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Full Length Research Paper

Effect of Levels of Camel Meat on Physiochemichal and Sensory Properties of Hamburger

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The quality and microbial attributes of camel meat (and cattle meat as control) and hamburgers manufactured with different levels of camel meat and cattle meat were studied. Moisture, acidity, protein, fat, pH, drip loss, shrinkage, cooking loss, water holding capacity, color, microbial counts and sensory evaluation were determined. The meat was obtained from mature camels and bee from Golestan Province, Iran. Two levels of camel meat treatments (30% and 60%) were used. Results showed that pH of camel and cattle meat were 5.29 and 5.44. Shrinkage were not affected by adding different level of camel meat. Fat, protein, drip loss, cooking loss, water holding capacity and shrinkage of hamburger from cattle meat (control) also increased, but increase the fat, drip loss and shrinkage were not significant ($p<0.05$). Increasing the level of camel meat resulted in increase moisture, cooking loss, drip loss and water holding capacity that only cooking loss was significant ($p>0.05$) while fat, acidity and protein decreased and only acidity was significant ($p>0.05$). Results of microbiological analysis showed that increasing the level of camel meat and cattle meat resulted in a decrease in Total count, *Enterobacteriaceae, Staphylococcus aureus* and Yeasts and mold count in hamburgers, but the microbial counts were higher in camel meat hamburgers than cattle meat hamburgers. Overall acceptability of hamburger contain 60% camel and cattle meat were similar and had not significant difference ($p<0.05$). Lightness (L*) of cattle meat were higher than camel meat but redness (a*) of camel meat were higher (not significant at $p<0.05$).

Keywords: Camel hamburger, Color, Drip loss, Fat, *Staphylococcus aureus*.

INTRODUCTION

Meat and meat products are essential components in the diets of human beings; their consumption is affected by various factors. The most important ones are product characteristics (sensory and nutritional properties, safety, price, convenience, etc.) and consumer and environment-related characteristics (psychological, health, family or educational aspects, general economic situation, climate, legislation, etc.) (Jimenez-Colmenero et al., 2001).

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Although camel meat is not universally consumed, it might be a potential alternative for beef particularly in arid /semi-arid regions where camels are usually bred (Rashed, 2002). In recent years the potential of the camel as a meat source has received increased recognition but only few investigations on the chemical composition and physical properties of this meat and their products have been published (Rawdah et al., 1994). In spite of its potential, the contribution of camel meat to the per capita meat consumption is not impressive. This can be attributed to the fact that camel meat is the least studied type of meat and is wrongly believed to be of lower nutritive value and quality than other types of red meat (Babiker and Yousif, 1990; Elgasim and Alkanhal, 1992). In some areas, camels are slaughtered at an advanced age, when they have reached the end of their useful working life as draught or milk-producing animals. This age factor probably accounts for the general opinion that camel meat is unacceptably tough (Dawood, 1995).

Camel meat is relatively high in polyunsaturated fatty acids (PUFA) in comparison with beef (Dawood and Alkanhal, 1995; Knoess, 1977; Rawdah et al., 1994). This is an important factor in reducing the risk of cardiovascular disease, which is related to saturated fat consumption (Giese, 1992). Camel meat is also used for remedial purposes for diseases such as hyperacidity, hypertension, pneumonia and respiratory disease, as well as for anaphrodisiac (Kurtu, 2004). Comparative technical information shows that the fat content of camel meat is considerably less than beef (Kadim et al., 2008), low in cholesterol, vitamin E and high in protein and water holding capacity (Soltanizadeh et al., 2010). Camel meat is similar in taste and texture to beef (Williams, 2002). Prime meat from young camels may be cooked rapidly with dry heat, while meat from the extremities of young animals and all the meat from older animals requires cooking with moist heat. Thus, both the toughness and fat content of camel meat increase with age (Kadim et al., 2008 and 2009).

Hamburger is a type of food consisting of ground meat, fat, salt, spices and fillers. Hamburger making is a very old food preservation technique. There is a paucity of information regarding the use of camel meat in hamburger production. The objective of the present study was to investigate the effect of concentrations of camel meat on chemichal, physical and sensory properties of hamburger made from camel meat compared with those hamburger made from just beef.

