Haryana Vet. (December, 2022) **61(2),** 169-172

Research Article

ASSESSMENT OF MICROWAVE PROCESSED READY-TO-EAT MEAT SNACKS

SOMESH KUMAR MESHRAM*, SANJOD KUMAR MENDIRATTA, PRANAV CHAUHAN, DEEPALI SAKUNDE, SERLENE TOMAR and BALESHWARI DIXIT
Department of Livestock Products Technology, IVRI, Izatnagar, Bareilly, Uttar Pradesh
*Department of Livestock Products Technology, College of Veterinary Science & A.H., Rewa, Madhya Pradesh

Received: 13.01.2022; Accepted: 27.10.2022

ABSTRACT

Microwave processing of food is popular due to their ease of handling, high heating rate and reduction of heating time. Meat improves protein quality and microwaving instead of frying reduces fat percent in snacks. The present work was conducted to study the application of microwave processing for development of low fat ready-to-eat meat based snack from meat of different species like chicken, chevon, mutton and pork. On the basis of sensory scores, chicken, chevon, mutton and pork based snacks were prepared for detailed studies on physicochemical characteristics and proximate composition. Amongst studied meat, mutton had significantly ($P<0.05$) higher values for product yield and pH, pork had significantly ($P<0.01$) higher value for expansion percent and chicken had significantly ($P<0.01$) lower value for water activity. Chicken based snacks had comparatively lower values for redness, yellowness and chroma values. Mutton was found to be most suitable for preparation of microwaved ready to eat snacks.

Keywords: Meat based snacks, Microwave processing, Physico-chemical characteristics

How to cite: Meshram, S.K., Mendiratta, S.K., Chauhan, P., Sakunde, D., Tomar, S. and Dixit, B. (2022). Assessment of microwave processed ready-to-eat meat snacks. *Haryana Vet.* **61(2)**: 169-172.

Most of the snacks available in the market are mainly based of cereals which are high in calorie and low in protein contents. Therefore, the incorporation of meat in these snacks is a good alteration because it has several key nutritional factors, like proteins with high biological value, trace elements and vitamins (Pighin *et al.*, 2016). Currently consumer focus on nutritional values of the product including low fat, low calories, high vitamins and high proteins and has worked in goodwill of the market (Market research report, 2019). There is a huge potential to develop the snacks food market in India into a thriving industry due to changing life-style, increasing number of young people and economic up-liftment.

The processing of meat into different ready-to eat value added products is also increasing due to urbanization and the growth of fast food sector (Singh *et al.*, 2013). Majority of snacks available in the market are based on refined wheat flour, which is inadequate in quantity as well as quality proteins. Lack of high quality proteins is one of the most common causes of nutritional deficiencies (Berwal *et al.*, 2013). In the present study, solemn efforts were made to develop low fat, palatable, nutritious and shelf stable ready-to-eat snacks incorporating meat from different species *viz*., chicken, sheep, goat and pig through process of microwave heating.

MATERIALS AND METHODS

Source of raw materials

Spent animal meat: Meats of different species *viz*., chicken, sheep, goat, pig and buffalo were obtained from experimental abattoir of Livestock Products Technology Division, IVRI or Central Avian Research Institute (CARI) or from local market of Bareilly.

*Corresponding author: drsomeshkm@gmail.com

Preparation of ready-to-eat meat based snacks

Analytical Procedures

Sensory evaluation of meat based snacks: Sensory evaluation of meat based snacks was conducted by 14 sensory panelists using an eight point scale (Keeton, 1983) with slight modifications, where 8 = excellent and 1 = extremely poor.

Physico-chemical Analysis:

1. $\text{Product yield (\%)} = \frac{\text{Weight of the dried snacks}}{\text{Weight of the batter}} \times 100$

2. $\text{Expansion percentage} = \frac{\text{Area of the snack chip after microwaving}}{\text{Area of the snack chip before microwaving}} \times 100$

3. pH: The pH of the meat based snacks was determined by using the method described by Strange *et al.*, (1977).
4. Water activity: Water activity was measured with the help of a water activity meter (Hygrolab 3, Rotronics, Switzerland).
5. Bulk density: The snack density was obtained by dividing the mass of the sample by the final volume (Bhattacharya *et al.*, 1986).
6. Colour: The colour of the meat based snacks was measured using a Lovibond Tintometer (Model F, Greenwich, UK).

