Vet. Med. J., Giza. Vol. 59, No.4. (2011): 123-132

EFFECT OF FAT LEVEL AND CORN FLOUR ON QUALITY OF CAMEL MEAT BURGER

Hayam A. Mansour
Department of Food Hygiene and Control, Faculty of Veterinary Medicine, Cairo University

Received: 20/8/2011
Accepted: 21/8/2011

SUMMARY

Effect of fat level (5, 10 and 20%) and corn flour (0, 2 and 5%) on chemical composition, physicochemical characteristics (cooking yield, fat retention, moisture retention, diameter reduction, thickness reduction and shrinkage percentages), color parameters, shear force and sensory attributes of camel burger were evaluated. Increase rate of addition of fat and corn flour significantly decrease moisture and protein content with increase in fat and ash percentages. Incorporation of corn flour significantly decreased the cooking yield at eat fat level. Fat retention was increased with lowering fat level. Corn flour at 2 and 5% significantly decreased fat retention in burger formulated with 10% fat. At 5% rate of addition, it was obvious that corn flour was effective in retaining moisture at low fat level burger. Fat level significantly increased reduction in burger diameter and thickness, moreover 5% corn flour significantly reduced the diameter and thickness of burger all fat levels. The lowest reduction in burger thickness was observed at 5% fat and 5% corn flour. However, 5% corn flour decreased the shrinkage of burger regardless fat level. Corn flour had no detrimental impact on sensory properties of all burger formulations with 5% corn flour increased sensory panel scores for odor in raw burger. Finally shear force values were decreased by increasing the fat level up to 20%, and 5% corn flour significantly increase shear force at each fat level.

INTRODUCTION

Camel meat is healthier as they characterized by having less fat as well as less cholesterol in fat than other meat (Al-Ani, 2004; Dawood and Alkanhal, 1995; Elfaer et al., 1991; Elgasim and Alkanhal, 1992; Elgasim et al., 1987). The meat of young camels (below 3 years) is comparable in taste and texture to beef (Dawood, 1995). Traditionally, camel meat comes mostly from seven years animals that are primarily kept for milk, racing, and transportation rather than form meat production (Kurtu, 2004). Therefore, the general consumers view is that camel is unacceptably tough. However, camel meat processing increased the tenderness, taste and palatability of the products (Mansour and Ahmed, 2000).

Dietary fat plays number of essential rules in the human body. It is necessary for the absorption of vitamins A,D,E, K and other fat soluble substances, it provides the essential fatty acids required for the production of some hormones. However, nowadays many consumers are concerned about the amount of fat in their diets (Yankelovich, 1985) because excessive fat intake is associated with various diseases including obesity, cancers and coronary heart diseases (Hooper et al., 2001; Rothstein, 2006), therefore, many consumers limit their dietary intake of fat and cholesterol (Burke, 1987).

Fats in processed meat products perform functional and organoleptic quality attributes including, tenderness, juiciness and flavor(Pearson and Gillett, 1999; Jimenez-Colmenero, 2000;Gujral et al., 2002; Tokusoglu and Unal, 2003). There is evidence that reducing fat level in processed meat products results in reduction of product quality and palatability (Desmond et al., 1998; Khalil, 2000; Serdaroğlu and Sapanci- Özsumer, 2003; Yilmaz and Dağlioglu, 2003), therefore, the goal of meat processors is to produce meat products with low-fat content without compromising sensory and texture characteristics of the processed meat products (Zhang et al.,2010).

Plant proteins such as soybean (Gujral et al., 2002; Pietrasik and Duda, 2000; Serdaroğlu and Sapanci-Özsümer, 2003; Trout et al., 1992), sunflower protein (Wills and Rabirullah, 1981), wild rice (Minerich et al., 1991), buckwheat protein (Bejesano and Corke, 1998), wheat germ proteins (Gnanasambandam and Zayas, 1992), corn germ protein (Linn and Zagas, 1987; Zagas and Linn, 1988) and common bean flour (Dzudie et al., 2002) have been used as binders and extenders in comminuted meat products . Not much work has been done on corn flour as a binder in ground meat products such as patties and burgers. The objective of the present study was to determine the effect of rate of addition of corn flour (2 and 5%) to camel meat burgers formulated with different fat levels (5, 10 and 20%).

