ^{ns}

ns – non- significant at 0.05 level

Means with same superscript have no significant difference between them

The values are expressed as their mean ± standard error

Number of observations = 8

Table 6. Effect of different millet flours on the sensory attributes of enrobed chicken nuggets

Sensory attributes	C_1	T_1	T_2	T_3	Chi- square value (p-value)
Appearance and colour	7.01 ± 0.08	6.96 ± 0.08	7.09 ± 0.59	7.02 ± 0.07	2.581 (0.461) ^{ns}
Flavour	6.85± 0.10	6.95 ± 0.10	6.99 ± 0.09	6.76 ± 0.09	4.962 (0.175) ^{ns}
Texture	6.88 ± 0.09	6.91 ± 0.09	7.00 ± 0.07	6.84 ± 0.09	2.404 (0.493) ^{ns}
Crispiness	6.88 ± 0.125	6.98 ± 0.11	6.95 ± 0.09	6.95 ± 0.11	0.460 (0.928) ^{ns}
After taste	6.92 ± 0.08	6.87 ± 0.09	6.93 ± 0.08	6.85 ± 0.06	0.474 (0.925) ^{ns}
Overall acceptability	6.88 ± 0.09 ^{a}	7.08 ± 0.08 ^{ab}	7.16 ± 0.10 ^{b}	6.91 ± 0.06 ^{ab}	8.679 (0.034)*

*significant at 0.05 level; ns – non- significant at 0.05 level

Means with same superscript have no significant difference between them

The values are expressed as their mean ± standard error

Number of observations = 36

might be the reflection of mineral content of the millet flour incorporated in nuggets. Reddy *et al.* (2017) stated that total ash per cent of functional chevon sausages incorporated with foxtail millet flour was higher when compared to control and the value increased with increase in the level of incorporation of millet flour.

Sensory attributes

The sensory parameters for analysing the effect of incorporation of different millet flour in enrobed chicken nuggets includes appearance and colour, flavour texture, crispiness, oiliness and overall acceptability. The scores of the sensory evaluation were compiled and given in the table 6.

All the sensory attributes scores except overall acceptability for control and the treatment did not differ significantly. Overall acceptability scores differed significantly ($p<0.05$) among the control and the treatments. The highest score was noted for T_2 (7.16 ± 0.10) and the lowest for the control (6.88 ± 0.09). There was no significant difference observed between the treatment samples. Control and T_2 differ significantly from each other but there was no significant difference between the other two treatments and control.

According to Brasil *et al.* (2015) *kibbeh* incorporated with roasted pearl millet flour had better sensory qualities. Reddy *et al.* (2017) stated that foxtail millet flour might be effectively used at a level of 6 per cent in functional chevon sausages, which improved the physical and proximate parameters as well as better sensory ratings. The result was not similar to the results of Pavan *et al.* (2019). They found that finger millet incorporated nuggets had no significant difference for sensory parameters when compared to that of control samples.

Conclusion

From the present study it can be concluded that millet flours can successfully replace refined wheat flour in chicken nuggets without affecting sensory attributes. Incorporation of the millet flour in to the nuggets had increased the nutritive content of the nuggets. Among the three millet flours used pearl millet flour incorporated nuggets had better sensory acceptability than finger millet flour and foxtail millet flour incorporated nuggets.

Acknowledgement

The authors are grateful to Kerala Veterinary and Animal Sciences University for providing the research facilities to complete the study.

Conflict of interest

The authors declare that they have no conflict of interest.

References

Adzitey, F.,Yaro, J., Korese, J.K., Jeinie, M. H. and Huda, N. 2021. Effect of raw pearl millet flour inclusion on the quality and formulation cost of beef sausages. *Slovak J. Food Sci.* **15**:1039-1048

Ahmed, M. E., Anjaneyulu, A.S.R., Sathu, T., Thomas. R. and Kondaiah, N. 2007. Effect of enrobing on the quality and shelf life of buffalo meat cutlets under frozen storage. *J. Muscle Foods* **18**: 19-34.

Ann T. J., Sathu, T., Sunil, B. Vasudevan, V. N. and Uma, R. 2022. Effect of different levels of mayonnaise on the physicochemical and sensory attributes of chicken meat spread. *J. Vet. Anim. Sci.* **53**: 458-463.

