J.Meat Sci., 2017, 12 (1) : 65 - 68

Research Note

Studies on Quality Characteristics of Chicken Meat Patties Extended with Oat Flour

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ABSTRACT

The present investigation was carried out to evaluate different levels (2, 3 and 5 percent) of oat flour on quality characteristics of chicken meat patties. Among different treatments, meat patties incorporated with oat flour at 5 per cent level recorded significantly ($p<0.05$) lower per cent cooking loss, protein and crude fat contents, but higher emulsion stability, water-holding capacity, moisture and crude fibre contents. This product also exhibited superior flavour, juiciness, tenderness and overall acceptability scores. Colour scores did not affect significantly ($p>0.05$) by addition of different levels of oat flour. It was concluded that addition of oat flour at 5 percent level produced excellent quality chicken meat patties.

Keywords : *Chicken meat patties, Low-fat, Oat flour, Quality characteristics*

Received : 31.05.2016 Accepted: 02.09.2016

Presently, consumers are very concerned about their diet and the food they eat and attention has been diverted toward processed meat products that are lean, low-fat and high in protein content (Bhaskar Reddy *et al.* 2012). This powerful influence of diet on health and wellbeing and increasing scientific evidence confirms that specific components in diet may tend to reduce the occurrence of certain chronic diseases such as cardiovascular diseases, various cancers and neurological disorders. Functional meat products either possess nutritional ingredients that improve health or contain lesser quantity of harmful compounds like cholesterol and fat etc. (Yue 2001). Meat products which contain dietary fibes are excellent meat substitutes due to their inherent functional and nutritional effects. Further, dietary fibre intake through meat reduces plasma and LDL-cholesterol, reduce the risk of major dietary problems such as obesity, coronary diseases, diabetes, gastrointestinal disorders, including constipation, inflammatory bowel diseases etc., (Schneeman 1999). Besides health benefit effects, dietary fibre supplementations increase the bulk and prevent cooking loss in meat products with fewer changes in textural parameters by enhancing water binding capabilities and carries great economic advantages for both the consumers and processors (Grigelmo- Miguel *et al.* 1999).

Oats are lowering the blood cholesterol level, as well as blood glucose and insulin levels which are of great interest in prevention and control of atherosclerosis and diabetes. Oats contain the soluble fibre beta-glucan which has been shown to have cholesterol-lowering effect in humans (Braaten *et al.* 1994). Moreover, oats contain antioxidants that protect foods against rancidity. One group of antioxidants is the oat-specific avenanthramides; polyphenolics potentially beneficial to health. Among the cereals, oats not only have the highest protein content but also the best protein quality, as the primary storage protein is globulin, containing higher levels of essential amino acids than prolamine (the predominant storage protein in other cereals) (Webster 2002). Oats also contain linoleic (18:2, n6) and linolenic acid (18:3, n3) fatty acids, although the content of the latter is relatively low (<5% of total fatty acids). The above-mentioned nutritional properties of oats have led to an increased interest in the development of oat-based functional meat products. With this background, the present research work was designed to develop low fat functional chicken meat patties extended with different levels of oat flour and to study the quality and organoleptic characteristics of developed low fat functional chicken meat patties.

Preparation of chicken meat patties: Chilled boneless chicken procured from market was packaged in LDPE pouches and stored at refrigeration temperature (4±1°C) till product preparation. The proportion of all ingredients {vegetable oil (5%), salt (1.5%), chilled water (9.5%), spices (2%), condiments (5%), chilli (1%)} except meat and oats remained same for both the control and treatment groups. The proportion of chicken and oat flour in the control and treatment groups are: Control: 76% meat, 0 % oat; T1: 74% meat, 2 % oat; T2: 73% meat, 3 %

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oat; T3: 71% meat, 5 % oat. The chicken meat patties were prepared by mincing the lean meat in a meat mincer and then chopping in a bowl chopper with non meat ingredients. The emulsion was then molded in the form of patties (1.2 cm thick, 4.4 cm diameter circular shaped patties weighing 23 g) and evaluated for various quality characteristics and sensory attributes.

Evaluation of quality characteristics of chicken patties: Cooking loss was estimated by recording the difference between the pre and post cooking weights of meat patties and expressed as percentage. Emulsion stability was estimated as per the method outlined by Baliga and Madaiah (1971), with slight modifications. Fifteen grams of emulsion was weighed and packed in polyethylene bag and heated at 80° C for 20 min in a constant temperature water bath. The fluid released was drained and sample was weighed. The emulsion stability was calculated by recording the difference between the pre (raw) and post heating weights of meat emulsion and expressed as percentage.

