Sudan University of Science and Technology

College of Animal Production Science and Technology

Quality Attributes of Manufactured Burgers with Different Portion of camel meat

خصائص جودة البيرقر المصنع من نسب مختلفة من لحم الإبل

A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor Science (B.Sc.) in Animal Production

(Meat Science and Technology)

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بسم الله الرحمن الرحيم

(اقرا باسم ربك الذي خلق□خلق الانسن من علق□اقرأ وربك الأكرم□الذي علم بالقلم□ علم الانسن ما لم يعلم□)

صدق الله العظيم

سورة العلق (الآية 1-5)

إهداء

بسم الله الرحمن الرحيم

(قل اعملوا فسيرى الله عملكم ورسوله والمؤمنون)

صدق الله العظيم

إلهي لايطيب الليل إلا بشكرك ولايطيب النهار إلى بطاعتك.. ولاتطيب اللحظات إلا بذكرك.. ولا تطيب الآخرة إلا بعفوك.. ولا تطيب الجنة إلا برؤيتك

"لله جل جلاله"

إلى من بلغ الرسالة وأدى الأمانة.. ونصح الأمة.. إلى نبي الرحمة ونور العالمين

"سيدنا محمد صلى لله عليه وسلم"

إلى من كللهم الله بالهيبة والوقار. إلى من علمونا العطاء بدون انتظار..

إلى من نحمل أسمائهم بكل افتخار..

نرجو من الله أن يمد في أعمارهم ليروا ثمارا قد حان قطافها

بعد طول انتظار وستبقي كلماتهم نجوم نهتدي بها

اليوم.. وفي الغد.. وإلى الأبد

شكر وعرفان

نتقدم بخالص شكرنا وعظيم تقديرنا الي الدكتور الفاضل:

أبوبكر سيد علي

على خدماته ودعمه وتوجيهاته وسعة صدره فجزاه الله عنا كل الخير ورعاه وانار دربه

كما يسعدنا ان نتقدم بجزيل شكرنا الى الأستاذ *محمد حسن البدوي* – *جامعه الخرطوم*

ولا يفوتنا ان نتقدم بشكرنا إلي الاستاذ الصاوي قريب الله

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شكرا جزيلا لكل من ساهم في انجاز هذا البحث وإلى كل من يستفيد من قراءه هذا البحث

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Abstract

The study was conducted to evaluate the manufactured burgers with different portion camel meat, three types of burger were processed using different portion of camel meat and beef, type A (100% camel meat) B (50%camel meat and 50% beef meat C (100%beef), samples were ready for analysis after processing. Proximate analysis, water holding capacity (WHC), cooking loss%, colour parameters (lightness L^*, redness $a^*$and yellowness b^*) and organoleptic tests were assessment. Collected data were statistically analysed using by One-way ANOVA followed by least significant different test. The results revealed that all proximate analysis parameters of the three types of burger were significantly different with exception of fat content. Excluding colour parameters, the physicochemical parameters were highly significant different ($p<0.01$) all the organoleptic tests were not different ($p>0.05$) among the three types of burger.

Keywords: Camel meat, Proximate analysis, Cooking loss, Juiciness

الملخص

أجريت هذه الدراسة لتقييم البيرجر المصنع من نسب مختلفة من لحم الإبل،ثلاثة أنواع من البيرجر تم تصنيعها، النوع "أ" (لحم إبل 100%) النوع "ب" (لحم بقر 50%، لحم إبل 50%) النوع "ج" (لحم بقر 100%).تم تجهيز العينات بعد التصنيع لتقييم التحليل التقريبي، قابليةحمل الماء، فاقد الطبخ%، قياسات اللون (اللون الشفاف *L، الإحمرار *a والإصفرار *b)والخواص الحسية. أُستخدم إختبار تحليل التباين للإتجاه الواحد في تحليل البيانات التي تم جمعها. أظهرت النتائج وجود فروق معنوية في قياسات التحليل التقريبي لعينات البيرقر الثلاث فيما عدا محتوي الدهن. وباستثناء نتائج قياسات اللون كانت بقيت القياسات الفيزوكيميائيه تختلف بدرجة معنوية عالية (بإحتمالية أقل من0.01) بينما لم تظهر فروق معنوية (باحتماليه اكبر من0.05) في الاختبارات الحسية بين الثلاثة انواع من البيرجر.