MATERIALS AND METHODS

Preparation of raw materials

Fresh chuck meat (76.42% moisture, 18.73% protein, 3.87 fat and 0.98% ash) of 3-4 years old camels (Camelus dromedarius) slaughtered at Elbasateen municipal slaughterhouse, Cairo Egypt was used in the experiment. Camel meat was purchased from a local supplier 24 hours after slaughter, trimmed from visible fat and connective tissues and kept frozen at -18°C. Fresh abdominal fat from the same animals was purchased; washed and kept frozen at -18°C. Corn flour (9.45% protein and 1.5% fat)as well as other ingredients e.g. common salt, sodium tripolyphosphate and spices were provided from local suppliers in Cairo.

Burger production

The experiment was á 3×3 factorial design with three levels of fat (5, 10 and 20%) and three levels of corn flour (0, 2 and 4%).

In the next day post-freezing at -18°C, both of lean and fat were minced separately using Fama (Fabbrica Attrezzature Macchine Alimentrac, Rimini-Italy) meat mincer through a 5 mm mincing plate. Seven burger formulations (Table 1) were produced. Frozen minced meat was firstly transferred to a paddle mixer, where the dry ingredients (1.7% common salt, 0.03% sodium polyphosphates, and 0.5% seasonings) were slowly added as powders while mixing. Afterwards cold water was incorporated, and then minced fat was added during mixing. The addition of ingredients took less than 5 minutes and the final temperature of batter varied between -5 to -7°C. The batter was manually formed into discs of 75 grams using manual former (Fac Affecttatrici).Burger discs were placed on plastic trays and wrapped with polyethylene film and frozen at -18°C until further analysis.

Table (1): Camel' burger formulations

Treatment	Ingredients			
	Lean	Fat	Water	Corn flour
$5^{A}/0^{B}$	85.00	5.00	8.00	-
5/2	83.00	5.00	8.00	2.00
5/5	80.00	5.00	8.00	5.00
10/0	80.00	10.00	8.00	-
10/2	78.00	10.00	8.00	2.00
10/5	75.00	10.00	8.00	5.00
20/0	70.00	20.00	8.00	-
20/2	68.00	20.00	8.00	2.00
20/5	65.00	20.00	8.00	5.00

A Fat level (%),B Corn flour level (%)

Proximate analysis

Moisture, fat, protein and ash percentages were determined following the procedures of AOAC (1995).

Color evaluation

Color was determined on three raw burgers patties per formulation using a Minolta Chroma Meter CR410(Minolta Co. Ltd., Japan) calibrated with a white plate and light trap. Color was expressed according to the Commission International de L'Eclairage (CIE),1976 and reported as L*(lightness),a*(redness) and b*(yellowness).

Cooking procedures and physicochemical characteristics

Burger patties were thawed at 4°C overnight and cooked in a preheated electric grill for 2.5 minutes on each side to reach 70°C core temperature (hypodermic probe-type thermocouple (Model HVP-2-21-V2-TG- 48-OCT-M Omega, Stanford, CT). All cooking measurements were done on three replicates per treatment.

Physicochemical characteristics

Cooking yield

Cooking yield of burger patties was determined by the difference in weight before and after cooking (Piñero et al., 2008).

$$\text{Cooking yield \%} = \frac{\text{Cooked weight}}{\text{Raw weight}} \times 100$$

Moisture retention

The moisture retention value represents the amount of moisture retained in the cooked product/ 100g sample. The percentage of moisture retention was calculated according to the equation of El-Magoli et al. (1996) as follows

$$\text{Moisture retention \%} = \frac{\text{Cooking yield X Moisture \% in cooked sample}}{100}$$

Fat retention

The fat retention value represents the amount of fat retained in the cooked product/ 100g raw sample. The percentage of fat retention was calculated according to Murphy et al. (1975) as follows

$$\text{Fat retention \%} = \frac{\text{Cooking weight x Fat \% in cooked sample}}{\text{Raw weight x Fat \% in raw sample}} \times 100$$

$$\text{Thickness reduction \%} = \frac{\text{Thickness of raw sample - Thickness of cooked sample}}{\text{Thickness of raw sample}} \times 100$$

$$\text{Shrinkage \%} = \frac{(\text{Raw thickness} - \text{Cooked thickness}) + (\text{Raw diameter} - \text{Cooked diameter})}{\text{Raw thickness} + \text{Raw diameter}} \times 100$$

