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ORIGINAL ARTICLE

Development of dietary fiber rich chicken meat patties using wheat and oat bran

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Abstract Dietary fiber rich chicken meat patties were developed by incorporating wheat and oat bran to chicken meat at 5, 10 and 15% levels. Oat bran contained higher amount of soluble dietary fiber (SDF) and unsaturated fatty acids (USFA) than wheat bran, whereas total dietary fiber (TDF), insoluble dietary fiber (IDF) and saturated fatty acids (SFA) were higher in wheat bran. Incorporation of bran significantly increased the water holding capacity (WHC) and emulsion stability (ES). Oat bran showed better effect on WHC and ES than wheat bran. Addition of bran resulted in significant increase in cooking yield, firmness, TDF, USFA and reduction in sensory attributes, moisture, protein, fat and cholesterol content. IDF was higher in wheat bran added patties and SDF and SFA/USFA ratio in oat bran added patties. It is concluded that oat and wheat bran can be incorporated up to 10 and 15% level, respectively for preparation of baked and steamed chicken patties.

Keywords Dietary fiber · Chicken meat patties · Chemical · Physico-chemical · Sensory properties

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Introduction

Diet containing meat is rich in energy, saturated fatty acids and cholesterol and deficient in dietary fiber. Epidemiological research has demonstrated a relationship between energy rich diet and chronic diseases (Best 1991, Kaeferstein and Clugston 1995) and thus diet with high fiber has been recommended (Johnson and Southgate 1994). Dietary fibers are incorporated in the products for their functional and technological properties (Thebaudin et al. 1997). Various types of fibers have been used in meat products to increase the cooking yield due to their water and fat binding properties and to improve texture (Cofrades et al. 2000). Many of the characteristics of oat fiber such as its water absorption capacity could potentially benefit products such as fat free frankfurters and low fat bologna (Fernandez-Gines et al. 2005). Oat bran and oat fiber provide the flavour, texture and mouth feel of fat in ground beef and pork sausages (Garcia et al. 2002). Effect of various fibers on food differs according to quantity and nature of dietary fiber (Thebaudin et al. 1997). Hence this study was carried out to assess the utility of wheat and oat bran in formulation of chicken meat patties.

Materials and methods

Broiler birds of 6 weeks old reared under similar feeding and management were slaughtered, dressed and deboned meat was obtained manually after trimming of fat and connective tissue. Meat was frozen for 24 h and then minced in an electrical mincer. Wheat bran collected locally was cleaned off extraneous materials, powdered with the help of hand blender and stored in air tight container. Oat bran was obtained from Bagrry's India Ltd., New Delhi

Preparation of patties: Control patties contained 2% sodium chloride, 0.4% sodium tripolyphosphate, 100 ppm sodium nitrite and 2% spice mix. Treatment consisted of addition of wheat and oat bran at 5, 10 and 15% levels

each, besides other additives which were used in control in similar concentrations. After mixing of additives emulsion with bran was prepared in food processor and it was hand moulded into patties of 100 × 20 mm size. For preparation of steamed patties, raw patties were put in moulds and cooked in pressure (1 kg/cm^2) cooker for 20 min. Raw patties were baked in preheated conventional electrical oven at 160°C for 25 min (15 min first side and 10 min another side).

Analysis: Proximate composition (AOAC 1995), pH (Trout et al. 1992), water holding capacity (WHC) (Wardlaw et al. 1973) and emulsion stability (ES) (Baliga and Madaiah 1970) were determined. Weight of patties before and after cooking was recorded and cooking yield was expressed in percentage. Force needed to shear 1 cm^3 piece of patties was recorded using Warner Bratzler Shear Press (Salter, 235 6S, Manhattan, USA) and values were expressed in kg/cm. A 9-point Hedonic scale (where 1 is dislike extremely and 9 is like extremely) was used to evaluate sensory attributes of patties. For estimating the saturated (SFA) and unsaturated fatty acids (USFA) and their ratio, total lipids from sample were extracted according to the method of Angelo et al. (1987) and methyl esters were prepared by the method of Luddy et al. (1968). Methyl esters of fatty acids were separated in a gas chromatograph (Nucon-5765, Mumbai, India) equipped with flame ionization detector. Total lipids from meat sample were extracted as earlier and total cholesterol was assessed in auto analyzer using standard diagnostic kit and expressed as mg cholesterol/100 g sample. Enzymatic method of Furda (1981) was employed to assess total dietary fiber (TDF), soluble dietary fiber (SDF) and insoluble dietary fiber (IDF). Experiments were conducted with 6 replicates and data obtained were subjected to statistical analysis by applying t-test (Snedecor and Cochran 1989).