Proximate composition:

Moisture, crude fat, protein and ash contents of meat

based snacks were determined by procedures prescribed by Association of Official Analytical Chemists (AOAC, 1995).

Statistical analysis:

The data generated from various trials under experiment were analyzed by statistical method of one way-ANOVA and Mean±S.E as per the procedure of Snedecor and Cochran (1995) using IBM SPSS Statistics software (Version 22.0 for Windows; IBM SPSS Inc, Chicago, 111, USA) and the significant differences ($P<0.05$) in the means were compared (Duncan, 1955).

RESULTS AND DISCUSSION

Sensory evaluation:

Mean ± SE values for the scores of the sensory attributes are presented with spider graph in figure 1. Among different treatments snacks prepared from mutton had higher scores whereas control had the lower scores for most of the sensory attributes. Scores for flavour were almost similar for all species but differ significantly from control which indicate, that addition of meat had significant ($P<0.01$) desirable effect on the flavour. Species had no significant ($P>0.05$) effect on the texture/crispness scores of meat snacks. This might be due to the fact that texture/crispness of snacks is affected by the gelatinization of starch mixed with meat and not by the compositions of meat of different species.

Mutton based snacks had significantly higher overall acceptability scores which may be due to significantly ($P<0.01$) higher flavor scores. Singh et al. (2002) as well as Sharma and Nanda (2002) also reported comparable values of meat flavour intensity and overall acceptability in extruded microwave dried and deep fat fried chicken snacks and chips, respectively. On the basis of sensory scores chicken, chevon, mutton and pork based snacks were selected for further detailed studies.

Physico-chemical quality

Physico-chemical characteristics of microwave processed ready-to-eat snacks prepared from meat of selected species *viz*., chicken, sheep, goat and pig are presented in Table 3.

The yield percentage was significantly ($P<0.05$) higher for mutton and chicken than chevon and pork based snacks. This might probably be due to lower moisture loss from the product during drying process or high water holding capacity of mutton based snacks.

Meat of different species had significant effect on the expansion percentage of snacks. The expansion percentage was in the ranges of 179.05 to 258.42 and significantly ($P<0.01$) higher for pork and mutton as compared to chevon and chicken based snacks. Expansion ratio ranges from 560 to 660 of expanded Snack product made from pumpkin flour-corn grits was observed by Nor *et al.* (2013). This might be due to presence of muscle protein and their interaction with starch during development of product.

There was significant ($P<0.05$) difference in pH among different formulations. Thus meat of different species had significant effect on pH of snacks. Mutton had highest value (6.49±0.03) whereas chicken had the lowest value (6.29±0.06) for pH. Alamin (2019) also reported higher value of pH in sheep meat than cattle meat, camel meat and Goat meat.

Water activity (aw) is directly responsible for microbiological safety of the foods (Gibbs and Gekas, 2010). Water activity was significantly ($P<0.01$) lower for snacks of chicken as compared to chevon, mutton and pork. Values of aw ranged from 0.245±0.003 for chicken to 0.273±0.003 for pork. Water activity was below 0.3 in all snacks prepared from different species, which represents a microbiologically stable product. Similar finding of aw below 0.4 in snacks was observed by Reyes-Jaquez *et al.* (2012). Snacks prepared from different species had low water activity due to processing methods like drying, cooking and microwaving. Addition of salt and sugar which were also act as humectants reduces aw of snacks.

Meat of different species had significant ($P<0.05$) effect on the bulk density of snacks. Snacks prepared from chevon had highest value whereas pork snacks had the lowest for bulk density. Values for bulk density of snacks ranged from 0.69 to 0.75 g/100 ml whereas Nor *et al.* (2013) reported bulk density ranged from 53.7 to 134.7 kg/L in expanded Snack product made from pumpkin flour-corn grits. Bulk density was inversely correlated to expansion percentage. Similar behaviour was reported by Ascheri *et al.* (1995). Aguilar-Palazuelos *et al.* (2012), who found that apparent density was inversely related to expansion index for snacks.

In colour profile analysis, there was significant ($P<0.05$) difference in yellowness and chroma among different treatments. Chicken snacks had insignificantly lower value of redness, which could be due to low myoglobin content of chicken meat as compared to other species. The yellowness, chroma and hue were comparatively higher for pork and mutton as compared to chicken and chevon. Colour parameters of meat based snacks from different species were shown in table 4.