The water-holding capacity of the emulsion was determined by following the procedure of Weirbicki *et al.* (1962). 25 grams of emulsion mix was blended with 75ml of distilled water for 90 seconds in a high speed blender. 35 ml of the meat slurry was centrifuged at room temperature at 1000 rpm for 15 minutes. After centrifugation the volume of supernatant liquid was collected in a graduated cylinder. The per cent of water-holding capacity was determined by the following formula.

WHC (%) =300-11.43/100 X S/100
(S = Amount of supernatant collected in ml)

The percentage moisture, fat, crude protein and crude fiber were estimated as per AOAC (1995). The prepared chicken meat patties were cooked in microwave oven for 6 minutes and subjected to a 6 member semi-trained taste panel for evaluating the color, flavor, juiciness, tenderness and overall acceptability on a 9 point hedonic scale. The data thus obtained was subjected to statistical analysis using SPSS MAC, version 20.0, SPSS Chicago (US).

Quality characteristics of chicken patties: Chicken meat patties incorporated with oat flour at 5 per cent level (T3) recorded significantly ($p<0.05$) lower cooking loss than the control, T1 and T2 (Table 1). This might be due to optimum absorption of moisture from the emulsion by the extenders thus lowering the loss of moisture during cooking and also due to the water binding capacity of the flour (Reddy and Rao 1996). Higher cooking yield in T3 was probably due to ability of oat hydrocolloids to create a three dimensional matrix, holding both water and fat thereby avoiding losses of fat and water during cooking (Warner and Inglet 1997; Bhaskar Reddy *et al.* 2012). Control had registered lower cooking yield and this was probably due to low density meat protein matrix along with a high fat instability (Suman and Sharma 2003). Irrespective of the different levels of oat flour, increased levels of extender had significantly ($p<0.05$) reduced the per cent cooking loss. The findings are in accordance with Hughes *et al.* (1997) in frankfurters, Modi *et al.* (2008) in cooked and fried meat *kofta* and Prasad *et al.* (2011) in chicken *kofta*.

Addition of oat flour significantly ($p<0.05$) influenced the emulsion stability of patties. Chicken meat patties extended with 5 per cent oat flour (T3) recorded significantly ($p<0.05$) higher emulsion stability as compared to control and T1 and T2. This might be due to high functional properties of oat flour. Irrespective of the different levels of oat flour formulations, increased level of oat flour had significantly ($p<0.05$) increased the emulsion stability. On the other hand, control recorded significantly ($p<0.05$) lower emulsion stability than the other treatments. This might be due to the absence of flour needed for binding of water (Bhaskar Reddy *et al*. 2012).The results are in agreement with the reports of Hughes *et al.* (1997) in frankfurters.

The water-holding capacity of meat patties was significantly ($p<0.05$) affected by the level of oat flour inclusion. Chicken meat patties extended with oat flour at 5 percent level (T3) had significantly ($p<0.05$) higher water-holding capacity as compared to control, T1 and T2. This might be either due to the fact that higher level of flour retains more water, by increasing the water-holding capacity (Bhaskar Reddy *et al.* 2012) or due to the formation of more stable meat and protein matrix which leads to a smaller release of water and fat thus improving binding properties. The results obtained in the study are in accordance with Yang *et al.* (2007) in low fat sausages and Modi *et al.* (2008) in meat *kofta*.

Chicken meat patties extended with 5 per cent oat flour (T3) had significantly ($p<0.05$) higher per cent moisture and crude fibre than the control and other treatments (Table 1). Crude fibre per cent also increased from 1.17 (control) to 2.85 (T3). This might be due to water binding properties of added flours which retains more moisture during cooking whereas control had lower water binding properties due to lack of flour (Bhaskar Reddy *et al.* 2012). Increased level of oat flour in the formulation had significantly ($p<0.05$) increased the percent moisture and fiber. The results obtained in the study are in accordance with Prasad *et al.* (2011).