Results and discussion

Composition of bran: Moisture and ash contents of wheat bran were significantly higher than oat bran whereas oat bran had higher protein and fat contents (Table 1). TDF of wheat bran was 47.1%, out of which 95% was contributed by IDF. However, oat bran contained higher amount of SDF and higher degree of USFA. Findings are in accordance with those of Ranhotra et al. (1994) and Jaskari et al. (1995). High amount of IDF in wheat (Southgate et al. 1978, Englyst et al. 1982), SDF in oat (Horn 1997) and high degree of unsaturation (4.32) in oat bran (Yilmaz and Daglioglu 2003) have been reported.

Composition and physico-chemical properties of emulsion: Moisture content of control meat emulsion (Table 2) was significantly higher than wheat and oat bran added groups. Moisture content decreased with increase in the level of bran. No significant difference between wheat and oat bran emulsion was observed in moisture content. There was no significant difference in protein and fat content in bran added emulsions from control. Emulsion with 15% wheat bran showed the highest (1.9%) ash content. The pH of emulsion increased with the level of incorporation and emulsion with 15% wheat bran showed a significantly high (6.1) pH (Table 2). Yilmaz (2004, 2005) also observed an increase in pH of rye and wheat bran added meat balls.

Both brans were very effective in increasing the WHC at all 3 levels of incorporation (Table 2). Oat bran emulsion at 15% level of incorporation showed the highest (52.0%) WHC. Presence of high amount of SDF might be the reason for higher WHC (Dawkins et al. 1999). Fernandez-Gines et al. (2005) also reported that the addition of oat fiber increased the WHC of meat products. Stability of emulsion (ES) increased significantly on incorporation of bran (Table 2). Emulsion with oat bran had more ES than that with wheat bran because of higher amount of SDF (Table 1) resulting into entrapping and holding of moisture during application of heat. Similar observation with improved hydration capacity leading to better ES by fiber has been reported (Huffman et al. 1992, Hughes et al. 1997).

Composition of chicken meat patties: Baking resulted in significantly lower moisture and higher protein content in control as well as treated patties than steaming (Table 3). This might be due to dry and intense heat leading to evaporation of moisture and quantitative increase in protein content. No significant difference in fat and ash content of baked and steamed patties was observed in both control and bran added patties. Both steamed and baked bran added patties showed significantly lower moisture content compared to their respective controls. With the increase in the level of bran, protein content decreased due to contribution of carbohydrates from bran.

Fat content of steamed and baked bran added patties was lower than their respective controls however significant difference was observed in 15% wheat bran added baked patties (Table 3). Both steamed and baked patties with 15% wheat bran showed significantly higher ash content. Yilmaz

Table 1 Composition of wheat and oat bran

Content (%)	Wheat bran	Oat bran
Moisture	7.1 ± 0.66	6.2* ± 0.66
Protein	13.0 ± 0.46	16.6* ± 0.56
Fat	3.7 ± 0.55	7.5* ± 0.65
Ash	5.8 ± 0.15	2.1* ± 0.04
TDF (n=3)	47.1 ± 1.10	16.5* ± 0.84
SDF (n=3)	2.4 ± 0.73 (5)	7.9* ± 0.49 (48)
IDF (n=3)	44.8 ± 0.45 (95)	8.5* ± 0.38 (52)
SFA	21.6	17.4
USFA	78.4	82.6
SFA/USFA ratio	1 : 3.6	1 : 4.8

*Significant ($p \leq 0.05$), (n=6)
Figures in parentheses indicate per cent of total dietary fiber
TDF: Total dietary fiber, SDF: Soluble dietary fiber, IDF: Insoluble dietary fiber, SFA: Saturated fatty acid, USFA: Unsaturated fatty acid