Diameter reduction, thickness reduction and shrinkage percentages

The reduction in burger patties diameter and thickness as well as shrinkage percentage were determined using the equations of Serdaroğlu and Değirmencioğlu (2004) as follows

$$\text{Diameter reduction \%} = \frac{\text{Diameter of raw sample} - \text{Diameter of cooked sample}}{\text{Diameter of raw sample}} \times 100$$

Sensory analysis

Sensory analysis was performed by a 9 panelists from the Department of Food Hygiene and Control, Faculty of Veterinary Medicine, Cairo University, where burger was subjected to sensory evaluation of texture, juiciness, flavor and overall acceptability. An eight point scale was used where, 8=extremely tender, juicy, intense flavor, acceptable and 1=extremely tough, dry, devoid of flavor, unacceptable. Water and bread served for cleaning the mouth between samples. Prior to the analysis panelists were trained in the definition and intensities of the investigated parameters.

Shear force

Samples were tempered to 25^{0}C for 1hour, cut into cross sections(1cm×1cm) and sheared using Instron Universal Testing Machine (model 2519-105,USA) at a crosshead speed of 200 mm/min. Mean values for samples (n=10) were expressed in terms of peak force (kg/f).

Statistical analysis

Data were subjected to analysis of variance and Tukey multiple comparisons tests using SPSS statistics 17.0 for windows. Significance was determined by the Least Significant Difference test. Main effects were considered significance at P<0.05.

RESULTS AND DISCUSSION

Proximate composition

Proximate chemical analysis of camel burger showed that rate of addition of fat as well as corn flour induced a slight to significant decrease in moisture and protein content with increase in fat and ash content. The changes in the proximate chemical composition were evident at higher rates of fat (20%). Although, the ash content increased with increase the rate of addition of corn flour, the changes were non-significant (Table 2). Serdaroğlu and Degirmencioğlu (2004) reported a decrement in moisture content by addition of 4% corn flour in meat balls formulation.

Physicochemical characteristics

Corn flour incorporation significantly decrease cooking yield at each fat level (P<0.05) (Table 3). Cooking yield were the lowest (57.59%) for the treatment formulated with 20% fat and 5% corn flour and the highest (73.87%) for the treatment formulated with 5% fat-control. Such results disagree with that obtained by Serdaroğlu and Değirmencıöğlu (2004) for beef meatballs. Moreover, fat retention increased with decreased fat level in burger formulation (P<0.05).Both corn flour treatments (2or 5%) significantly decrease fat retention in burgers formulated with 10% fat meanwhile, a decrement in fat retention was recorded for treatment formulated with 5% fat and 5% corn flour (P<0.05). As fat content increase, the mean free distance between fat droplets decreases which causes coalescence of fat and then leaking from the product (Tornberg et al., 1989). Keeping fat within the matrix of meat products during processing is necessary for ensuring sensory quality and acceptability. High collagen content in camel meat could explain the low cooking yield as it absorbs moisture initially then upon heating, collagen fibers shorten by 1/3 its original length which releases fat and moisture from its structure. Product formulation and processing methodology are key determinants of fat loss and weight loss during cooking of products such as sausages and burgers (Sheard et al., 1989).

Incorporation of 5% corn flour was effective in retaining moisture at 5% fat level, whereas 2% corn flour and 20% fat treatment showed the lowest moisture retention (39.13%)(P<0.05). Fat level significantly increased reduction in burger diameter and thickness (P<0.05). Concerning diameter reduction, similar results were obtained by Berry, (1993); Serdaroğlu and Değirmencıöğlu (2004) however, Trout et al. (1992) found no effects of fat level on changes in burger diameter. Significant reduction in burger diameter was detected in treatments incorporated with 5% corn flour at all fat levels and in 2% corn flour and 5% fat level treatment ($P<0.05$). Burgers formulated with 20% fat and no corn flour had the highest reduction in diameter, however, formulation with 10% fat and 5% corn flour had the lowest value. Serdaroğlu and Değirmencıöğlu (2004) found no effect of corn flour on diameter reduction of beef meatballs. The highest reduction in burger thickness (24.3%) was recorded in samples formulated with 20% fat and 5% corn flour, however, the lowest value (10%) was for 5% fat and 5% corn flour formulated burger. A lowered reduction in thickness of meatballs formulated with corn flour at 5% and 10% fat levels was recorded by Serdaroğlu and Değirmencıöğlu (2004).

