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EFFECT OF OAT FLOUR ON PHYSCICO-CHEMICAL CHARACTERISTICS OF MUTTON NUGGETS

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Abstract: Repeated trials were conducted for incorporating the oat flour at right percentage in the mutton nuggets and its effect on physico-chemical and organoleptic qualities of mutton nuggets were evaluated. Mutton nuggets were prepared with 3%, 6% and 9% with oat flour to select an optimum desirable level. Among different treatments, oat flour at 9% produced significantly ($p<0.05$) higher cooking yield, emulsion stability, water holding capacity, penetration values and better organoleptic traits than the rest of the formulations. The proximate analysis of the product with 9% oat flour was superior in terms of moisture and fibre and recorded low fat than rest of the formulations. Hence incorporation of oat flour at 9 percent level was considered to be optimum with all the desired qualities in mutton nuggets.
Keywords: Mutton nuggets, Oat flour, value addition, Physico-chemical properties and sensory evaluation.

Introduction

Cereals have been considered as functional foods as they are rich in dietary fiber, protein, energy, minerals, vitamins, and antioxidants required for human health. Due to change in socio economic lifestyle and urbanization, everyone is aware about the risk associated with food and demanding foods with health promoting properties like high-fiber and low-fat meat products which place a greater attention in meat industry for health aspect. Though mutton has more intra muscular fat and least fiber content, it has more demand in the Indian market due to its high biological protein, vitamins and minerals. Daily intake of dietary fiber is essential for human health. Fortifying mutton which is low in fiber content with fiber rich foods like cereals will enhance the quality of mutton. Hence, the objective of present study was to optimize the inclusion of oat flour which is rich in dietary fiber, at different levels to fortify the mutton nuggets rich in fiber.

Materials and methods

Six trials were conducted initially to know the optimum levels of inclusion of oat flour. After desired levels were identified, six batches of mutton nuggets incorporated with

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three levels viz., 3, 6 and 9 percentages were subjected to quality analysis *i.e.* physico-chemical characteristics viz., cooking loss, emulsion stability, water holding capacity, hardness, proximate analysis and organoleptic evaluation.

Cooking loss was estimated by recording difference between the pre and post cooking weight of mutton nuggets and is expressed in percentage. Emulsion stability, Water holding capacity, Hardness of the product were determined as per the procedures of Townsend *et al*., (1968), Weirbicki *et al.,* (1962) and Dixon and Parekh (1979) respectively. Sensory evaluation of the product was carried out on a 9 point hedonic scale by a semi trained five members taste panel. The proximate analysis was conducted as per the procedures outlined by AOAC (1994). The data obtained in the present study were analyzed statistically as per the methods outlined by Snedecor and Cochran (1994).

Results and Discussion

The effect of incorporation of different levels of oat flour on various physico-chemical and organoleptic properties of mutton nuggets were presented in Table 1.

Cooking loss

Mutton nuggets at 9% oat flour showed significantly ($P<0.05$) lower cooking loss than the at 3% and 6 % which might be due to water binding capacity of the added flour that absorbs moisture from the emulsion lowering the loss of moisture during cooking (Reddy and Rao, 1996 and Serdaroglu 2006). The results of the present study were in accordance with reports of Dawkins *et al*., (1999) in chevon patties, Modi *et al.,* (2008) in cooked and fried meat kofta, Alvarez and Barbut (2013) in cooked meat batters and Santhi and Kalaikanna (2014) in low fat chicken nuggets.

Emulsion Stability

Mutton nuggets extended with 9% oat flour recorded significantly ($P<0.05$) higher emulsion stability as compared to other two formulations which might be due to high functional properties of added flour to hold the moisture in the emulsion. The results obtained in the study are in agreement with the reports of Hughes *et al.,* (1997) in frankfurters using oat fibre and Govind *et al*., (2013) in emu meat sausages prepared with oat flour.

Water-holding Capacity

Mutton nuggets at 9% oat flour has significantly ($P<0.05$) higher water-holding capacity than at 3% and 6% which might be due to the fact that higher level of flour retains more water, thereby increasing the water-holding capacity (Reddy *et al*., 1999) and also due to the formation of more stable meat-protein-matrix which leads to a smaller release of water

thus improving binding properties. The results obtained in the study are similar with findings of Hughes *et al.,* (1997) in frankfurters, Yang *et al.,* (2007) in low fat sausages, Modi *et al.,* (2008) in meat kofta and Govind *et al*., (2013) in emu meat sausages.

Hardness

The penetration value was significantly (P<0.05) higher in mutton nuggets extended with 9% oat flour which was due to fact that flour at 9% retains more water thus increasing the penetration value (Reddy *et al*., 1999). More water binding sites become available to dissociated protein subunits upon heat treatment. The results obtained were on par with studies of Yang *et al.,* (2007, 2009) in pork and duck meat sausages respectively, Modi *et al.,* (2008, 2009) in chicken and mutton kofta respectively.