الكلمات المفتاحية : لحم الابل – التحليل التقربيي- فاقد الطهي –العصيرية.

Chapter one

Introduction

Sudan has biggest population of animals in African and Arabic countries. The estimation of animal population was around 107.5 million heads. The count population of cattle about 30.6 million heads, it also has a population of camels 4.8 million heads Animal Resources, Fisheries and Ranges (MARFR, 2016). Camel population in Sudan has increased by approximately 38% during the years 1988-2008 (FAO,1986). Compared to other livestock, the camel is unique in having an exceptional ability to survive and thrive under adverse climatic conditions such as high ambient temperatures, low rainfall, and feed scarcity. Therefore, it offers an ideal option for animal production in arid and semi-arid regions of the world. Camel is a unique animal having the ability to survive and produce with low cost of feeding under harsh conditions compared to other livestock. It is a good source of meat in areas where the climate adversely affects other animal's production efficiency (Kadim *et al*., 2006).

Carcass characteristics of camels were equal to those of other red meat animal species (Elgasim and Alkanhal, 1992). Chemically camel muscles had been found to have low fat content, high water holding capacity recommending camel meat as a healthy food with good processing properties (Babiker and Yousif, 1990). 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 (Morton, 1984; Pérez et al., 2000). The export of camel meat is now creating interest for theinter motional meat

market. Comparative technical information shows that the fat content of camel meat is considerably less than beef, low in cholesterol and high in protein. Camel meat is similar in taste and texture to beef (Williams 2002). Meat and meat products are considered as an excellent source of high quality animal protein, vitamins especially B complex, and certain minerals, especially iron (Gracey *et al*., 1986).

The objective of this study was to evaluate the quality attributes of manufactured burgers with different levels of camel meat.

Chapter two

2. Literature review

2.1 Meat consumption:

Consumption of meat was increased over the world in the last decades where it was 22 kg/year for Egyptian individual, 54 kg/year in Saudi individual while the United States of America represents the highest consumption rates in the year the per capita consumption of the meat (FAO, 2012).

2.2 Camel Meat:

Camel meat has many benefits as a meat product. It has low fat content and is highly nutritious, and has potential to be used to combat hyperacidity, hypertension, pneumonia and respiratory disease(Kadim *et al*., 2006).

2.3 Proximate analysis of camel burger:

Ibrahim and Nour, (2010) reported that moisture content was increased as resulted of camel meat proportion, also they report reverse findings with fat% on the other hand they found that protein and ash were slightly decreased.

2.4 Meat quality attributes:

Meat quality includes tenderness, palatability, aroma, flavour, colour and juiciness. Species, sex, breed, age and post-mortem handling are known to influence these factors. It is also possible that diet or some components of

diet may exert some effects on the factors mentioned above. It may lead to reduce meat quality leading to low pricing (Dikeman 1990; Koohmaraie, 1992; Glitsch 2000; Kerry et al., 2002; Egena and Ocheme 2008). The effect of temperature of comminuting on stability and eating quality of "English" burger. It was found that increasing temperature of comminuting lead to increase cooking loss, softening in texture and darkening in colour and subjective assessment indicated that at least up to comminuting temperature of 25°C the sausage were acceptable and at temperature above 30°C off flavour developed (Sally Brown and Ledward, 1984).

2.4.1 Water holding capacity (WHC):

Ibrahim and Nour, (2010) reported that water holding capacity increased with an increase the level of camel meat.

2.4.2 Cooking Loss:

Adam and Abugroun, (2015) reported with increase in cooking loss% for beef burger and less in group C which consist 50% from camel and beef meat and improved quality of burger while Ibrahim and Nour, (2010) reported reduced cooking loss with the addition of more camel meat.

2.4.3 Meat colour:

Heba and Hussein (2016) reported that colour parameters including Lightness (L*), redness (a*) and yellowness (b*) values were not influenced by adding different levels of camel meat. The current study showed that the panel scores for the tenderness, flavor, juiciness and color were not affected by the added level of camel meat.

2.4.4 Tenderness and Juiciness:

Tenderness and juiciness are closely related, the more tender meat the juicier. Juiciness varies inversely with cooking loss (Lawrie, 1991; Judge et al., 2001). McMillin, (2005) reported that age, breed, and diet influence tenderness, juiciness. Moreover, Heba and Hussein (2016) found that tenderness and juiciness were not differ by adding different levels of camel meat. The values of the Tenderness and Juiciness in Ibrahim and Nour, (2010) were higher than the present study.