Fat level affected burger shrinkage, reducing the fat level from 20% to 5% significantly decreased shrinkage ($P<0.05$). Corn flour was not effective in reducing shrinkage at 2% incorporated burger. However, at 5% it lowered shrinkage in burgers regardless of the fat level ($P<0.05$) (Table 3). Serdaroğlu and Değirmencıöğlu (2004) concluded that adding corn flour into beef meatball formulations (2 or 4%) had no effect on shrinkage at fat levels 10or 20%.

Sensory evaluation

Ratings by the sensory panelists showed that burger formulated with 10% fat with or without corn flour had the most significantly higher flavor score ($P<0.05$)(Table 4). No detrimental effect of adding corn flour was observed on burger flavor since low amounts were used.

Table (2): Proximate chemical composition (%) of raw burgers formulated with different levels of fat (5-20%) and corn flour (0-5%)

Treatment	Moisture	Protein	Fat	Ash
$5^{A}/0^{B}$	69.7^{a}	17.22^{a}	$8.88^{a,b}$	2.28^{a}
5/2	67.8^{b}	15.83^{b}	$7.55^{a,b}$	2.46^{a}
5/5	63.4^{c}	$15.04^{b,c}$	6.37^{b}	2.64^{a}
10/0	$68.4^{a,b}$	15.7^{b}	10.42^{a}	2.57^{a}
10/2	64.8^{c}	$14.79^{b,d}$	10.3^{a}	2.68^{a}
10/5	61.3^{d}	$14.04^{c,d}$	$9.46^{a,b}$	2.97^{a}
20/0	56.7^{e}	$13.83^{c,d,e}$	23.89^{c}	2.87^{a}
20/2	54.1^{f}	12.7^{e}	23.25^{c}	3.00^{a}
20/5	53.8^{f}	11.45^{f}	20.68^{c}	3.20^{a}

Table (3): Physicochemical characteristics of burgers formulated with different levels of fat (5-20%) and corn flour (0-5%)

Treatment	Cooking yield	Fat retention	Moisture retention	Diameter reduction	Thickness reduction	Shrinkage (%)
$5^{A}/0^{B}$	73.87^{a}	97.00^{a}	$43.72^{a,b}$	$15.05^{a,b}$	11.11^{a}	14.75^{a}
5/2	71.68^{b}	$86.99^{a,b}$	$44.2^{a,b}$	$12.37^{c,d}$	11.11^{a}	$12.66^{b,c}$
5/5	$70.00^{b,c}$	$63.00^{c,d}$	48.90^{a}	$12.57^{c,d}$	10.00^{a}	$11.48^{b,c}$
10/0	73.80^{a}	$78.39^{b,c}$	$43.56^{a,b}$	$14.88^{a,b}$	17.14^{b}	$14.95^{a,d}$
10/2	69.40^{c}	$51.71^{d,e}$	$43.56^{a,b}$	$13.80^{a,c}$	15.48^{b}	$13.55^{a,b}$
10/5	65.04^{d}	$56.54^{d,f}$	$46.00^{a,b}$	10.98^{d}	22.22^{c}	11.23^{c}
20/0	73.77^{a}	$42.76^{e,f,g}$	$45.04^{a,b}$	19.00^{e}	22.22^{c}	19.27^{e}
20/2	65.45^{d}	29.90^{g}	39.13^{b}	18.98^{e}	23.00^{c}	$18.59^{e,f}$
20/5	57.59^{e}	27.55^{g}	$41.85^{a,b}$	16.48^{b}	24.30^{c}	$16.89^{d,f}$

Table (4): Sensory evaluation of burgers formulated with different levels of fat (5-20%) and corn flour (0-5%)

