Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 21(2) May-August 2023]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)

G.B. Pant University of Agriculture & Technology, Pantnagar

PANTNAGAR JOURNAL OF RESEARCH

Vol. 21(2) May-August, 2023

CONTENTS

Quality characteristics of low salt functional chicken meat patties incorporated with Barnyard Millet

DEEPSHIKHA SINGH [1*], ANITA ARYA[1], P. PRABHAKARAN[1], P.K. SINGH[1], SHIVE KUMAR[2], N.C. HAHI[3] and A.K. UPADHYAY [4]

[1,2]Department of Livestock Products Technology, [4]Department of Veterinary Public Health and Epidemiology, College of Veterinary and Animal Sciences, [3]Department of Department of Post Harvest Process and Food Engineering, College of Technology, G B Pant University of Agriculture and Technology, Pantnagar-263145, (U.S. Nagar, Uttarakhand)

[*]Corresponding author's email Id: deepshikhasingh46@gmail.com

ABSTRACT: This study has been undertaken to develop low-salt functional chicken patties(T1) incorporated with barnyard millet based on a sensory optimization trial. The developed patties were further coated with sodium alginate edible coating (T2) and compared with control patties C (patties with no functional ingredient and sodium alginate coating) and T1. The pH, protein, moisture, fat, ash, and fiber content of the 3 treatments were evaluated. The results revealed that there was no significant difference ($p>0.05$) in pH and fat content among all three treatments. The protein and moisture content of T1 and T2 was significantly lower than C. The fiber content of T1 and T2 was significantly higher($p<0.05$) than that of the control. There was no significant difference ($p>0.05$) between T1 and T2 for all the parameters of proximate composition and pH. This study revealed that 6% barnyard millet can be successfully incorporated into chicken patties without causing any significant change in the sensory attributes, proximate composition, and pH of the product.

Key words: Barnyard Millet, chicken patties, functional meat products

Reformulation of meat products to a healthier and sustainable version can help meet the sustainable development goals. It is done through the reduction of harmful saturated fatty acids, salt, and cholesterol and the incorporation of functional ingredients like plant carbohydrates, fiber, plant protein, and oil sources (Pintado and Delgado-Pando, 2020). High salt (NaCl) content in processed meats is linked to deteriorating effects on health like increased blood pressure which is linked to cardiovascular diseases (Aprilia and Kim, 2022). Partial replacement of sodium chloride (NaCl) with potassium chloride (KCl) can help in minimizing the negative effects of sodium chloride on health. Millets are nourishing and have substantial health benefits, which explains why they are used in multigrain and gluten-free cereal products. In addition to their nutritional benefits, millets include several phytochemicals, especially phenolic compounds, which are helpful for treating metabolic diseases like diabetes, cancer, and cardiovascular diseases. Barnyard millet is mostly grown in India in two distinct agroecology, one in the Deccan plateau area in Tamil Nadu and another in the Himalayan region of Uttarakhand. Barnyard millet is one of the earliest domesticated millets of Asia and Africa (Sood *et al.*, 2015). The millet had 10.5% protein 3.6% fat, 68.8% carbohydrate, and 398 kcal/100 g energy. The total dietary fiber content is high (12.6%) including soluble (4.2%) and insoluble (8.4%) fractions (Ugare et al., 2014).

Meat products that are extended with millets provide a mixture of plant and animal-based proteins as well as dietary fiber, which is lacking in meat. Dietary fibre incorporated meat productscan help in decreasing LDL-cholesterol, and diet-related diseases like diabetes, obesity, cardiac diseases, constipation, etc. (Angulo-López *et al.*,2022). Dietary fiber supplementation via millets in meat products increases the bulk and reduces cooking loss by enhancing water-binding capabilities (Amadi *et al.*, 2022).

Naveena *et al.* (2006) reported that chicken patties formulated with ragi flour had less reduction in diameter and thickness after cooking. Moreover, the fiber and calcium content of chicken cutlets prepared with finger millet flour was greater than control samples which is desirable to make food nutritious. Kumar *et al.* (2015) reported that chevon patties fortified with finger millet flour had good fibre content.

A thin layer of sodium alginate edible coating on the food surface can help increase its shelf life as it acts as a barrier between food and spoilage organisms present in the environment like bacteria, fungus, etc (Song *et al.*, 2011).

Barnyard millet is an underutilized food resource and has considerable potential to be used in human food. This study was done with the objective of preparing coated (sodium alginate edible coating) and uncoated low-salt functional chicken patties containing an optimized concentration of Barnyard Millet.

MATERIALS AND METHODS

Location of experiment

The experiment was conducted in the Department of Livestock Products Technology, College of Veterinary and Animal Sciences, G.B.P.U.A.T.