Chicken meat patties incorporated with oat flour at 5 per cent level (T3) had significantly ($p<0.05$) lower per cent crude protein and per cent crude fat than control, T1 and T2. Control had significantly ($p<0.05$) higher crude protein and crude fat content. The higher per cent protein of chicken meat patties in control may be due to higher moisture losses during processing and high per cent of meat in control. Increased level of addition of extender had significantly decreased both per cent protein and per cent crude fat. The results obtained in this study are in accordance with Yang *et al*. (2007) in low fat pork sausages and Prasad *et al.* (2011) in chicken *kofta*.

Table 1: Influence of different levels of oat flour on physico-chemical parameters, proximate composition and organoleptic properties of chicken meat patties (Mean ± S.E)

Parameter (%)	Control	T1	T2	T3
Emulsion stability	67.32 ± 0.26^{a}	79.74 ± 0.04^{b}	83.82 ± 0.25^{c}	87.47 ± 0.366^{d}
WHC	55.16 ± 0.20^{a}	60.70 ± 0.21^{b}	63.51 ± 0.16^{c}	67.92 ± 0.233^{d}
Cooking loss	12.38 ± 0.13^{d}	9.29 ± 0.10^{c}	7.29 ± 0.07^{b}	6.59 ± 0.11^{a}
Moisture	63.82 ± 0.27^{a}	66.24 ± 0.27^{b}	67.06 ± 0.27^{c}	70.05 ± 0.27^{d}
Crude protein	19.81 ± 0.21^{d}	17.91 ± 0.11^{c}	17.09 ± 0.17^{b}	16.12 ± 0.06^{a}
Crude fat	5.30 ± 0.11^{d}	4.71 ± 0.14^{c}	4.27 ± 0.13^{b}	3.93 ± 0.06^{a}
Crude fibre	1.17 ± 0.04^{a}	1.66 ± 0.06^{b}	2.13 ± 0.06^{c}	2.85 ± 0.08^{d}
Colour	7.16±0.02	7.20±0.03	7.24±0.04	7.29±0.03
Flavour	6.61 ± 0.05^{a}	7.45 ± 0.06^{b}	7.75 ± 0.09^{c}	8.06 ± 0.01^{d}
Tenderness	6.44 ± 0.09^{a}	7.34 ± 0.04^{b}	7.40 ± 0.05^{b}	8.30 ± 0.01^{c}
Juiciness	6.31 ± 0.04^{a}	7.22 ± 0.03^{b}	7.44 ± 0.05^{c}	8.20 ± 0.03^{d}
Over all acceptability	6.43 ± 0.08^{a}	7.49 ± 0.06^{b}	7.83 ± 0.02^{c}	8.42 ± 0.07^{d}

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

Functional low fat chicken meat patties extended with 2 % oat flour

Functional low fat chicken meat patties extended with 3 % oat flour

T3: Functional low fat chicken meat patties extended with 5 % oat flour

No significant ($p>0.05$) difference observed due to addition of different levels of oat flour on colour scores of chicken meat patties. This is in agreement with Hughes *et al*. (1997) in frankfurters incorporated with oat fibre. Chicken meat patties extended with 5 per cent oat flour (T3) recorded significantly ($p<0.05$) higher flavour, juiciness, tenderness and overall acceptability scores than the control and T1 and T2. Flavour scores increased from 6.61 (control) to 8.06 (T3) and this increase in flavour scores might be due to oat flour which contains certain flavour precursors and also high temperature of cooking to carry the flavour compounds like alcohols and esters. The highest juiciness scores in T3 might be due to increased moisture retention of the product during cooking. The tenderness scores increased from 6.44 (Control) to 8.30 (T3). This might be due to the breakage of intra and inter molecular cross linkages between the poly peptide chains of collagen during mincing of meat. Highest overall acceptability scores in T3 might be due to the fact that chicken meat patties incorporated with oat flour at 5 per cent level had scored significantly ($p<0.05$) higher scores for flavour, juiciness and tenderness scores and thereby also increased the overall acceptability scores. These results were in accordance with those of Yang *et al.* (2007) in low fat sausages and Modi *et al*. (2008) in cooked *kofta*.

The results of the study revealed that chicken patties added with oat flour at 5 per cent level had recorded significantly ($p<0.05$) higher cooking yield, water-holding capacity, moisture, crude fiber and lower crude protein, crude fat and superior organoleptic characteristics compared to the control, 2 percent and 3 percent oat flour. Hence, it is concluded that, addition of 5 per cent oat flour give superior quality chicken meat patties.

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