MATERIALS AND METHOD

Sampling and hamburger preparation

The camel (Camelus dromedaries, single-humped camel) and cattle meat were obtained from butchery of Aghghla city (Golestan Province, Iran). In Iran usually two types hamburger is produced and consumpted widely, 30% and 60% red meat, hence, in this study these two types prepared. Meat and fat for each treatment group were run separately through an electrical meat grinder, the meat through 8mm plate and the fat through 6mm plate. Samples from the meat were used for the proximate analysis as described by AOAC (1990). Then the rest of the meat and the other ingredients were thoroughly mixed by hand and the mixture was regrinded through a 5mm plate and finally burgers were formed, 100 g in weight. After freezing, the burgers were packed into suitable plastic bags, and immediately stored at -18^{o}C until analysis

Chemical analysis

Moisture, protein (N × 6.25), fat, ash and pH of samples were determined according to the ANONYM methods (1997). For determination of pH, 20 g of sample was blended with 20 mL distilled water for 1 min. A CG822 pH meter was used to determine the pH at 20 °C.

Physical analysis

Water holding capacity (WHC), cooking loss, Drip loss and shrinkage of raw camel meat, control (raw cattle meat and hamburger from cattle meat) and hamburgers determined according to A.O.A.C. official method (1990), Malcolm (2002), Honikel (1998) and Ibrahim and Nour (2010).

Water holding capacity (WHC)

The method of Hung and Zayas (1992) was used for determination of WHC. A Whatman No.2 filter paper was soaked in saturated KCl and then dried under vacuum. The sample (0.3 g) was placed on the paper and 2 plastic plates with dimensions of 6 × 6 × 0.8 inches were placed above and below the paper. A 1-kg weight was placed on the top plate. After 20 min, the area of the pressed sample and the total area of the moistened paper was measured using area measurement system. WHC was calculated from the following equation:

$WHC = [1- (B-A)/A] \times 100$

where B is the area of the moistened filter paper and A is the area of the pressed meat.

Cooking loss

Control (cattle meat and hamburger from cattle meat) and camel meat and hamburger from camel meat sections were cut into steaks (2.5 cm thick) and weighted, then cooked in a microwave on a power of 100W for 3 min . The difference in weight of samples before and after cooking was expressed as a percentage of cooking loss.

Dripping loss

samples were cut from the frozen muscles and immediately weighed. The samples were placed within the container on the supporting mesh and sealed. After a storage period (usually 24hr) at chill temperatures (1 to 5 °C), samples were again weighed. Drip loss is expressed as a percentage of the initial weight.

Shrinkage

The same samples were used for shrinkage determination. The meat film area was traced with a ball pen before and after frying. The filter paper was allowed to dry and areas were measured. Shrinkage was expressed as a percentage of weight before cooking.

Microbial Analysis

Microbiological assay only carried out for hamburger samples. Colony forming units for total bacterial count were counted by plating on plate count agar medium and incubation at 30°C for 3-5 days (APHA, 1992). *Enterobacteriaceae* were counted on violet red bile glucose agar medium after incubation for 20–24 h at 37°C (Roberts et al, 1995). *Staphylococcus aureus* was counted using Baird–Parker medium after incubated at 35°C for 24–48 h (Oxoid, 1998). Also yeasts and mold count carried out on YGC medium and incubation at 25° C for 4-5 days (El-Ziney and Al-Turki, 2006).

Color measurement

Hunter color components lightness (L*) redness (a*) and yellowness (b*) were recorded using Hunter Lab Tristimulus colorimeter model D25 m-2.

Sensory Evaluation

The sensory evaluation was carried out for hamburger samples. hamburgers evaluated for their appearance, flavor, tenderness, texture and overall acceptability. The panel consisted of ten members from students and university staff and scores were obtained as described by Nikmaram et al (2011) by rating the above quality characteristics using the following rating scale: 5= Excellent, 4= Good, 3=fair, 2= Poor and 1= Very poor.

Statistical analysis

Data were analyzed using SPSS version 10.05-computer program.

RESULTS AND DISCUSSION

Kadim et al (2008) found Arabian camel meat (longissimus thoracis) to have a mean pH of 5.89, with a range from 5.56 to 6.61. Rates of post-mortem glycolysis may be relatively slow in camel meat (Soltanizadeh et al, 2008). Low ultimate pH values been reported in some camel muscles (Gheisari et al, 2009) and in fermented products (El Malti and Amarouch, 2009). pH of camel and cattle meat were 5.29 and 5.44 that were higher than those reported by Ibrahim and Nour (2010) and approximately equal with those reported by Shariatmadari and Kadivar (2006), difference in pH highly related to animal conditions before slaughtering and supply the carbohydrates. The slight increase in pH values of the hamburger with an increase the level of camel meat in this study may be due to pre-slaughter stress of camel as previously reported by Babiker and Tibin (1986) and Babiker and Yousif (1990). Results showed in Table 1.