Sources of Material

The fresh chicken meat was purchased from the Local market, Pantnagar, and brought to the lab within one hour, packaged airtight in low-density polyethylene bags (LDPE) and stored at -20 °C till further use.

Spices and condiments mix

Spice mix and condiments (garlic, black pepper, chili, and ginger) were purchased from a local market. Test ingredient Barnyard Millet, Rice bran oil was purchased from local market.

Chemicals

All the chemicals were of analytical grade and procured from Hi media® Mumbai and Merck® Mumbai.

Preparation of chicken patties

Low Salt Functional Chicken Meat Patties Incorporated with Barnyard Millet were prepared by sensory optimization trials with varying concentrations of the millet (Table 1).

Boneless meat was minced via a 6mm plate, all the ingredients were mixed at specific concentrations in different treatments to form meat batter. Meat batter was placed in a mould to get the desired shape after which they were cooked in an oven at 160 °C. One side was cooked for 15 minutes and the other side was cooked for 10 minutes. It was ensured that the internal temperature of the cooked patties reaches at least 70 °C (Talukder and Sharma, 2010). After the optimization trials, chicken patties with optimum content of Barnyard Millet were selected for further analysis.

Preparation of chicken patties with sodium alginate edible coating

2.5 grams of sodium alginate was dissolved in 100 ml of distilled water (80°C) to form the coating solution. Chicken patties were dipped in the coating

Table 1: Composition of chicken patties

Ingredients (%)	C	T_A	T_B	T_C	T_D
Lean chicken meat	67.2	64.2	61.2	58.2	55.2
Refined soyabean oil	10	0	0	0	0
Rice bran oil*	0	10	10	10	10
Water	10	10	10	10	10
Ginger+ Garlic+ Onion(1:1:2)	5	5	5	5	5
Refined wheat flour	4	4	4	4	4
Spice Mixture	2	2	2	2	2
Salt (Nacl)	1.5	0	0	0	0
Low sodium Salt (NaCl:Kcl: 1:1)*	0	1.5	1.5	1.5	1.5
Sodium tripolyphosphate	0.3	0.3	0.3	0.3	0.3
Barnyard millet*	0	3	6	9	12

* *functional ingredients; C: chicken patties,* T_A*: chicken patties +barnyard millet 3%,* T_B*: chicken patties +barnyard millet 6%,* T_C*: chicken patties+ barnyard millet 9%,* T_D*: chicken patties+ barnyard millet 12%*

Table 2: Effect of different levels of barnyard millet on the sensory score of chicken patties

Parameter	Appearance	Texture	Juiciness	Flavor	Overall acceptability
C	7.28±0.15[a]	7.28±0.17[a]	7.88±0.05[a]	7.48±0.07[a]	7.54±0.17[a]
T_A	7.25±0.12[a]	7.25±0.18[a]505	7.85±0.02[a]	7.55±0.18[a]	7.55±0.18[a]
T_B	7.62±0.02[b]	7.77±0.05[b]	7.56±0.04[a]	7.92±0.15[b]	7.9±0.05[b]
T_C	6.12±0.02[c]	6.00±0.05[c]	6.22±0.04[b]	6.00±0.15[c]	6.51±0.05[c]
T_D	5.14±0.02[d]	5.64±0.09[d]	5.14±0.02[c]	5.04±0.19[d]	5.24±0.09[d]

Mean ± SE, bearing small alphabet superscripts column-wise differ significantly (P<0.05); C: chicken patties, TA: Chicken patties +Barnyard millet 3%, TB: Chicken patties +Barnyard millet 6%, TC: Chicken patties+ Barnyard millet 9%, TD: Chicken patties+ Barnyard millet 12%

solution for 1 minute followed by draining for 2 minutes. Further, the patties were dipped in a 2 % calcium carbonate solution to ensure proper bond formation (Raeisi *et al.*, 2016). The final treatments include C (chicken patties without barnyard millet and edible coating), T1(chicken patties with barnyard millet), and T2 (barnyard millet incorporated chicken patties coated with 2.5% sodium alginate).

Analytical Tests

Estimation of moisture, ash, fat, crude fiber, and protein was done according to the method given in (AOAC, 2000). For pH determination, each sample was first blended with distilled water, 5 times the weight of the sample to produce a uniform suspension. The pH was recorded by a digital pH meter (Reddy *et al.,* 2023). Sensory evaluation was done based on different attributes like appearance, flavor, juiciness, texture, and overall palatability, and 8 points descriptive scale was used which ranged from extremely desirable to extremely poor (Keeton, 1983).