Table 2 Proximate composition and physico-chemical properties of chicken meat emulsions containing wheat and oat bran

Content	Control	Emulsion with wheat bran, %			Emulsion with oat bran, %		
		5	10	15	5	10	15
Moisture, %	$72.1^{A} \pm 0.60$	$69.1^{B} \pm 0.65$	$66.3^{C} \pm 1.20$	$63.5^{D} \pm 1.01$	$68.8^{B} \pm 1.05$	$66.2^{C} \pm 1.10$	$63.1^{D} \pm 1.20$
Protein, %	$21.4^{A} \pm 0.31$	$21.1^{A} \pm 0.31$	$20.6^{A} \pm 1.01$	$20.4^{A} \pm 1.02$	$21.1^{A} \pm 1.11$	$20.9^{A} \pm 1.08$	$20.7^{A} \pm 0.75$
Fat, %	$4.3^{A} \pm 0.04$	$4.2^{A} \pm 0.64$	$4.2^{A} \pm 0.87$	$4.2^{A} \pm 0.72$	$4.5^{A} \pm 0.78$	$4.6^{A} \pm 0.49$	$4.8^{A} \pm 0.34$
Ash, %	$1.3^{B} \pm 0.44$	$1.5^{B} \pm 0.28$	$1.6^{AB} \pm 0.28$	$1.9^{A} \pm 0.18$	$1.3^{B} \pm 0.37$	$1.4^{B} \pm 0.19$	$1.4^{B} \pm 0.29$
pH	$6.0^{BC} \pm 0.04$	$6.0^{BC} \pm 0.06$	$6.0^{AB} \pm 0.06$	$6.1^{A} \pm 0.05$	$6.0^{C} \pm 0.03$	$6.0^{BC} \pm 0.03$	$6.0^{BC} \pm 0.02$
WHC, %	$40.5^{D} \pm 1.24$	$49.3^{C} \pm 0.91$	$49.7^{BC} \pm 0.33$	$50.0^{BC} \pm 1.49$	$50.0^{BC} \pm 1.80$	$50.8^{AB} \pm 0.91$	$52.0^{A} \pm 0.92$
ES, %	$74.2^{E} \pm 0.67$	$88.6^{D} \pm 0.88$	$94.6^{B} \pm 0.29$	$97.7^{A} \pm 0.69$	$90.7^{C} \pm 0.56$	$95.4^{B} \pm 0.65$	$98.2^{A} \pm 0.99$

Means with different superscripts in a row differ significantly ($p \leq 0.05$) (n=6) WHC: Water holding capacity, ES: Emulsion stability

Table 3 Proximate composition of chicken patties containing wheat and oat bran

	Cooking methods	Control	Patties with wheat bran,%			Patties with oat bran,%		
			5	10	15	5	10	15
Moisture,%	Steamed	$66.7^{Aa} \pm 1.14$	$64.2^{Ca} \pm 0.76$	$63.9^{DCa} \pm 0.43$	$60.5^{Ea} \pm 0.96$	$66.1^{ABa} \pm 0.91$	$64.8^{BCa} \pm 0.53$	$62.7^{Da} \pm 1.12$
	Baked	$62.6^{Ab} \pm 0.11$	$60.2^{DCb} \pm 0.53$	$59.8^{DEb} \pm 1.02$	$59.0^{Eb} \pm 0.89$	$62.1^{ABb} \pm 0.92$	$61.8^{ABb} \pm 0.28$	$61.0^{BCb} \pm 1.09$
Protein,%	Steamed	$25.6^{Aa} \pm 0.48$	$24.2^{Ba} \pm 0.42$	$22.1^{DCa} \pm 0.36$	$22.0^{DCa} \pm 0.41$	$22.9^{Ca} \pm 0.16$	$21.6^{DEa} \pm 0.66$	$20.7^{Ea} \pm 0.51$
	Baked	$28.4^{Ab} \pm 1.05$	$26.9^{Bb} \pm 0.62$	$24.5^{Db} \pm 1.02$	$22.9^{Ea} \pm 0.62$	$25.6^{Cb} \pm 0.56$	$23.4^{Eb} \pm 0.53$	$21.6^{Fa} \pm 0.58$
Fat,%	Steamed	$5.1^{Aa} \pm 0.34$	$4.9^{Aa} \pm 1.04$	$4.6^{Aa} \pm 0.20$	$4.5^{Aa} \pm 0.98$	$4.9^{Aa} \pm 0.28$	$4.8^{Aa} \pm 0.73$	$4.8^{Aa} \pm 0.34$
	Baked	$5.7^{Aa} \pm 1.07$	$5.4^{ABa} \pm 0.34$	$5.0^{ABa} \pm 0.84$	$4.7^{Ba} \pm 0.76$	$5.5^{ABa} \pm 0.60$	$5.2^{ABa} \pm 1.04$	$5.0^{ABa} \pm 0.65$
Ash,%	Steamed	$1.5^{CBa} \pm 0.33$	$1.7^{Ba} \pm 0.26$	$1.7^{Ba} \pm 0.35$	$2.0^{Aa} \pm 0.14$	$1.4^{Ca} \pm 0.15$	$1.4^{Ca} \pm 0.26$	$1.4^{Ca} \pm 0.18$
	Baked	$1.7^{BCDa} \pm 0.18$	$1.9^{ABCa} \pm 0.31$	$2.0^{ABa} \pm 0.41$	$2.1^{Aa} \pm 0.17$	$1.5^{Da} \pm 0.25$	$1.5^{Da} \pm 0.19$	$1.6^{DCa} \pm 0.19$