24.5 Flavour and aroma:

Meat aroma develops from the interactions of non-volatile precursors, including free amino acids, peptides, reducing sugars, vitamins, nucleotides and unsaturated fatty acids, during cooking. (Mottram, 2002). Ibrahim and Nour, (2010) found that burger manufactured with different levels of e camel meat had the almost the same flavour

2.5 Organoleptic properties of camel products:

Steak were fabricated from three wholesale cuts rib, chuck and leg of 18 Najdi male camels averaging eight, 16 and 26 month of age the influence of age type of cut, freezing and cooking method on the physical and palatability traits of meat has been investigated the results indicated that age had a significant influence on cooking loss and shear value but there was no significant effect on drip loss expressible moisture and organoleptic properties(tenderness , Juiciness and flavour) .However, steaks from younger camels were more acceptable . The result also showed that wholesale cut significantly affects cooking loss, shear force value,

tenderness, juiciness and flavour but the effect on drip loss and expressible moisture was shear value ,also the highest organoleptic scores .Except for cooking loss ,freezing and cooking method had no significant effect on shear value and organoleptic properties the acceptability of cam burger was also studied .added fat resulted in higher cooking loss ,but the sensory panel ratings were not significantly affected . (A. Dawood, 1993)

2.6: Meat processing

Processed meats are products that have been altered in form, size, shape, function and palatability to provide more highly desired product by consumers. There are many different types of processing including size reduction, freezing, curing, tenderizing and forming (Acton *et al*., 1983; Feeding and Ramsey, 1986; Barbut, 1995). During processing, meat is mixed with ingredients, common salt, phosphate and protein or carbohydrate binders that will bind the particles back together directly or indirectly. The mixture is formed to desired shape include various sausages, frankfurter, bologna and some meat loaves and formed shape will maintained after freezing and cooling (Romans *et al*., 1994; Barbut, 1995).

2.7: Burger ingredients:

2.7.1 Meat:

Meat can be defining as the whole or part of the carcass of any cattle, sheep, goat, camel buffalo deer here poultry or rabbit (Williams.2007).For desirable colour meat from older animals more myoglobin is preferred (Toldra, 2002)

2.7.2 Non meat ingredients (additives):

Food additives are used to accomplish certain functions such as colouring, antimicrobial, ant oxidative, preservation, improved nutritionincreased emulsification and altered flavour (Okerman 1986, Jehad *et al*., 2009)

2.7.3 Salt:

Salt is one of the main additives for meat and its products as it is a preservative and again for taste. Salt is used in many function when preparing food products. which plays an important role in the production of processed meat as it dissolves muscle proteins responsible for the cohesion of the tissues of the meat and the retention of moisture and fat and the formation of the desirable strength of meat when cooking (Okerman 1986, Jehad *et al*., 2009)

2.7.4 Ice or cold water:

Water or ice added to meat mixture provides considerable functional qualities it chills the meat during the chopping or mixing operations which give longer and more efficient churning of meat mass without mechanical

overheating .it aids in dissolving sodium chloride and curing salts to give better distribution in the mixture .Also it imparts fluidity to the meat mixture or emulsion that aids in proper filling of the casings moreover the added water content markedly affects texture and tenderness of finished burger (Pearson and Gillett.1996)

2.7.5 Binders and extenders Non- meat:

Proteins are widely used in meat processing Non-meat proteins used in meat processing technology divided into two groups 1 plant proteins such as soy isolates. soy concentrates and flours 2 protein of animal origin such as milk proteins soy products have been used in meat processing to improve functional properties such as water binding and textural properties they are hydrophilic (absorb and retain water) and have adhesive properties (Giese 1992) Dexter *et al* ., 1993 ; Mittal and Barbur, 1993 pietrasik and Duhe ,2000 porcella *et al* ., 2001 Dolata and piotrowska 2002 Meltem and Meltem 2003 Milk proteins can act both as emulsifier and as water and fat binders in foods (Sebranek . 1996).

2.7.6 Seasonings:

Seasonings influence the Flavour appearance or shelf. life of the product they are classified further as spices herbs aromatic vegetables flavouring enhancers and stimulated meat flavours certain spices such as black pepper ginger and mace have will help extend the shelf life of (Komarik et al , 1978) pearson and Gillett 1996).