Table 3: Proximate composition and pH values of chicken patties

Parameters	C	T1	T2
Protein%	19.22±0.27[a]	18.42±0.095[b]	18.45±0.098[b]
Fat%	7.12±0.38[a]	6.99 ±0.22[a]	7.19±0.17[a]
Moisture%	69.19±0.12[a]	61.47±0.03[b]	61.61±0.022[b]
Ash%	2.38±0.019[a]	2.8±0.016[b]	2.9±0.007[b]
Fibre%	0.29±0.002[a]	1.79±0.011[b]	1.79±0.016[b]
pH	6.12±0.005[a]	6.14±0.003[a]	6.10±0.003[a]

mean ± SE values bearing different superscript row-wise by small alphabets (a,b,c) differ significantly (p<0.05) C- chicken patties with no barnyard millet, T1 – low salt chicken patties with 6% barnyard millet, T2- low salt chicken patties with 6% barnyard millet coated with sodium alginate

RESULTS AND DISCUSSION

3%, 6%, 9%, and 12% levels of barnyard millet were selected for final optimization in chicken patties Mean ± SE values of sensory scores are presented in Table 2

Results revealed a significant difference (P<0.05) in appearance, flavor, texture, juiciness, and overall acceptability of control and treatments. T2 had a better appearance, texture, flavor, and overall acceptability than C, $T_A T_C$, and T_D. There was no significant (P>0.05) difference between T_A and C for all the sensory properties. Moreover, there was no significant (P>0.05) difference in the juiciness score of C, $T_{A,}$ and T_B. The unique grainy and gritty texture of the millet helps to impart desirable sensory properties. The water-holding capacity of millet flour increases the juiciness of developed meat (Talukder and Sharma, 2015). In a study conducted by Gorachiya *et al.* (2022), it was found that the sensory properties of low-fat chicken sausage incorporated with ragi flour (millet) decreased with an increase in the concentration of millet. Gamit *et al.* (2020) reported that chicken meat cutlets with the optimized level (5%) of finger millet flour did not show a significant effect on any of the sensory parameters.

The proximate composition and pH values are given in Table 3. The results revealed that the protein content (19.22%) of C was significantly higher (p<0.05) than T1 and T2. Sharma *et al.* (2014) reported the percentage of protein in flax seed flour added restructured mutton chops, which was highest in control and decreased slightly due to the replacement of lean meat with a fat-rich ingredients like palmitic, linoleic, and oleic acid (Ugare *et al.,* 2014). There was no significant difference (p>0.05) in the fat content of the C, T1, and T2. The moisture content of T1 and T2 was significantly lower than the control. This might be due to an increment in dry matter in the patties formulation due to added barnyard millet. Dried millets are hydrophobic in nature due which leads to the decreased moisture content of functional patties. Similar findings were reported by Turhan *et al.,* (2005) for beef burgers incorporated with hazelnut pellicle. The total ash content of T1 and T2 was significantly higher (P<0.05) than C. It is due to the addition of millet increasing the dry matter content of the patties thereby increasing the ash content. In a study conducted by Santhi *et al.* (2020) inclusion of pearl millet had enhanced the total ash content of chicken meatballs. The crude fiber content was significantly higher in T1 and T2 (P<0.05) as compared to C. This increment might be due to the replacement of lean meat with barnyard millet, which is an excellent dietary fiber source (12.6 %) Although meat is a poor source of fibre however, a small amount of fiber content noticed in control was due to the addition of spices and condiments during the processing of patties. Chatli *et al.* (2015) developed functional emu meat nuggets incorporated with finger millet flour (FMF) at 4, 6, and 8 percent levels, the crude fiber content increased significantly ($p < 0.05$) with the increasing levels of incorporation. In a study conducted by Santhi *et al.* (2020) inclusion of pearl millet enhanced the fiber content of chicken meatballs. There was no significant difference (p>0.05) in the pH value of all 3 treatments.

CONCLUSION

Based on sensory scores, it was found that barnyard millet at a concentration of 6% can be successfully added to develop functional chicken patties. The protein content of both sodium alginate-coated and uncoated functional chicken patties was found to be less than that of control. The ash content of patties containing barnyard millet was higher than the control sample. Both coated and uncoated functional chicken patties had significantly higher crude fiber content. However, there was non-significant difference between T1 and T2, which means that the application of sodium alginate edible coating on functional chicken patties does not cause any significant change in proximate composition. Thus, it may be concluded that the chicken patties with acceptable sensory and proximate characteristics can be prepared by incorporating 6% barnyard millet.

REFERENCES

Amadi, G.A., China, M.A.H., Ujong, A.E. and Christian, M. (2022). Effect of African Yam Bean Flour as an Extender on the Physicochemical and Sensory Properties of Cooked Beef Sausage. *European Journal of Nutrition and Food Safety*, 14(7): 13-23.