Means with different small letter superscripts in columns and capital letter superscripts in rows in each group differ significantly ($p \leq 0.05$) (n=6)

(2005) and Yasarlar et al. (2007) reported a decrease in moisture and fat content and increase in ash content on addition of wheat bran to patties. Dawkins et al. (1999) also observed decrease in moisture, protein and fat contents with addition of oat bran in chevon patties.

Moisture content of oat bran added patties was higher and protein content lower than wheat bran added patties both after steaming and baking. Composition of meat products is influenced by composition of binder and fillers added to them. Oat bran had a greater proportion of SDF (48%) as compared to wheat bran (5%) (Table 1). SDF of oat bran has been reported to have β- glucan, a hydrophilic component which binds water (Dawkins et al. 1999) resulting into higher moisture content of patties. Ash content of wheat bran added patties was significantly higher at all levels of incorporation than oat bran added patties. Higher ash content of wheat bran added patties was contributed by more ash content of wheat bran (5.8%) as compared to oat bran (2.1%) (Table 1).

pH, cooking yield and shear press value: The pH of control and bran added steamed and baked meat patties (Table 4) was higher than that of raw emulsion. Bouton et al. (1971) observed an increase in pH on cooking. Babu et al. (1994) attributed the increase in pH on cooking to increased salt concentration due to loss of moisture and change in the net charge of proteins due to denaturation. Wheat bran meat patties showed significantly higher pH than oat bran patties in both steaming and baking treatments. Higher pH of wheat bran meat balls than control (Yilmaz 2004, 2005) and slightly lower pH values of meat balls with added oat bran (Yilmaz and Daglioglu 2003) have been reported.

Baking resulted in lower cooking yield in control and bran added patties due to more loss of moisture owing to dry and severe heat. Addition of both types of bran increased the cooking yield and it increased with the level of addition (Table 4). SDF in bran is known to increase the yield by uptake of free water. Addition of wheat and oat bran has been shown to increase the yield by reducing the cooking losses in beef burgers (Mansour and Khalil 1999) and in meat balls (Yilmaz 2005, Yasarlar et al. 2007). Oat bran was more effective in increasing the cooking yield than wheat bran due to higher SDF content which could hold more water during cooking. As low as 1% cooking loss was reported in patties with 50% oat bran (Dawkins et al. 1999) due to the absorbent nature of β-glucan.

Shear press value was significantly higher in baking than steaming both in control and bran added patties (Table 4). Incorporation of wheat and oat bran increased the shear press values. Higher shear press value of oat bran added frankfurters and wheat bran added burgers has been report-

ed by Chang and Carpenter (1997) and Mansour and Khalil (1999), respectively.