AOAC [Association of Official Analytical Chemists]. 2016. Meat and meat products. In: Latimer, G.W. (ed.), *Official Methods of Analysis of Analytical Chemists*, *Vol*. *II*. (20th Ed.). Association of Official Analytical Chemists Inc., Rockville, International, Maryland, 3172p

Biswas, A. K. and Keshri, R. C. 2003. Incorporation of Bengal gram flour in development of enrobed pork patties. *J. Vet. Public Health*, **1**: 75-80.

Brasil, T.A., Capitani, C.D., Takeuchi, K.P. and Ferreira, T.A.P.D.C. 2015. Physical, chemical and sensory properties of gluten-free kibbeh formulated with millet flour (Pennisetum glaucum). *Food Sci. Technol*. **35**: 361-367.

Bravo, L.1998. Polyphenols: chemistry, dietary sources, metabolism and nutritional significance. *Nutr. Rev.* **56**: 317–333.

Gopalan, C., Ramashastri, B.V. and Balasubramanium, S.C.2004. Nutritive value of Indian foods Hyderabad: National Institute of Nutrition (NIN), Indian Council of Medical Research. pp 59-67.

Hauzoukim, Xavier, K.A.M. Kannuchamy, N., Balange, A. and Gudipati, V. 2019. Development of enrobed fish products: improvement of functionality of coated materials by added aquatic polymers. *J. Food Process Eng.* **142**: e12999.

Hsia, H. Y., Smith, D. M. and Steffe, J. F. 1992. Rheological properties and adhesion characteristics of flour-based batters for chicken nuggets as affected by three hydrocolloids. *J. Food Sci*. **57**: 16-18.

Kondaiah, N. 2004. Value added meat products and development of processed meat sector. *Nat. Prod. Radiance,* **3**: 281-283.

Lukman, I., Huda, N. and Ismail, N. 2009. Physicochemical and sensory properties of commercial chicken nuggets. *Asian J. Food Agro- Ind.* **2**: 171-180.

McKeown, N.M., Meigs, J.B., Liu. S., Wilson, P.W. and Jacques, P.F. 2002. Whole-grain intake is favourably associated with metabolic risk factors for type 2 diabetes and cardiovascular disease in the Framingham offspring study. *Am. J. Clin. Nutr.* **76**: 390-398.

Para, P.A. and Ganguly, S. 2015.Effect of bajra flour (Pearl millet) on some quality and sensory attributes of chicken nuggets. *Asian J. Anim Sci.* **10**:107-111.

Pavan, M., Kuriyan, Y., Nayar, R., Rajgopal, K., Sathu, T. and Sunanda, C. 2019. Development and Quality Evaluation of Chicken Nuggets Incorporated with Finger Millet (*Eleusine coracana*). *Int. J. Livest. Res.* **9**: 116-126.

Reddy, G.V., Mallika, E.N., Reddy, B.O., Veena, D. and Naik, A.S., 2017. Effect of foxtail millet flour on quality and storage stability of functional chevon sausages. *Indian J. of Small Rumin.* **23**: 61-67.

Reddy, T.J., Rao, B.E., Mallika, E.N. and Subhashini, N. 2022. Physico-chemical and sensory properties of chicken nuggets supplemented with green gram

paste at varied levels. *J. Pharna Innov.* **11**: 1043-1046.

Saini, S., Saxena, S., Samtiya, M., Puniya, M. and Dhewa, T. 2021. Potential of underutilized millets as Nutri-cereal: An overview. *J. Food Sci. Technol.* **58**:4465-4477.

Suderman, D.R. 1983. Use of batters and breadings on food products: A review. Batter and breading, Westport: Avi Publishing Company,P.2.

Silpa, S., Sathu, T., Sunanda, C., Pavan, M., Vasudevan, V.N., Irshad, A., and Kiran, K.S. 2020. Effect of jackfruit powder on the physicochemical and sensory attributes of poultry meat cocktail nuggets. *J. Vet. Anim. Sci.* **51**: 108 – 114.

Xavier, K.A.M, Kannuchamy, N., Balange A.K, Chouksey, M.K, Gudipati, V. 2017. Functionality of chitosan in batter formulations for coating of fish sticks: effect on physicochemical quality. *Carbohydr. Polym.***169**:433–440. ■