Angulo-López, J.E., Flores-Gallegos, A.C., Ascacio-Valdes, J.A., Contreras Esquivel, J.C., Torres-León, C., Rúelas-Chácon, X. and Aguilar, C.N. (2022). Antioxidant dietary fiber sourced from agroindustrial byproducts and its applications. *Foods*, 12(1): 159.

AOAC (2000) Official methods of analysis, 17th ed. Washington, DC: Association of Official Analytical Chemists.

Aprilia, G.H.S. and Kim, H.S. (2022). Development of strategies to manufacture low-salt meat products–a review. *Journal of Animal Science and Technology*, 64(2): 218.

Chatli, M.K., Kumar, P., Mehta, N., Verma, A.K., Kumar, D. and Malav, O.P. (2015). Quality characteristics and storage stability of emu meat nuggets formulated with finger millet (*Eleusine coracana*) flour. *Nutrition and Food Science*, 45(5): 740-752.

Gamit, M., Gupta, S. and Savalia, C.V. (2020). Quality characteristics of chicken meat cutlets incorporated with finger millet (*Eleusine coracana*) flour. *Journal of Animal Research*, 10(1): 111-116.

Gorachiya, P.R., Bais, B., Pathak, V. and Goswami, M. (2022). Quality Evaluation of Low Fat Chicken Sausages Fortified with Dietary Fibre. *Journal of Animal Research*, 12(3):

421-428.

Keeton, J.T. (1983). Effects of fat and NaCl/ phosphate levels on the chemical and sensory properties of pork patties. *Journal of Food Science*, 48(3):878-881.

Kumar, D., Chatli, M.K., Mehta, N., Verma, A.K. and Kumar, P. (2015). Quality evaluation of chevon patties fortified with dietary fibre. *Indian Journal of Small Ruminants*, 21(1): 85-91.

Naveena, B.M., Muthukumar, M., Sen, A.R., Babji, Y. and Murthy, T.R.K. (2006). Quality characteristics and storage stability of chicken patties formulated with finger millet flour (*Eleusine coracana*). *Journal of Muscle Foods*, 17(1): 92-104.

Pintado, T. and Delgado-Pando, G. (2020). Towards more sustainable meat products: Extenders as a way of reducing meat content. *Foods*, 9(8): 1044.

Raeisi, M., Tabaraei, A., Hashemi, M. and Behnampour, N. (2016). Effect of sodium alginate coating incorporated with nisin, *Cinnamomum zeylanicum*, and rosemary essential oils on microbial quality of chicken meat and fate of Listeria monocytogenes during refrigeration. *Int. J. Food Microbiol*, 238:139-145.

Reddy, G.B., Natha Reddy, K.V. and Amaravathi, P. (2023). Quality characteristics and ultra structural changes of restructured buffalo meat slices with flax seed flour as binder: A novel value-added technology. *Emirates Journal of Food and Agriculture*, 35:342-350.

Santhi, D., Kalaikannan, A. and Natarajan, A. (2020). Characteristics and composition of emulsion based functional low fat chicken meat balls fortified with dietary fiber sources. *Journal of Food Process Engineering*, 43(3): 13333.

Sharma, H., Sharma, B.D., Mendiratta, S.K., Talukder, S. and Ramasamy, G. (2014). Efficacy of flax seed flour as bind enhancing agent on the quality of extended restructured mutton chops. *Asian-Australasian Journal of Animal Sciences*, 27(2): 247.

Song, Y., Liu, L., Shen, H., You, J. and Luo, Y. (2011). Effect of sodium alginate-based edible coating containing different anti-oxidants on quality and shelf life of refrigerated bream (*Megalobrama amblycephala*). *Food Control*, 22(3-4): 608-615.

Sood, S., Khulbe, R.K., Gupta, A.K., Agrawal, P.K., Upadhyaya, H.D. and Bhatt, J.C. (2015). Barnyard millet–a potential food and feed crop of future. *Plant Breeding*, 134(2): 135-147.

Talukder, S. and Sharma, D.P. (2010). Development of dietary fiber-rich chicken meat patties using wheat and oat bran. *Journal of Food Science and Technology*, *47*: 224-229.

Turhan, S., Sagir, I. and Ustun, N.S. (2005). Utilization of hazelnut pellicle in low-fat beef burgers. *Meat Science*, *71*(2): 312-316.

Ugare, R., Chimmad, B., Naik, R., Bharati, P. and Itagi, S. (2014). Glycemic index and significance of barnyard millet (*Echinochloa frumentacae*) in type II diabetics. *Journal of Food Science and Technology*, 51: 392-395.

Received: July 19, 2023
Accepted: August 10, 2023