Treatment	Raw burger			Cooked burger			
	color	Odor	Overall acceptability	Flavor	Juiciness	Tenderness	Overall acceptability
$5^{A}/0^{B}$	4.50^{a}	5.00^{a}	6.50^{a}	$6.60^{a,b}$	6.60^{a}	6.80^{a}	6.80^{a}
5/2	4.50^{a}	$6.00^{a,b}$	$6.25^{a,b}$	$6.60^{a,b}$	6.20^{a}	6.60^{a}	6.40^{a}
5/5	$5.50^{a,b}$	6.50^{b}	5.00^{c}	$6.4^{a,b}$	6.60^{a}	6.60^{a}	6.60^{a}
10/0	$6.00^{b,c}$	$5.25^{a,b}$	$6.00^{a,d}$	7.00^{a}	6.20^{a}	6.40^{a}	6.60^{a}
10/2	$5.75^{a,c,e}$	$6.00^{a,b}$	$5.75^{b,d,c}$	7.00^{a}	6.00^{a}	5.80^{a}	6.20^{a}
10/5	$5.75^{a,c,d}$	$6.00^{a,b}$	5.00^{c}	$6.60^{a,b}$	6.40^{a}	6.60^{a}	6.50^{a}
20/0	$6.00^{b,d,e}$	$5.75^{a,b}$	$6.00^{a,c}$	6.00^{b}	5.80^{a}	6.20^{a}	6.80^{a}
20/2	$5.75^{a,c,e}$	$6.00^{a,b}$	$6.00^{a,e}$	$6.20^{a,b}$	5.60^{a}	6.20^{a}	6.80^{a}
20/5	$6.00^{b,d,e}$	6.50^{b}	6.50^{a}	$6.40^{a,b}$	6.40^{a}	6.40^{a}	6.20^{a}

Means with different superscripts in the same column indicate significant differences ($P < 0.05$)
A Fat level (%), B Corn flour level (%)

Table (5): Shear force and color parameters of burgers formulated with different levels of fat (5-20%) and corn flour (0-5%)

Treatment	Shear force (kg/f)	Color Parameters		
		L*	a*	b*
$5^{A}/0^{B}$	$0.99^{a,b}$	46.66^{a}	$11.72^{a,b}$	11.54^{a}
5/2	$1.04^{a,c}$	46.81^{a}	$11.83^{a,c}$	$10.59^{b,c}$
5/5	$1.09^{c,d,e}$	46.56^{a}	13.80^{d}	12.92^{d}
10/0	0.96^{b}	48.67^{b}	$10.79^{a,e}$	10.17^{b}
10/2	$1.06^{a,d}$	48.13^{b}	9.81^{e}	10.44^{b}
10/5	1.15^{e}	48.81^{b}	$12.81^{c,d}$	$11.08^{a,c}$
20/0	0.88^{f}	51.00^{c}	$11.90^{b,c}$	13.59^{e}
20/2	$1.12^{d,e}$	50.02^{d}	$11.41^{a,b}$	13.71^{e}
20/5	$1.09^{c,d,e}$	51.06^{c}	13.53^{d}	$13.14^{d,e}$

Means with different superscripts in the same column indicate significant differences ($P < 0.05$)
A Fat level (%), B Corn flour level (%)

Fat level had no effect on texture, juiciness and overall acceptability of camel burger. Several studies found that low fat patties were lower in juiciness, texture and overall acceptability (Berry and Wergin, 1993; Tory et al., 1999) however; Serdaroğlu and Değirmencıoğlu (2004) recorded no effect of fat level on meatball juiciness. Low fat and moisture retention percentages could explain the absence of fat level effect on juiciness and overall acceptability scores. Addition of 5% corn flour in 5% fat incorporated burger significantly increased odor of raw burger ($P<0.05$)(Table 4). Color scores for raw burgers were significantly increased by increasing fat level and overall acceptability decreased with the addition of corn flour (2 or 5%) at 5% and 10% fat levels ($P<0.05$).