2.8 physicochemical properties:

2.8.1. Water holding capacity (W. H. C):

Is the ability of meat hold its own or added water during the application of any force (Hamm, 1986).Babike etal .(1990) mentioned that had superior water holding capacity than lamb fat reduction decreased emulsion stability and water holding capacity resulted in higher cooking losses (Meltem and Meltem 2003) .

2.8.1. pH:

The pH is an important determinant of microbial growth high pH beef has high spoilage potential and a short shelf. life (Newton and Gell. 1981). Walker and Betts (2000), reported that ultimate pH of meat was significant for its resistance to spoilage because most bacteria grow optimally at about pH 7 and not below pH 4. Deva and Narayan (1988) and Dharma veer et. al(2007) reported that microbial load increased with increase in pH of the meat product (Simela et al 2004)

Chapter three

3. Materials and methods:

3.1 Location of the study:

The Study was conducted at the laboratory of Meat Science and Technology, College of Animal Production Science and Technology, Sudan University of Science and Technology.

3.2 Meat Samples Source:

The sample of camel meat used in this Study was purchased from Alnaga Local Market from 3-4 years old camels, Omdurman while the Beef samples were purchased Kuku market.

3.3: Preparation of Samples:

Meat was minced using electrical grinder (3.5 mm) then it was mixed by hand with other ingredients to formulate the final three types of burgers (Table 1) [camel burger (A), mixed (B) and beef burger (C)]. 50 grams from each type was stuffed using burger stuffer (3 inches' diameter) to formulate each bur the weight of burger piece.

3.4 Proximate Analyses:

Determination of total moisture, crude protein (CP) Fat and ash of the burger samples were done according to AOCA (1995) procedure.

3.5: Water Holding Capacity (WHC):

One gm from samples were used for WHC determination each Sample was placed on humidified filter paper and pressed between Two Plexiglas plates for one minute at 25 kg /cm load the meat filter area was traced with a ball Pen and The Filter Paper was allowed to dry, meat and moisture areas covered by meat (meat film area) was subtracted from the moisture area and then divided by meat film area to give the ratio expressed as water holding

capacity of the meat, a large ratio indicates an increase in the watery condition of the flesh or a decrease in the water holding capacity (Babiker and lawrie,1983).

$$\text{WHC} = \frac{\text{Loose water area} - \text{meat film area}}{\text{meat film area}}$$

3.6 Cooking loss determination:

The frozen burger samples were thawed in a refrigerator for overnight. The samples were cooked in a pen using vegetable oil at constant temperature (90) for 5 minutes with continuo's turning of the samples. The cooked samples were dried of the oil using absorbent kitchen paper and allowed to cool, weighed and kept for sensory evaluation. The difference in weight of samples before and after cooking was recorded as the total cooking loss and expressed as a percentage of weight before cooking.

$$\text{Cooking loss \%} = \frac{\text{wt before cookig} - \text{wt after cooking}}{\text{wt before cooking}} \times 100$$

3.7: Objective colour measurements:

The colour of fresh samples of burger was determined by using laboratory of animal production research center (Kuku) colour meter Model D 25 M. 2 optical sensor machine. Lightness (L*), redness (a*) and yellowness (b*) measurement were determined.

3.8: Sensory evaluation Sensory:

Samples were performed by 15 semi trained sensory panellists to evaluate colour, tenderness, juiciness, flavour, and overall acceptability using an 8-point (hedonic scale) card (cross et al., 1978), in which the highest score of 8 being extremely desirable and 1 being extremely undesirable.

3.9 pH determination:

Ten gm of each sample were blended with 100ml distilled water in a blender jar at high speed for one minute before pH measurement on laboratory pH meter (Okerman 1891).

3.10 statistical analyses:

Complete randomised design was used to analyse the results obtained from this study and subjected to One-way ANOVA followed by least significant difference test (LSD) using the SPSS 17.0 (2007).