Sensory Evaluation

No significant (P>0.05) effect was brought about on the colour scores of mutton nuggets by incorporating oat flour at various levels. Similar findings were noted by Hughes *et al*., (1997) in frankfurters and Serdaroglu and Degirmencioglu (2004) in Turkish beef meat sausages whereas flavor, juiciness and tenderness scores were significantly (P<0.05) higher for mutton nuggets at 9% oat flour. These results are in agreement with that of Garcia *et al.,* (2002) in ground beef and low fat dry fermented sausages, Sedaroglu (2006) in beef patties, Yang *et al.,* (2007, 2009) in pork and duck meat sausages respectively, Pinero *et al*., (2008) in low-fat beef patties, Modi *et al.,* (2008, 2009) in chicken and mutton kofta and Santhi and Kalaikannan (2014) in low fat chicken nuggets. Addition of oat flour might have incorporated the flavour precursors like alcohols and esters during cooking which have appreciable odour and taste. Mutton nuggets with 9% oat flour increases moisture retention during cooking than the other treatments which enhances juiciness to product. The higher tenderness in the product is because of breakage of intra and inter molecular cross linkages between the polypeptide chains of collagen during mincing of meat. Higher significant difference between different combinations of oat flour in the product for various parameters like flavour, juiciness and tenderness have influenced the panelists to rate high for the product and increases the overall acceptability of mutton nuggets at 9% level.

Proximate analysis of the mutton nuggets

Among different treatments mutton nuggets prepared with oat flour at 9 per cent level had significantly (P<0.05) higher moisture % and crude fiber % whereas Crude Protein % and crude fat % were significantly (P<0.05) lower at 9% than the remaining treatments and control. The higher moisture % in the obtained in the product was due to water binding

properties of added flour which retains more moisture during cooking. Higher percentage of crude fiber was obtained in the present study which might be due to higher concentration of insoluble fiber in oats than in meat (Huang *et al*., 2011) in sausages prepared with wheat, oat fibers and inulin) whereas the lower percentage of crude protein and crude fat in the product were due to lower moisture losses during processing at higher concentration of oat flour. Kerr *et al.,* (2005) observed a decrease in crude protein and fat levels with increase in the levels of oat flour which may be attributed to the contribution of carbohydrates from oat flour where the protein and fat content of oats is lower than that of meat. The results obtained in the present investigation were similar with findings of Yang *et al.,* (2007, 2009) in pork and duck meat sausages respectively, Modi *et al.,* (2008, 2009) in chicken and mutton kofta respectively and Santhi and Kalaikannan (2014) in chicken nuggets.

Conclusion

The results of this study revealed that mutton nuggets added with oat flour at 9 per cent level had recorded significantly ($P<0.05$) higher percent cooking yield, higher percent emulsion stability, higher percent water-holding capacity, higher penetration values, higher per cent moisture, crude fiber and lower per cent crude fat and better organoleptic traits viz., flavour, juiciness, tenderness and overall acceptability compared to other treatments and control. Hence, incorporation of oat flour at 9 per cent level in mutton nuggets was considered to be optimum for all the desired qualities.

References

[1] Alvarez, D and Barbut, S. 2013. Effect of Inulin, β-Glucan and their mixtures on emulsion stability, color and textural parameters of cooked meat batters. *Meat Sci.* 94: 320-327.

[2] AOAC. 1994. Official Methods of Analysis 16th edition. Association of Official Analytical Chemists, Washington, D.C.

[3] Dawkins, N.L., Phelps, O., McMillin, K.W and Forrester, I.T. 1999. Composition and physico-chemical properties of chevon patties containing oat bran. *J Food Sci.* 64: 597-600.

[4] Dixon, B.D. and Parekh, J.V. 1979. Use of the cone penetrometer for testing the firmness of butter. *J. Texture Studies.* 10:421-434.

[5] Garcia, M.L., Dominguez, R., Galvez, M.D., Casas, C and Selgas, M.D. 2002. utilization of cereal and fruit fibres in low fat dry fermented sausages. *Meat science.* 60 : 227-236.

[6] Govind, V., Prabhakar, K., Eswara Rao, B. and Naga Mallika, E. 2013. Eating quality and physico-chemical properties of fresh emu meat sausages prepared in comparison with broiler and spent hen meat sausages with oat flour and corn flour. *International J. of Food, Agriculture and Veterinary Sciences*. Vol. 3 (1): 247- 253.

[7] Huang, S.C., Tsai, Y.F., Chen, C.M. 2011. Effects of wheat fiber, oat fiber, and inulin on sensory and physico-chemical properties of Chinese-style sausages. Asian- Australas J Anim Sci. 24: 875-880.

[8] Hughes, E., Confrades, S and Troy, D.J. 1997. Effects of fat level, oat fibre and carrageenan on frankfurters formulated with 5, 12 and 30 % fat. *Meat Science* 45 (3):273-281.

[9] Kerr, W.L., Wang, X and Choi, S.G. 2005 Physical and sensory characteristics of low- fat Italian sausage prepared with hydrated oat. J Food Qual 28: 62-77.