Proximate composition:

There was no significant ($P>0.05$) effect of different species of meat on proximate composition of developed

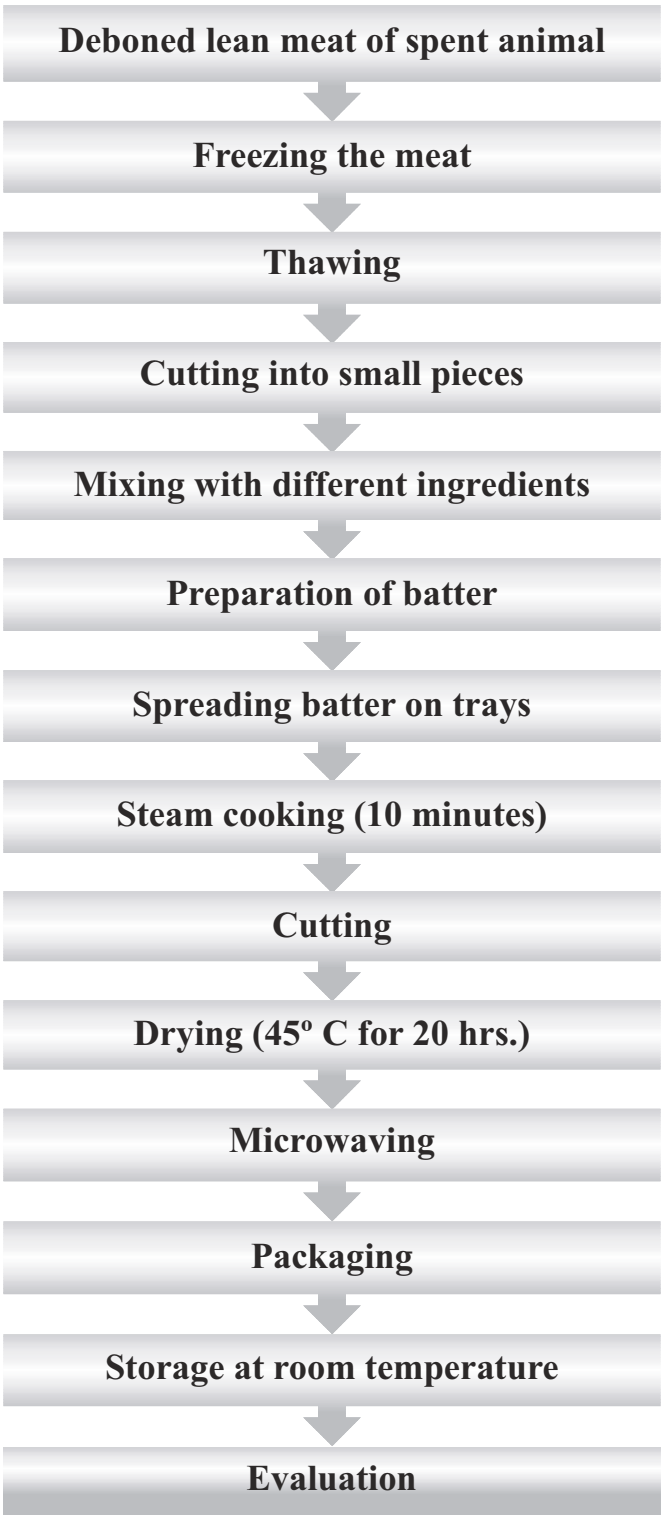

Fig. 1. Flowchart of preparation of microwave processed ready to eat meat snacks; Mean with different superscripts (column wise) differ significantly (P<0.05)

snacks. Proximate parameters of meat based snacks from different species were shown in table 5. FAO recommends that non-fried snacks should contain at least 12% crude protein (FAO, 2001). The developed snacks of the present study had not only protein content above the recommended value but also had good quality animal protein. Fat content was low due to microwave processing instead of frying.

Table 1. Formulations of control and treatments for microwaved ready-to-eat snacks.