Table (1): Ingredients composition of the three types of burger:

Ingredients (g)	Camel burger (A)	Mixed burger (B)	Beef burger (C)
Beef meat	-	335	670
Camel meat	670	335	-
Bread crumbs	60	60	60
Flour	50	50	50
Water (ml)	110	110	110
Onion	50	50	50
Skimmed milk	30	30	30
Salt	15	15	15
Coriander	3	3	3
Black pepper	2	2	2
Nutmeg	2	2	2
Kebab china	3	3	3
Garlic	3	3	3
Cinnamon	2	2	2
Total	1000	1000	1000

Chapter four

Results and Discussion

Table (2) showed the proximate analysis of the three types of burger. With exception of fat all proximate analysis parameters were significantly differed among the studied burger types. Moisture content was the highest (P<0.01) in beef burger (69.5%) while it was lower in camel burger (67.93%) than mixed burger (68.00%), these findings were disagreed with those of Ibrahim and Nour, (2010) and Adam and Abugroun, (2015), it could be due to the source of meat were from younger animals, while it was agreed with those of Heba and Hussein (2016).Camel burger was the highest in CP (17.58%) content followed by mixed burger (17.30%), these findings were in line with those of Adam and Abugroun, (2015) and disagreed with the results reported by Heba and Hussein (2016), this could be attributed to degradation of protein with proteolytic enzyme forming free amino acids and peptides.

Table 2. Proximate analysis of the studied beef types

Parameters	Type of burger			Significant
	Camel	Mixed	Beef	
Moisture	67.93 ± 0.31^{b}	68.00 ± 0.40^{b}	69.50 ± 0.17^{a}	**
CP	17.58 ± 0.15^{a}	17.30 ± 0.05^{b}	17.14 ± 0.04^{c}	**
Fat	1.42 ± 0.24	1.24 ± 0.18	1.17 ± 0.04	NS
NFE	11.62 ± 0.13^{a}	11.76 ± 0.66^{a}	10.61 ± 0.06^{b}	**
Ash	1.45 ± 0.11^{b}	1.64 ± 0.02^{a}	1.58 ± 0.04^{a}	*

**=significant differences at P<0.01
*=significant differences at P<0.05
NS=No significant differences
Different superscript letters with in the same row means significant differences at P<0.05

Table (3) showed the physical and chemical properties of the studied burger types. Excluding colour parameters (L^*, a^*, b^*) other physical properties were significantly differed ($P<0.01$) among the three types of burger. Camel burger was the highest in WHC and cooking loss % ($P<0.01$) while the beef burger was the lowest, similar results were found by Ibrahim and Nour, (2010) and Adam and Abugroun, (2015). Beef burger was highest in pH value whereas, camel burger was the lowest pH value, these results were agreed with those of Ibrahim and Nour, (2010).

Table3. Physical and chemical properties of the studied burger types

Parameters	Type of burger			significant
	Camel	Mixed	Beef	
WHC	0.99 ± 0.06^{a}	0.60 ± 0.06^{b}	0.53 ± 0.03^{c}	**
Cooking loss%	19.44 ± 0.83^{a}	17.38 ± 0.35^{b}	15.24 ± 0.10^{c}	**
pH	5.83 ± 0.02^{c}	5.91 ± 0.0^{3b}	5.98 ± 0.03^{a}	**
Lightness L^*	49.87±1.38	50.91±2.25	51.01±0.44	NS
Redness a^*	7.54±0.42	7.22±0.63	7.47±0.15	NS
Yellowness b^*	17.63±0.23	17.72±0.68	17.49±0.11	NS

**=significant differences
NS=No significant differences

Table (4) showed the Sensory evaluation of the three types of burger, it revealed no significant differences ($P>0.05$) between the three types of burger. Although there were no significant differences in sensory characteristics but camel burger showed the highest ranks in the colour and flavour, moreover it was higher than beef burger in texture and juiciness, these results were meanwhile similar to many researchers such as Williams (2002) and Ibrahim and Nour, (2010).

Table 4. Sensory evaluation of the studied burger types

Parameters	Type of burger			significant
	Camel burger	Mixed burger	Beef burger	
Colour	7.00±0.93	6.80±0.94	7.00±0.53	NS
Texture	6.73±1.10	7.00±1.00	6.67±0.82	NS
Flavour	6.73±0.96	6.67±1.18	6.27±1.53	NS
Juiciness	6.60±0.99	7.00±0.93	6.47±1.06	NS
Overall	6.77±0.82	6.87±0.80	6.60±0.82	NS

NS= no significant differences

Chapter five

5. Conclusion and Recommendations

It could be concluded that:

- Camel burger was the highest in water holding capacity and cooking loss.
- No differences in sensory evaluation among the three types of burger.
- Camel meat should be added in meat products manufacturing.

It might be recommended:

- Further studies should be done on manufacturing camel meat products.

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