Sensory scores of bran added patties: Incorporation of wheat and oat bran decreased scores of all sensory attributes progressively as the level increased both in steamed and baked patties (Table 5). Overall acceptability of steamed wheat bran meat patties significantly decreased but even at 15% level score was acceptable (7.1) whereas, in baked wheat bran added patties overall acceptability score of 6.8 was observed at 10% level. Moist heating was more acceptable than baking as wheat bran could be incorporated up to 15% level. Oat bran could be incorporated up to 10% level in both steamed and baked patties as overall acceptability scores were around 7 (like moderately). Significant decrease in all the sensory attributes of meat balls on addition of wheat and oat bran has been reported by Yasarlar et al. (2007). Similar to this study they also indicated higher sensory scores for wheat bran than oat bran meat balls.

Dietary fiber, cholesterol and SFA/USFA ratio of fatty acids: Control steamed and baked patties showed 0.35 and 0.43% TDF (Table 6). Increase in TDF in control samples could be due to addition of spice mix. TDF significantly increased on addition of bran to patties. Oat bran meat patties showed significantly lower TDF than wheat bran added patties. This was on expected lines as TDF content of wheat bran (47.1%) was much higher than oat bran (16.5%) (Table 1). Steamed patties with 15% wheat bran can meet around 1/4th of RDA of dietary fiber (20–30 g) (Dawkins et al. 1999). Wheat bran patties contained higher amount of IDF as compared to oat bran patties. High amount of IDF content in wheat bran (Ranhotra et al. 1994) and high SDF content in oat bran (Jaskari et al. 1995) have been reported. The SDF constituted 5% of TDF of wheat bran (Table 1) and during cooking, SDF increased to 10% on steaming and 8% on baking. Similarly, SDF in oat bran (48%) increased to 54% on steaming and 52% on baking. Similar changes were also observed by Hwang et al. (1995).

Table 4 pH, cooking yield and shear values of chicken meat patties with wheat and oat bran

	Cooking methods	Control	Patties with wheat bran, %			Patties with oat bran, %		
			5	10	15	5	10	15
pH	Steamed	$6.7^{Ca} \pm 0.04$	$6.8^{Da} \pm 0.03$	$6.8^{DEa} \pm 0.04$	$6.8^{Ea} \pm 0.03$	$6.6^{Aa} \pm 0.05$	$6.6^{ABa} \pm 0.03$	$6.6^{Ba} \pm 0.04$
	Baked	$6.7^{Ca} \pm 0.04$	$6.8^{Da} \pm 0.05$	$6.8^{Da} \pm 0.03$	$6.9^{Eb} \pm 0.03$	$6.6^{Aa} \pm 0.04$	$6.6^{ABa} \pm 0.04$	$6.7^{Ba} \pm 0.03$
Cooking yield, %	Steamed	$70.2^{Aa} \pm 1.72$	$72.0^{ABa} \pm 1.41$	$73.0^{Ba} \pm 1.41$	$74.0^{Ba} \pm 1.41$	$89.0^{Ca} \pm 3.74$	$94.7^{Da} \pm 1.86$	$96.0^{Da} \pm 1.41$
	Baked	$67.2^{Ab} \pm 1.17$	$69.0^{Ab} \pm 1.41$	$71.0^{Bb} \pm 1.41$	$73.0^{Ca} \pm 1.41$	$87.0^{Da} \pm 1.41$	$90.0^{Eb} \pm 1.41$	$91.2^{Eb} \pm 2.31$
Shear, kg/cm	Steamed	$1.0^{Aa} \pm 0.13$	$1.0^{ABa} \pm 0.09$	$1.1^{BCa} \pm 0.08$	$1.1^{Ca} \pm 0.05$	$1.0^{Aa} \pm 0.07$	$1.0^{BCa} \pm 0.09$	$1.1^{BCa} \pm 0.08$
	Baked	$1.1^{Ab} \pm 0.14$	$1.1^{ABb} \pm 0.10$	$1.2^{ABa} \pm 0.08$	$1.3^{Cb} \pm 0.07$	$1.1^{ABb} \pm 0.05$	$1.1^{ABb} \pm 0.07$	$1.2^{Bb} \pm 0.05$

