Quality characteristics of beef patties extended with date fiber

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Abstract

The United Arab Emirates produce 13% of the world date production. In addition to direct consumption, dates are processed in date paste and date syrup which incorporated in several food products. Date fiber (DF), by-product produced during date syrup production, contains 52% total dietary fiber could be considered for food fortification. The effect of different levels of DF (0, 5, 10, and 15%) on the quality characteristics (moisture, fat retention, water holding capacity, cooking yield, instrumental color and texture) and sensory properties of beef patties (BP) were evaluated. BP formulated with date fiber and control had similar instrumental texture and internal color. Incorporating DF increased moisture content, water holding capacity, fat retention and cooking yield significantly. Replacing up to 15% of patty formula with DF produced browner, tender, juicier, firmer and less fatty beef patties without affecting appearance, aroma and flavor. Healthier and high quality BP was produced by replacing 15% of the patty formula with date fiber.

Introduction

United Arab Emirates produce 13% of the world date production [1]. Date is consumed as fresh fruit at all repining stages or processed to produce date paste and date syrup that incorporated in different food products. The dietary fiber content of fresh dates ranged from 6.4 to 11.4% depending on the stage of ripening [2; 3]. Date fiber (DF) is a by-product remained after date syrup extraction and used mainly as animals feed DF contains 51.5% total dietary fiber (5.1% soluble and 46.6% insoluble). DF possesses a hypolipidmic effects, addition of 5% DF to the diet of rats fed cholesterol, significantly increased HDL, lessened the rise in plasma LDL and increased the HDL/LDL ratio [4]. DF was used as functional ingredient in yogurt [5] and baked products [6; 7].

Meats do not contain fiber, fiber was used in cooked meat products to increase cooking yield, improve texture and formulation of reduced-fat meat products. Rye bran, inner pea fiber, inulin, lemon albedo, cereal and fruit fiber were used as a fat substitute in meat products [8; 9]. The main objective of the study was to use date fiber as functional ingredient in meat products to produce functional meat products. Specific objectives were to investigate the effect of replacing patties formula with different levels of hydrated date fiber on quality (moisture, fat content, cooking yield, instrumental color and texture) and sensory characteristics of beef patties (BP).

Materials and methods

Fresh lean beef and kidney fat were obtained from a local market. Lean beef samples, boneless rounds, were trimmed from fat and visible connective tissue. The fat content of the lean and fat portions were determined prior to the manufacture of beef patties. Crude date fibers were obtained from Al-Saad date factory (Al-Ain, UAE). The lean beef, kidney fat and date fiber were used to formulate the beef patties. The control patties were formulated to contain 65% lean beef and 20% kidney fat. Different levels of patty formula (5, 10 and 15%) were substituted with date fiber to formulate BP. The DF was hydrated with water (1:2 w/v). All the formulations contained 2g salt; 1.5g spices mixture, 1g sugar, 0.2g tripolyphosphate, 0.3g ascorbic acid and 10g water.

Fat, moisture, pH and water holding capacity (WHC) were determined for uncooked patties using standard procedures [10]. Fat and moisture were determined for cooked patties. Fat retention during cooking and cooking yield was calculated. Instrumental color values [CIE L (lightness), a (redness), and b (yellowness)] were measured with a ColorFlex Hunter Color Lab (model No. 45/0, Reston, VA., USA). For textural measurements (hardness, cohesiveness, and springiness) were determined. Samples were compressed for 5 mm at 10 mm/min using Texture Analyzer TA 39 (Model 7113, Pinnacles West Harlow. Essex, UK).

Eight panelists (faculty and staff members at Al-Maqam Campus, UAE University) were recruited and trained to evaluate beef patties. Cooked samples were cut into 4 equal-sized wedges and served at approximately 50C and assigned randomly to each panelist. Samples were presented in paper plates coded with 3-digit random numbers. Patties were evaluated for appearance, color, aroma, tenderness, juiciness,

flavor, texture, and fat content using an 8-point horizontal line scale (1=extremely poor, light, devoid of beef aroma, tough, dry, devoid of ground beef flavor, soft-textured, and low fat content and 8= extremely excellent, dark, intense of beef aroma, tender, juicy, intense of ground beef flavor, firm-textured, and high fat content). Panelists were provided with water to clean their palates between samples.

Results and discussion

Moisture and fat content of raw and cooked patties, WHC of raw patties and cooking yield are presented in table 1. Moisture and fat contents in raw and cooked patties varied according to the formulations as expected. Moisture content of raw and cooked patties was significantly ($p \leq 0.05$) affected by patty formula. Raw and cooked patties formulated with DF had higher ($p \leq 0.05$) moisture content compared to control. Patties' moisture content increased with increasing date fiber level. This could be attributed to the water binding ability of the fiber [11]. Heat process might result in protein denaturation and starch hydration which partially affect the binding ability of date fiber. Water holding capacity of BP formulated with DF were significantly ($p \leq 0.05$) higher than control. Increasing date fiber resulted in increasing the WHC. The water binding activity of fiber was reported by several investigators [8; 12].