Shear force and color evaluation

Average shear force values were significantly decreased by increase fat level to 20% either with 0 and 2% corn flour. Since fat makes an important contribution to the texture of meat products it was expected that increased fat levels would decrease shear force value. On the other hand, treatments incorporated with 5% corn flour were significantly higher in shear force value at each fat level. This increment in shear force value was observed for 2% corn flour at both 10 and 20% (Table5).The lowest shear force value (0.88kg/f) was recorded for 0%corn flour and 20% fat samples meanwhile the highest value (1.15kg/f) was for 5% corn flour and 10% fat. The sensory panel assessment did not support the objective measurement of burger tenderness; it seems that difference in shear force between treatments has been to obvious that were not able to be detected by the panelists. The fat level significantly affected L* and b* values. Burgers formulated with 2% fat were lighter and yellowish than samples formulated with 5% and 10% fat ($P<0.05$). Increasing fat level probably resulted in dilution of the myoglobin, while reducing the fat content caused a significant decrease in the lightness of frankfurters (Grehan et al., 2000) and meatballs (Serdaroğlu, 2006). Corn flour addition at 5% was effective in increasing a* value at each fat level moreover at 5 and 10% treatments it could also increase b* value ($P<0.05$).

In conclusion, incorporation of 5% corn flour in formulation of camel meat burger could retain moisture and fat, lowered the shrinkage percentage and increased a* and b* value but increased the shear force values and diameter reduction.

REFERENCES

Al-Ani, F.K. (2004): Camel management and diseases (1st ed.) Amman, Jordan: AL – Shraq Printing Press & Dar Ammar Book Publishing.

AOAC "Association of Official Analytical Chemists"(1995): Official Methods of Analysis.16th ed. Association of Official Analytical Chemists. Washington, DC,USA.

Bejesano, F.P. and Corke, H. (1998): Amarantus and back wheat protein concentrate effects on an emulsion-type meat products. Meat Science, 50 (3): 343-353.

Berry, B.W. and Wergin, W.P. (1993): Modified Pre-gelatinized potato starch in low fat ground beef patties. Journal of Muscle Foods, 4: 305-320.

Berry, B.W.J. (1993): Fat Level and freezing temperature affect sensory, shear, cooking and compositional properties of ground beef. Journal of Food science, 58 (34-37): 48.

Burke (1987): The Consumer Climate for Meat Industry. Prepared for the National Live Stock and Meat Board, Chicago, IL, and the American Meat Institute, Washington, D.C. Burke Marketing Research, Cincinnati, OH.

CIE 'Commission International de L'Eclairage' (1976): Official recommendations on uniform color spaces. Color difference equations and metric color terms,Suppl.No.2.CIE Publication No.15 Colorimetery. Paris.

Dawood, A. (1995): Physical and sensory characteristics of Najdi camel Meat. Meat Science, 39: 59-69

Dawood, A. and Alkanhal, M.A. (1995): Nutrient Composition of Najdi camel meat Science, 39: 71-78

Desmond, E.M., Trou, D.J. and Buckley, D.J. (1998): The effects of tapioca starch , oat fibre and whey protein on the physical and sensory properties of low – fat beef burgers. Lebensmittelwiss . U – Tecchnolog, 31: 653-657

Dzudie, T.; Scher, J. and Hardy, J. (2002): Common bean Flour as an extender in beef sausages . Journal of Food Engineering , 52: 143-147 .

El-Faer, M.Z.; Rawdah, T.N.; Attar, K.M. and Dawson, M.V. (1991): Mineral and proximate composition of the meat of the one-humped camel (Camelus dromedaries). Food Chemistry, 42: 139–143.

Elgasim, E.A. and Alkanhal, M.A. (1992): Proximate composition, amino acids and inorganic minerals content of Arabian camel meat: comparative study. Food Chemistry, 45: 1–4.

Elgasim, E.A.; Elhag, G.A. and Elnawawi, F.A. (1987): Quality attributes of camel meat. 2nd Congress report, The Scientific Council, King Fasil University, Alhash, KSA.

El-Magoli, S.B.; Laroia, S. and Hansen, P.T.M. (1996): Flavor and texture characteristics of low fat ground beef patties formulated with whey protein concentrate. Meat Science, 42 (2): 179-193.

Fbabasanbandam, R. and Zayas , J.F. (1992): Functionality of wheat germ protein in comminuted meat products as compared with corn germ and soy proteins . Journal of Food science, 57: 829-833.