[10] Modi, V.K., Yashoda, K.P and Naveen, S.K. 2008. Effect of carrageenan and oat flour on quality characteristics of meat kofta. *International Journal of Food Properties* 12(1): 228-242.

[11] Modi, V.K., Yashoda, K.P., Bhaskar, N and Mahendrakar, N.S. 2009. Effect of carrageenan and oat flour on storage characteristics of fried mutton kofta. *Journal of For Processing and Preservation* 33(6): 763–776

[12] Pinero, M.P., Parra, K., Leidenz, N.H., Arenas De Moreno, L., Ferrer, M., Araujo, S and Barboza, Y. 2008. Effects of oat's soluble fibre(β-glucan) as a fat replacer on physical, chemical, microbiological and sensory properties of low-fat beef patties. *Meat Science* 80:675-680.

[13] Reddy, N.S.P., Reddy, M.S and Reddy, K.S. 1999. Influence of inclusion of non-meat extenders in mutton sausages on its quality. *Indian Food Packer* Mar-Apr: 20-21.

[14] Reddy, P and Rao, T.S. 1996. Influence of binders and refrigerated storage on the quality characteristics of chicken patties. *Indian Journal of Poultry Science* 31(2): 110-114.

[15] Santhi, D and Kalaikannan, A. 2014. The effect of the addition of oat flour in low-fat chicken nuggets. Journal of Nutrition & Food Sciences, 4:260.

[16] Serdaroglu, M and Degirmencioglu, O. 2004. Effects of fat level (5%, 10%, 20%) and corn flour (0%, 2%, 4%) on some properties of Turkish type meat balls (Koefte). *Meat Science.* 68 (2): 291-296.

[17] Serdaroglu, M. 2006. The characteristics of beef patties containing different levels of fat and oat flour. Int J Food Sci Technol 41: 147-153.

[18] Snedecor, G.W and Cochran, W.G. 1994. Statistical methods. 8th edn. Oxford and IBH Publishing Co. Calcutta.

[19] Townsend, W.E, Witnauer, L.P., Riloff, J.A and Swift, L.E. 1968. Comminuted meat emulsions. Differential thermal analysis of fat transistion. *Food Technology.* 22: 319-323.

[20] Wierbicki, E., Tiede, M.G and Burrell, R.G. 1962. Determination of meat swelling as a method for investigating the water binding capacity of muscle proteins with low water holding forces. *Journal of Food Science*. 37, 860-864.

[21] Yang, H.S., Ali, M.S., Jeong, J.Y., Moon, S.H., Hwang, Y.H., Park, G.B and Joo, S.T. 2009. Properties of duck meat sausages supplemented with cereal flours. *Poultry Science.* 88 (7): 1452-1458.

[22] Yang, H.S., Choi, S.G., Jeon, J.T., Park and Joo, S.T. 2007. Textural and sensory properties of low fat pork sausages with added hydrated oat meal and tofu as texture – modifying agents. *Meat Science* 75:283-89.

Table 1. Effect of incorporation of different levels of oat flour on the physico-chemical and organoleptic properties of mutton nuggets (Mean ± S.E)

Attributes / Parameters	**Control**	**Mutton nuggets incorporated with oat flour**		
		3 per cent	**6 per cent**	**9 per cent**
Cooking loss (%)	15.15±0.13^{d}	8.65±0.14^{c}	6.81±0.05^{b}	4.89±0.07^{a}
Emulsion stability (%)	85.01±0.94^{a}	89.86±0.40^{b}	93.23±1.07^{c}	96.46±0.17^{d}
WHC (%)	59.95±0.17^{a}	66.72±0.47^{b}	75.52±0.23^{c}	81.22±1.04^{d}
Hardness (penetration values)	100.73±3.44^{a}	129.90±3.69^{b}	147.31±4.86^{c}	175.52±1.70^{d}
Moisture (%)	62.76±0.27^{a}	64.52±0.31^{b}	66.34±0.31^{c}	68.08±0.38^{d}
Crude protein (%)	19.82±0.15^{d}	17.65±0.50^{c}	15.69±0.35^{b}	13.75±0.17^{a}
Crude fat (%)	14.52±0.11^{c}	12.16±0.11^{b}	11.92±0.09^{b}	9.56±0.17^{a}
Crude fiber (%)	0.75±0.01^{a}	1.20±0.15^{b}	1.65±0.17^{b}	2.12±0.13^{c}
Colour	7.48±0.33^{a}	7.43±0.36^{a}	7.52±0.27^{a}	7.48±0.37^{a}
Flavour	6.69±0.71^{a}	7.45±0.35^{ab}	7.53±0.63^{ab}	8.03±0.26^{c}
Juiciness	6.33±0.49^{a}	7.02±3.41^{b}	7.58±2.20^{c}	8.45±0.48^{d}
Tenderness	6.75±0.40^{a}	7.18±0.45^{b}	7.88±0.58^{c}	8.58±0.20^{d}
Over all acceptability	6.42±0.33^{a}	7.67±0.40^{b}	7.72±0.58^{c}	8.50±0.26^{d}

($P<0.05$); Means bearing at least one common superscript in the same row do not differ significantly.