Several studies have been published concerning the physical characteristics, chemical composition, sensory properties and nutritive values of *Najdi* camel meat (Dawood, 1995; Dawood and Alkanhal, 1995; EL-Faer et al, 1991; Elgasim and Alkanhal, 1992; Elgasim and Elhag, 1992). In this study, increasing the level of camel meat resulted in a increase in moisture, cooking loss, drip loss and water holding capacity that only cooking loss was significant ($p>0.05$) while fat, acidity and protein decreased and only acidity was significant ($p>0.05$). increasing the cooking loss about camel meat and hamburger from came meat in this study was against to those reported by Soltanizadeh et al (Soltanizadeh et al, 2010) and Ibrahim and Nour (2010), but results of water holding capacity, fat, protin, moisture and pH was agree with results of Soltanizadeh et al (2010) and Ibrahim and Nour (2010). Shrinkage were not affected by adding different level of camel meat. Fat, protein, drip loss, cooking loss, water holding capacity and shrinkage of hamburger from cattle meat (control) also increased, but increase the fat, drip loss and shrinkage were not significant ($p<0.05$).

According to Babiker and Tibin (1986) and Babiker and Yousif (1990) increasing the level of camel in burger recipes resulted in an increase in moisture % and a decrease in fat %. This could be attributed to the fact that camel meat had high moisture and low fat content. Results of current study also agreed with those reported by FAO (1991). The improvement in the water holding capacity could be due to the fact that camel meat had superior water content compared with beef which had been reflected on the reduction of cooking loss and

Table 1. Chemical and physical parameters of raw cattle and camel meat and different hamburgers prepared from cattle and camel meat

Chemical and physical parameters	Raw cattle meat	Raw camel meat	Hamburger contains 30% cattle meat	Hamburger contains 60% cattle meat	Hamburger contains 30% camel meat	Hamburger contains 60% camel meat
pH	5.44^{c}	5.29^{c}	6.21^{a}	6.34^{a}	6^{b}	6.23^{a}
Moisture (%)	63.46^{b}	65.50^{b}	59.32^{c}	61.67^{bc}	64^{b}	78.8^{a}
Acidity	11.80^{c}	13.50^{c}	27.6^{b}	26.34^{b}	31.4^{a}	26.9^{b}
Ash (%)	0.79^{c}	0.75^{c}	1.31^{b}	1.22^{b}	2.10^{a}	2.22^{a}
Fat (%)	7.46^{a}	6.30^{a}	4.78^{b}	5.13^{b}	2.50^{c}	2.20^{c}
Protein (%)	24.72^{a}	22.34^{b}	22.68^{b}	23.11^{ab}	21.3^{c}	21.1^{c}
Drip loss	19.75^{a}	19.30^{a}	2.45^{b}	3.11^{b}	1.40^{c}	1.60^{c}
Cooking loss	32^{a}	28.17^{b}	30.21^{ab}	31.42^{a}	26.4^{c}	31.46^{a}
Shrinkage	20.27^{a}	19.48^{a}	6.34^{b}	7.53^{b}	2.25^{c}	2.25^{c}
Water holding capacity	0.50^{c}	0.83^{b}	0.67^{bc}	0.71^{b}	1.07^{a}	1.20^{a}

Table 2. Microbial counts for cattle and camel meat hamburgers.

Microbial count (Cfu/ml)	Hamburger contains 30% cattle meat	Hamburger contains 60% cattle meat	Hamburger contains 30% camel meat	Hamburger contains 60% camel meat
Total count	$54\times10^{4\ b}$	$31\times10^{4\ c}$	$68\times10^{4\ a}$	$55\times10^{4\ b}$
Enterobacteriaceae	$1\times10^{1\ a}$	$0.4\times10^{1\ b}$	$1.1\times10^{1\ a}$	$0.9\times10^{1\ a}$
Staphylococcus aureus	$5.7\times10^{1\ b}$	$2.5\times10^{1\ c}$	$9.2\times10^{1\ a}$	$3.2\times10^{1\ c}$
Yeasts and mold	$25\times10^{3\ b}$	$21\times10^{3\ c}$	$32\times10^{3\ a}$	$30\times10^{3\ a}$

Table 3. Effect of different level of cattle and camel meat on hamburgers sensory properties

Parameter	Level of camel and cattle meat in hamburger formulation			
	30% cattle meat	60% cattle meat	30% camel meat	60% camel meat
Appearance	4.1^{c}	4.3^{b}	4.35^{b}	4.7^{a}
Flavor	4.56^{c}	4.7^{b}	4.65^{bc}	5^{a}
Tenderness	4.3^{c}	4.7^{b}	4.57^{b}	5^{a}
Texture	4.1^{c}	4.7^{a}	4.4^{b}	4.8^{a}
O.Acceptability	4.17^{c}	4.8^{a}	4.43^{b}	4.9^{a}