Gnanasambandam, R.; and Zayas, J.F. (1992): Functionality of wheat germ protein in comminuted meat products as compared with corn germ and soy proteins. Journal of Food Science, 57:829-833.

Grehan, C.M.; Hughes, E.; Tory, D.J. and Buckley, D.J. (2000): Effects of fat level and maltodextrin on the functional properties of frankfurters formulated with fat 5%,12%,30%. Meat Science, 55: 463-469.

Gujral, H.S.; Kaur, A.; Singh, N. and Sldhi, S.N. (2002): Effect of liquid whole egg , fat and textured soy protein on the protein on the textural and cooking properties of raw and baked patties from goat meat. Journal of Food Engineering, 53: 377-385.

Jimenez-Colmenero, F. (2000): Relevant factors in strategies for fat reduction in meat products. Trends in Food Sci. Tec., 11: 56- 66.

Kadim, I.T.; Mahgoub, O. and Purchas, R.W. (2008): A review of the growth, and of the carcass and meat quality characteristics of the one–humped camel (Camelus dromedaries). Meat Science, 80: 555 – 569.

Khalil, A.H. (2000): Quality characteristics of low– fat beef patties formulated with modified corn starch and water. Food Chemistry, 68: 61-68.

Kurtu, M.Y. (2004): Assessment of the productivity for meat and carcass yield of camel (Camelus dromedarious) and the consumption of camel meat in the Eastern region of Ethiopia. Tropical Anima Health and production, 36: 65-76

Linn, C.S. and Zagas, J.T. (1987): Influence of corn germ protein on yield and quality characteristics of comminuted meat products in a model system. Journal of Food science, 52: 545-550.

Mansour, M.E. and Ahmed, S.M. (2000): Advanced technology in camel meat processing. The camel Newsletter, 17: 27-29.

Minerich, P.L.; Addis, P.B.; Epley, J. and Bingnam, C. (1991): Properties of wild rice/ground beef mixtures. Journal of Food science, 56: 1154-1157.

Murphy, E.W.; Criner, P.E. and Grey, B.C. (1975): Comparison of methods for calculating retentions of nutrients in cooked foods. Journal of Agricultural Food Chemistry, 23: 1153-1157.

Pearson, A.M. and Gillett, T.A. (1999): Effects of Fat on Flavor in Processed Meats. 3rd ed., p: 356- 358. Aspen Publication, Aspen Publisher, Inc. Gaithersburg . Maryland, USA

Pietrasik. Z., and Duda, Z. (2000): Effect of fat content and soy protein/ carrageenan mix on the quality characteristics of comminuted, scalded sausages. Meat science, 56: 181-188.

Piňero, M.P.; Parra, K.; Huerta-Leidenz, K.; Arenas de Moreno, L.; Ferrer, M.; Araujo, S. and Barboza, Y. (2008): Effect of oat's soluble fiber (b-glucan) as a fat replacer on physical, chemical, microbiological and sensory properties of low-fat beef patties. Meat Sci., 80: 675–680.

Serdaroğlu, M. (2006): Improving low fat meatballs characteristics by adding whey powder. Meat Science, 72: 155-163.

Serdaroğlu, M. and Değirmencioğlu, O. (2004): Effects of fat level (5%, 10%, 20%) and corn flour (0%, 2%, 4%) on some properties of Turkish type meatballs (koefte). Meat Sci., 68: 291-296.

Serdaroğlu, M. and Sapanci-Ozsumer, M. (2003): Effects of soy protein: whey powder and wheat gluten on quality characteristics of cooked beef sausages formulated with 5, 10 and 20% Fat. Electronic Journal of Polish Agricultural University series: Food Science and Technology, 6 (2).

Sheard, P.R.; Jolley, P.D.; Hall, L.D. and Newman, P.B. (1989): The effect of cooking on the chemical composition of meat products with special reference to fat loss . International Journal of Food science and Technol., 24: 421-427.

Tokusoglu, O. and Unal, K.M. (2003): Fat replacer in meat products. Pakistan J. of Nut., 2 (3): 196- 203

Tornberg, E.; Olsson, A.M. and Persson, K. (1989): A comparison in fat holding between hamburgers and emulsion sausages. In proceedings of the 35 the international congress on meat science and Technology (PP. 753 – 757), 24 – 26 September 1989. Denmark: Kopenhagen .