Fat content of raw patties decreased with increasing date fiber. Patties formulated with replacing patty formula with date fiber (BP) had similar fat content as control. Replacing patty formula with date fiber resulted in higher ($p \leq 0.05$) fat retention compared to control. Increasing date fiber resulted in significant ($p \leq 0.05$) increase in fat retention in cooked patties. Similar results indicated that fat retention was higher in pea fiber formulations compared to the regular patties [8].

Cooking yield was increased ($p \leq 0.05$) in patties formulated with date fiber. Increasing fiber level of BP above 5% had no effect on cooking yield.

Table 1. Effect of date fiber on moisture, fat content, water holding capacity and cooking yield of beef patties[1]

Patty	Moisture (%)		Fat (%)		Fat retention (%)	WHC (%)	Cooking yield
	Raw	Cooked	Raw	Cooked			
Control	62.14d	52.26d	21.76a	19.73a	68.45d	61.82c	70.11b
DF-5%	63.44c	54.02c	20.53b	20.54a	72.36c	65.22b	71.51a
DF-10%	65.84b	57.94b	19.84bc	19.88a	72.28b	69.36a	72.05a
DF-15%	68.21a	61.45a	18.26c	19.75a	77.41a	70.27a	72.56a
LSD	0.95	1.05	0.82	1.16	1.10	0.95	1.35

[1] Each value is the mean of three replicates and two determinations per replicate
[2] Means in the same column with different letters are significantly different ($p \leq 0.05$).

Hunter Color Lab values (L*, a* and b*) for external and internal cooked patties and texture measurements (Hardness, Springiness and Cohesiveness) formulated by replacing patty formula with DF are presented in Table 2. The external L^* values (lightness) of patties were significantly ($p \leq 0.05$) affected by date fiber level. Lighter external color was observed for all BP compared to control which could be attributed to the dilution of the meat pigment and in turn, increase the L^* values. These results are in consistent with the results reported an increase of L^* values of light bologna and fat-free frankfurters formulated with oat fiber [17]. Patties formulated with date fiber had significantly lighter internal L*.
The external color a^* (redness) and internal color b* (yellowness) of the BP were not affected by date fiber. Data indicated that texture characteristics of BP were not affected by date fiber.

Table 2. External and internal instrumental color and texture of patties[1]

Patty	External Color			Internal Color			Texture		
	L	L	a	b	a	b	Hardness	Springiness	Cohesiveness
Control	32.53c	44.08c	6.43a	10.24a	6.02a	18.15a	3.70a	7.29	12.09a
DF-5%	33.95b	45.13b	6.23a	10.32a	6.07a	17.98a	3.72a	7.32	12.16a
DF-10%	34.13b	45.88ab	6.13a	10.39a	6.32a	18.24a	3.79a	7.38	12.22a
DF-15%	35.33a	46.29a	6.09a	10.37a	6.52a	18.38a	3.86a	7.46a	12.32a
LSD	078	0.86	0.38	0.76	0.68	0.89	0.18	0.20	0.25

[1] Each value is the mean of three replicates and two determinations per replicate
[2] Means in the same column with different letters are significantly different ($p \leq 0.05$).

Sensory characteristics of cooked patties are presented in table 3. Patties formulated with DF were more tender and juicy than the control which might be due to retaining more water by the fiber. Similar

improvement was reported [13]. The appearance and flavor of patties containing DF were similar to the control. Patties formulated with DF were firmer and darker than control. The ratings for firmness and darkness were increased with increasing DF level. It was reported that addition of oat fiber to frankfurters increased the hardness [11]. Ratings for fattiness were significantly influenced by the DF level. As the DF level increased fattiness ratings decreased.

Table 3. Sensory properties[1] of patties as influenced by date fiber (n = 8)

Patty	Appearance	Color	Aroma	Tenderness	Juiciness	Flavor	Firmness	Fattiness
Control	6.56a	5.75d	6.32a	6.01c	6.01c	6.37a	6.11c	6.15a
DF-5%	6.55a	6.11c	6.16a	6.20b	6.21b	6.35a	6.30b	5.92b
DF-10%	6.54a	6.32b	6.15a	6.30a	6.41a	6.37a	6.47a	5.65c
DF-15%	6.39a	6.53a	6.14a	6.36a	6.45a	6.26a	6.50a	5.37d
LSD	0,26	0.20	0.15	0.17	0.18	0.17	0.15	0.20

[1] 8-point horizontal scale

[2] Means in the same column with different letters are significantly different ($p \leq 0.05$).

Conclusion

Results indicated that, incorporation of date fiber produced tender, juicy, firm patties with higher cooking yield compared to control patties.

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