Means with different capital letter superscripts in rows and small letter superscripts in columns within each parameter differ significantly ($p \leq 0.05$) (n=6)

Table 5 Sensory scores of chicken patties containing wheat and oat bran

	Cooking methods	Control	Patties with wheat bran, %			Patties with oat bran, %		
			5	10	15	5	10	15
Color	Steamed	$8.3^{Aa} \pm 0.51$	$8.2^{Aa} \pm 0.40$	$7.5^{Ba} \pm 0.54$	$7.1^{Ba} \pm 0.49$	$7.2^{Ba} \pm 0.40$	$7.4^{Ba} \pm 0.49$	$6.5^{Ca} \pm 0.54$
	Baked	$8.0^{Aa} \pm 0.00$	$7.8^{BAa} \pm 0.40$	$7.2^{ABCa} \pm 0.75$	$6.7^{Ca} \pm 0.81$	$7.0^{BCa} \pm 1.09$	$7.2^{ABCa} \pm 0.40$	$6.3^{Ca} \pm 1.03$
Flavour	Steamed	$8.5^{Aa} \pm 0.54$	$8.2^{ABa} \pm 0.98$	$7.5^{BCa} \pm 0.44$	$7.0^{Ca} \pm 0.54$	$7.3^{Ca} \pm 0.51$	$7.3^{Ca} \pm 0.51$	$6.0^{Da} \pm 0.63$
	Baked	$8.0^{Aa} \pm 0.00$	$7.3^{Bb} \pm .51$	$7.2^{Ba} \pm 0.40$	$6.3^{Cb} \pm 0.51$	$7.7^{ABa} \pm 0.51$	$7.2^{Ba} \pm 0.75$	$5.3^{Db} \pm 0.81$
Tenderness	Steamed	$8.3^{Aa} \pm 0.51$	$7.8^{ABa} \pm 0.75$	$7.3^{BCDa} \pm 0.41$	$6.8^{Da} \pm 0.51$	$7.5^{BCa} \pm 0.54$	$7.2^{Da} \pm 0.40$	$6.0^{Ea} \pm 0.00$
	Baked	$8.0^{Aa} \pm 0.00$	$7.5^{ABCa} \pm 0.54$	$7.3^{BCa} \pm 0.51$	$6.5^{Da} \pm 0.54$	$7.8^{ABa} \pm 0.40$	$7.2^{Ca} \pm 0.75$	$5.5^{Ea} \pm 0.54$
Juiciness	Steamed	$8.5^{Aa} \pm 0.83$	$7.7^{Ba} \pm 0.81$	$7.4^{Ba} \pm 0.49$	$7.0^{Ba} \pm 0.65$	$7.5^{Ba} \pm 0.54$	$7.2^{Ba} \pm 0.40$	$5.8^{Ca} \pm 0.40$
	Baked	$8.0^{Aa} \pm 0.00$	$7.2^{BCa} \pm 0.40$	$6.7^{Cb} \pm 0.51$	$6.5^{Ca} \pm 0.54$	$7.5^{ABa} \pm 0.54$	$6.7^{Ca} \pm 1.03$	$5.7^{Da} \pm 0.51$
Texture	Steamed	$8.0^{Aa} \pm 0.89$	$8.0^{Aa} \pm 0.89$	$7.3^{Ba} \pm 0.41$	$7.0^{Ba} \pm 0.31$	$7.3^{ABa} \pm 0.51$	$7.3^{ABa} \pm 0.51$	$6.0^{Ca} \pm 0.00$
	Baked	$8.0^{Aa} \pm 0.00$	$7.3^{Ba} \pm 0.51$	$6.7^{DCa} \pm 0.51$	$6.3^{Da} \pm 0.51$	$7.5^{ABa} \pm 0.54$	$7.0^{BCa} \pm 0.65$	$5.5^{Ea} \pm 0.40$
Overall acceptability	Steamed	$8.2^{Aa} \pm 0.75$	$7.9^{ABa} \pm 0.66$	$7.3^{Ca} \pm 0.41$	$7.1^{Ca} \pm 0.37$	$7.3^{BCa} \pm 0.51$	$7.3^{BCa} \pm 0.40$	$5.8^{Da} \pm 0.40$
	Baked	$8.0^{Aa} \pm 0.00$	$7.8^{Aa} \pm 0.40$	$6.8^{Ba} \pm 0.40$	$6.3^{Bb} \pm 0.40$	$7.8^{Aa} \pm 0.40$	$6.8^{Ba} \pm 0.75$	$5.3^{Ca} \pm 1.03$