Torut, E.S.; Hunt, M.C.; Johnson, D.E.; Clous, J.R.; Kastner, C.L. and Kropf. D.H. (1992): Chemical, physical and sensory characteristics ground beef containing 5 - 30 % fat . Journal of Food Science, 57: 19-24

Troy, D.J.; Desmond, E.M. and Buckley, D.J. (1999): Eating quality of low-fat burgers containing fat replacing functional blends. Journal of food science and Agriculture, 79: 507-516.

Wills, R.B.H. and Rabiullah, M. (1981): Use of sunflower protein in sausages. Journal of Food Science, 46: 1657-1658.

Yankelovich (1985): The Consumer Climate for Meat Products. Prepared for the American Meat Institute, Washington, D.C. and the National Live Stock and Meat Board, Chicago, IL, New York: Yankelovich, Skelly and White, Inc.

Yilmaz, I. and Daglioglu, O. (2003): The effect of replacing fat with oat bran of fatty acid composition and physicochemical properties of meatballs. Meat Science, 65: 819-823.

Zagas, F.J. and Lin, C.S. (1988): Quality characteristics of frankfurters containing corn germ protein. Journal of Food science, 53: 1587-1591.

Zhang, W.; Xiao, S.; Samaraweera, H.; Lee, E.J. and Ahn, D.U. (2010): Improving functional value of meat products (review). Meat Science, 86: 15-31.

تأثير نسبة الدهون ودقيق الذرة علي جودة برجر اللحم الجملي

هيام عبد العال منصور حسن

قسم الرقابة الصحية علي الأغذية -كلية الطب البيطري- جامعة القاهرة

اجريت هذه الدراسة لمعرفة تأثير إضافة نسب مختلفة من الدهن (٥، ١٠، ٢٠%) ودقيق الذرة (صفر، ٢، ٥%) على التركيب الكيميائي، الخصائص الطبيعية والكيميائية، مقاييس اللون، قيمة قوة الشد والخصائص الحسية لبرجر لحم الجمال. وفي هذا الصدد تم تقييم الخصائص الطبيعية والكيميائية عن طريق قياس نسبة ناتج الطهي والاحتفاظ بالدهن، والرطوبة وأيضاً نسبة التقلص في القطر والسمك ونسبة الإنكماش وأظهرت النتائج أن زيادة معدل إضافة الدهن ودقيق الذرة أدت إلى نقص معنوي في نسبة الرطوبة والبروتين مع زيادة في نسبة الدهن والرماد، في حين أن إضافة دقيق الذرة أدت إلى إنخفاض معنوي في ناتج الطهي عند كل مستويات الدهن المضافة. وكان واضحاً أن نسبة الاحتفاظ بالدهن تزيد مع نقص نسبة الدهن المضاف في حين أن إضافة دقيق الذرة أدت إلى إنخفاض معنوي في نسبة الاحتفاظ بالدهن في المعاملات التي تحتوي على ١٠% دهن. وكانت إضافة دقيق الذرة مؤثرة في زيادة نسبة الاحتفاظ بالرطوبة في المعاملات التي تحتوي على ٥% دقيق ذرة و ٥% دهن. وأظهرت النتائج أن الدهن له تأثير معنوي على زيادة نسبة التقلص في قطر وسمك البرجر.في حين أن إضافة ٥% دقيق الذرة أدت أيضاً إلى تقلص قطر البرجر ولكنها أدت إلى الإقلال من نسبة الإنكماش عند كل مستويات الدهن المضافة. وجدير بالذكر أن أقل نسبة إنكماش في سمك البرجر كانت للمعاملات المصنعة بـ ٥% دهن و ٥% دقيق الذرة وبالنسبة لنتائج الخصائص الحسية لم يكن لإضافة دقيق الذرة تأثيراً سلبياً بل إن إضافة ٥% دقيق الذرة أدت إلى زيادة مقاييس اللون في البرجر وأخيراً فإن قيمة قوة الشد كانت تقل بزيادة نسبة الدهن حتى ٢٠% في حين أن إضافة ٥% دقيق الذرة أدت إلى الزيادة المعنوية في قيمة قوة الشد عند كل مستويات الدهن المضافة.