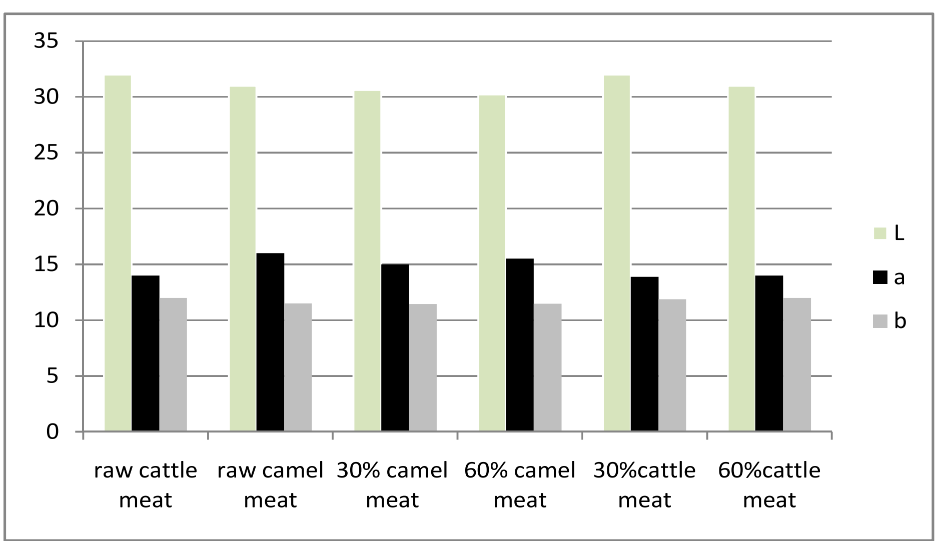

Figure 1. Effect of level of camel and cattle meat on hamburgers color value.
L- lightness, a- redness, b- yellowness

shrinkage (Saliha, 2001).

Results of microbiological analysis showed that increasing the level of camel meat and cattle meat resulted in a decrease in Total count, *Enterobacteriaceae* count, *Staphylococcus aureus* and Yeasts and mold count in hamburgers, but the microbial counts were higher in camel meat hamburgers than cattle meat hamburgers (Table 2). High microbial count in samples probably is due to use the species, soya powder, flour and other dry ingredients in formulation. Whereas hamburger before serving be cooked, the hazard of remaining the pathogenic microorganisms is low.

However, there is evidence of a great demand for fresh camel meat and for camel meat in blended meat products even in societies not herding camels (Pérez et al, 2000). There is also reluctance towards consuming camel meat in general as it is thought to be tough in texture and imparts poor organoleptic characteristics, coarse and watery. This is mainly because camel meat usually comes from old animals that have served other functions in their life or predominantly at the time their labour performance and milk yield declines (Wilson, 1998).

Sensory properties of hamburgers from camel and cattle meat showed that generally hamburger prepared from camel meat gained higher scores in compared with hamburger from cattle meat (Table 3). Hamburger prepared from 60% camel meat and cattle meat did not show significant difference ($p<0.05$) in texture that verified meat from camels is comparable in taste and texture to beef (Kurtu, 2004; Williams, 2002) (table 3), also this is agree with those reported by Kadim et al (2008). Overall acceptability of hamburger contain 60% camel and cattle meat were similar and had not significant difference ($p<0.05$) which is supported by Babiker and Tibin (1986) who reported that, flavor of sausage prepared of camel meat and beef with two fat levels (10 and 15%) were accepted by panelists. Tenderness of hamburger prepared from 60% camel meat significantly ($p>0.05$) higher than hamburger from cattle meat which probably due to higher misture and water holding capacity of camel meat (Soltanizadeh et al, 2010).

Lightness (L*), redness (a*) and yellowness (b*) values were not affected by adding different levels of camel meat (Figure 1). The increase in color values could be attributed to the difference in color between beef and camel meat. This result was indicated by Al-Qadi (2007) who pointed that camel meat sustains its redness for up to five days of storage.

CONCLUSION

It was concluded that the pH, drip loss, cooking loss and water holding capacity of the camel meat hamburger increased with increasing the level of camel meat, but fat and protein content decreased and Shrinkage were not affected. Also this study has shown that redness of raw camel meat higher than raw cattle meat and this reflected in hamburger prepared from camel meat. Based on the results of overall acceptability, it can be concluded that camel meat can be used in the production of hamburgers. Production of this sausage may also be considered economic since it has higher water-holding capacity. It also may have an edge for consumers as well as meat products producers over beef due to its lower price.

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