Treatment No.	Type of Meat	% of meat	Sago flour	Corn flour	Starch
Control	-	-	70%	20%	10%
Treatment 1	Chicken	50%	35%	10%	5%
Treatment 2	Chevon	50%	35%	10%	5%
Treatment 3	Mutton	50%	35%	10%	5%
Treatment 4	Buffalo meat	50%	35%	10%	5%
Treatment 5	Pork	50%	35%	10%	5%

Table 2. Condiments, spices and additives added in each formulation (w/w)

Ingredient	Percentage (%)
Salt	2.0
Chat masala	1.5
Meat masala	1.0
Sugar	1.0
Garlic paste	0.5
Turmeric	0.5
Black pepper powder	0.5
Red chilli powder	0.3
MSG (Monosodium Glutamate)	0.25

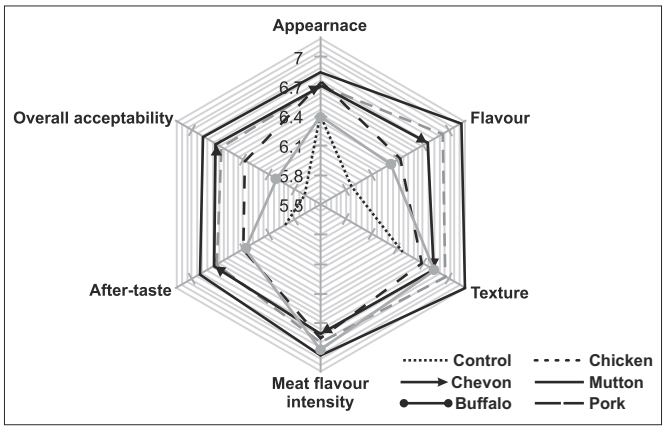

Fig. 2. Sensory scores of shelf stable microwaved ready-to-eat snacks prepared from meat of different species *viz*., chicken, sheep, goat, pig and buffalo (Total number of panelist were 20). (n=21)

CONCLUSION

Incorporation of meat significantly improved sensory qualities of snacks. Snacks containing chicken, chevon, mutton and pork had higher scores for sensory parameters than buffalo meat and control. Water activity of ready-to-eat snacks prepared from chicken, chevon, mutton and pork ranged from 0.245±0.003 to 0.273±0.003 and this was well under the limit of dried (0.00 to 0.60) and shelf stable product. Mutton incorporated microwaved snacks showed better physico-chemical characteristics

Table 3. Physico-chemical characteristics of shelf stable microwaved ready-to-eat snacks prepared from meat of different species *viz*., chicken, sheep, goat and pig (n=6)

Species	Product yield %	Expansion %	pH	Water activity	Bulk density (mg/100ml)
Chicken	23.38±0.38^{a}	191.52±7.41^{c}	6.29±0.06^{c}	0.245±0.003^{b}	0.71±0.008^{b}
Chevon	21.47±0.69^{b}	179.05±4.36^{c}	6.46±0.01^{ab}	0.266±0.003^{a}	0.75±0.009^{a}
Mutton	23.65±0.26^{a}	220.28±8.12^{b}	6.49±0.03^{a}	0.270±0.003^{a}	0.70±0.008^{b}
Pork	21.76±0.06^{b}	258.42±7.58^{a}	6.37±0.03^{bc}	0.273±0.003^{a}	0.69±0.006^{b}

Mean with different superscripts (column wise) differ significantly (P<0.05)

Table 4. Colour parameters of shelf stable microwaved ready-to-eat snacks prepared from meat of different species *viz*., chicken, sheep, goat, and pig (n=6)

Species	Colour			
	Redness	Yellowness	Chroma	Hue
Chicken	2.20±0.18	3.91±0.29^{b}	4.50±0.29^{b}	60.56±2.26^{ab}
Chevon	2.46±0.08	3.96±0.45^{b}	4.70±0.40^{b}	56.84±3.34^{b}
Mutton	2.43±0.07	5.08±0.30^{a}	5.64±0.26^{a}	64.05±1.73^{a}
Pork	2.41±0.09	5.35±0.26^{a}	5.88±0.23^{a}	65.47±1.55^{a}

Mean with different superscripts (column wise) differ significantly (P<0.05)

than chicken, chevon and pork incorporated microwaved snacks. Thus technology of microwave processing could be effectively utilized for preparation mutton based snack which ensure effective utilization of tough, low value meat from adult animals.

ACKNOWLEDGEMENT

The financial support provided by ICAR- IVRI Izatnagar, Bareilly was duly acknowledged.

REFERENCES

Aguilar-Palazuelos, E., Zazueta-Morales, J., Harumi, E.N. and Martínez-Busto, F. (2012). Optimization of extrusion process for production of nutritious pellets. *Food Sci. Technol.* **32**: 34-42.