Means with different small letter superscripts in columns and capital letter superscripts in rows in each group differ significantly ($p \leq 0.05$) (n=6)

Table 6 Dietary fiber, cholesterol, fatty acid content and SFA/USFA ratio of wheat and oat bran added chicken meat patties

	Control patties		Patties with wheat bran, %		Patties with oat bran, %	
	Steamed	Baked	15 Steamed	10 Baked	10 Steamed	10 Baked
TDF, %	$0.35^{D} \pm 0.15$	$0.43^{D} \pm 0.19$	$6.3^{A} \pm 0.59$	$5.0^{B} \pm 0.54$	$1.3^{C} \pm 0.23$	$1.3^{C} \pm 0.20$
SDF, %	$0.24^{B} \pm 0.08$ (69)	$0.25^{B} \pm 0.09$ (58)	$0.63^{A} \pm 0.41$ (10)	$0.39^{BA} \pm 0.15$ (8)	$0.68^{A} \pm 0.09$ (54)	$0.67^{A} \pm 0.11$ (52)
IDF, %	$0.11^{D} \pm 0.07$ (31)	$0.18^{D} \pm 0.09$ (42)	$5.6^{A} \pm 0.20$ (90)	$4.6^{B} \pm 0.43$ (92)	$0.57^{C} \pm 0.14$ (46)	$0.63^{C} \pm 0.12$ (48)
Cholesterol, mg/100g	$70.8^{B} \pm 3.45$	$78.1^{A} \pm 2.60$	$54.8^{E} \pm 2.48$	$64.7^{C} \pm 4.17$	$56.4^{DE} \pm 2.42$	$61.1^{DC} \pm 1.97$
SFA*	35.4	35.1	34.9	34.3	33.9	32.8
USFA*	64.6	64.9	65.1	65.7	66.2	67.2
SFA/USFA	1 : 1.8	1 : 1.8	1 : 1.9	1 : 1.9	1 : 2.0	1 : 2.1

Raw chicken meat: Cholesterol= 60.5 mg/100g, SFA= 36.2%, USFA=63.8%, SFA/USFA ratio=1:1.7
*Per cent of total fatty acids Means with different superscripts in a row differ significantly ($p \leq 0.05$) (n=3) Figures in parentheses indicate per cent of total dietary fiber TDF, SDF, IDF, SFA, USFA: As in Table 1

Cholesterol content 60.5 of raw chicken meat increased to 70.8 and 78.1 mg/100g in steamed and baked patties respectively (Table 6). Significant decline in cholesterol content was observed on addition of wheat and oat bran to patties. Higher cholesterol content was observed in baked patties due to greater moisture loss. Decrease in cholesterol content in oat bran added patties has earlier been reported (Dawkins et al. 1999). Mansour and Khalil (1999) reported that decrease in cholesterol content was proportional to the increase in the level of wheat bran to beef burgers.

Raw meat had 36.2% SFA and 63.8% USFA (Table 6). Cooking increased USFA and decreased SFA content. Addition of bran further reduced the SFA. SFA/USFA ratio of raw meat was 1:1.7 which increased on cooking and further on addition of bran to patties. Highest SFA/USFA ratio was observed in oat bran patties followed by wheat bran and control patties. Cooking has been reported to increase the USFA content in beef patties (Janicki and Appledorf 1974) and in chicken patties (Sharma et al. 2005). Dawkins et al. (1999) observed that chevon meat patties formulated with oat bran produced a higher percentage of USFA.

Conclusion

Oat and wheat bran can be incorporated up to 10 and 15% level, respectively for the preparation of steamed and baked chicken patties. The acceptability of steamed chicken patties was better than baked ones. Incorporation of bran improved the fiber and reduced the cholesterol content of meat products. Wheat bran patties have low cholesterol and can meet up to 1/4th of RDA of dietary fiber.

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