Alamin, S. A. (2019). Study of pH value in longissimus dorsi muscle of cattle meat, camel meat, sheep meat and goat meat in Khartoum State. *Sumerianz J. Biotechnol.* **2(2)**: 11-15.

Ascheri, J.L.R., Ciacco, C.F., Riaz, N.M. and Lusas, E.W. (1995). Effect of the formulation on the expansion and viscosity of "snacks" (pellets) produced by thermoplastic extrusion. *Alimentaria.* **33**: 111-117.

AOAC. (1995). Official methods of analysis. (16th Edn.), Assoc. of Official Analytical Chemists. Virginia, USA.

Berwal, R.K., Khanna, N. and Berwal, R. (2013). Storage quality of chicken meat mince incorporated cookies under aerobic packaging at ambient temperature. *J. Food Sci. Technol.* **1**: 28-34.

Berwal, R.K., Khanna, N. and Garg, S.R. (2013). Shelf stability of convenience and ready to eat chicken meat mince incorporated cookies. *Haryana Vet.* **52**: 82-87.

Bhattacharya, M., Hanna, M.A. and Kaufman, R.E. (1986). Textural properties of extruded plant protein blend. *J. Food Sci.* **51**: 988-993.

FAO. (2001). Food and Agriculture Organization of the United Nations, Rome. Codex Stan 222: Standard for Marine and Freshwater Fish Crackers and Crustacean and Molluscan Shellfish.

Gibbs, P. and Gekas, V. (2010). Water activity and microbiological aspects of foods a knowledge base. Leatherhead Food Research Association, Leatherhead, UK, pp. 1-6.

Keeton, J.T. (1983). Effect of fat and NaCl/phosphate levels on the chemical and sensory properties of pork patties. *J. Food Sci.* **48**: 878-881.

Market research report, (2019). Healthy snacks market size, share & trends analysis report by product (dried fruit, cereal & granola bars, nuts & seeds, meat, trail mix), by region, vendor landscape, and segment forecasts, 2019 - 2025.

Nor, N.M., Carr, A., Hardacre, A. and Brennan, C.S. (2013). The development of expanded snack product made from pumpkin flour-corn grits: effect of extrusion conditions and formulations on physical characteristics and microstructure. *Foods.* **2**: 160-169.

Pighin, D., Pazos, A., Chamorro, V., Paschetta, F., Cunzolo, S., Godoy, F. and Grigioni, G. (2016). A contribution of beef to human health: A review of the role of the animal production systems. *Sci. World J.* 10.1155/2016/8681491.

Reyes-Jaquez, D., Casillas, F., Flores, N., Andrade-Gonzalez, I., Solis-Soto, A., Medrano-Roldan, H., Carrete, F. and Delgado, E. (2012). The effect of glandless cottonseed meal content and process parameters on the functional properties of snacks during extrusion cooking. *Food Nutr. Sci.* **3**: 1716-1725.

Singh, P., Sahoo, J., Chatli, M.K. and Biswas, A.K. (2013). Effect of different levels of baking powder on the physico-chemical and sensory attributes of chicken meat caruncles. *Haryana Vet.* **52**: 17-21.

Singh, V.P., Sanyal, M.K. and Dubey, P.C. (2002). Quality of chicken snack containing broiler spent hen meat, rice flour and sodium caseinate. *J. Food Sci. Technol.* **39**: 442-444.

Snedecor, G.W. and Cochran, W.G. (1995). Statistical methods, (8th Edn.), IOWA State University Press, Ames, IOWA.

Strange, E.D., Benedit, R.C., Smith, J.L. and Swift, C.E. (1977). Evaluation of rapid test for monitoring alterations in meat quality during storage. *J. Food Prot.* **40**: 843-847.

Table 5. Proximate parameters of shelf stable microwaved ready-to-eat snacks prepared from meat of different species *viz*., chicken, sheep, goat, and pig (n=6)

Species	Moisture	Protein	Fat	Ash
Chicken	5.24±0.25	13.49±0.23	1.23±0.28	4.44±0.25
Chevon	5.09±0.15	12.94±0.34	1.04±0.14	5.04±0.37
Mutton	4.69±0.39	13.85±0.23	0.73±0.21	4.90±0.33
Pork	5.28±0.24	13.31±0.34	0.92±0.11	4.84±0.24