



A Comparative Study on some Quality Attributes of Locally Made Beef Burger and their Counterparts from Meat Industries

Rowaida S. Musa¹, O A. Idam², Y. H. Elhashmi³ and Ramzy A. Yousif⁴

^{1,3} Department of meat production technology, Faculty of Animal Production, University of Gezira, Madani, Sudan. E.mail: rowaidamusa88@gmail.com, ² Department of fish production and technology, Faculty of Animal Production, University of Gezira, Madani, Sudan. E.mail: Omerabimido@gmail.com.

⁴ Department of Fisheries and Wildlife Science, College of Animal Production Science and Technology, Sudan University of Science and Technology, Khartoum, Sudan. Email: ramzy173@gmail.com

Corresponding author: rowaidamusa88@gmail.com,

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Abstract

Meat and meat products are essential components in the diets of human beings; their consumption is affected by various factors Like product characteristics (Nutritional properties, safety, price, convenience, etc.) and consumer and environment related characteristics (psychological, health, family or educational aspects, general economic situation, climate, legislation, etc). The current study was conducted to evaluate and compare similarities and differences in nutritive value (moisture, Carbohydrate, CP, total fat, and ash) and macro-minerals (Calcium 'Ca' mg/g, Iron 'Fe' mg/g and Phosphate 'P' mg/g) of processed beef product (Burgers) among three companies (Looli, Al-goussi and Al-arabi) and compared with locally processed in laboratory. A total of 48 samples of beef sausage and burger were taken from local recipe and commercial companies (Looli, Al-goussi and Al-arabi) and subjected to chemical and minerals composition evaluation. The data was subjected to statistical analysis using SPSS software with completely randomized design (CRD). The findings of this study revealed that, chemical composition of sausages had highly significant differences ($P \leq 0.01$) in moisture, carbohydrates, protein, total lipids, and ash among all types of sausages. Also, chemical composition of burger showed that, highly significant differences ($P \leq 0.01$) in all parameters among types of burger. Minerals profile revealed that, there were highly significant differences ($P \leq 0.01$) in Ca and Fe, while P was recorded significant difference ($P \leq 0.05$) among groups of sausage. On the other way, burger showed highly significant difference ($P \leq 0.01$) in Ca and P, while Fe had significant difference ($P \leq 0.05$). The study was recommended that: Consumers should consume processed sausage and burger manufactured in scientific laboratory because the quantities of ingredients were significantly formulated.

Keywords: Beef, Burger, Algoussi, Looli and Al-arabi

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Introduction

Meat is well known as an excellent protein and energy source for our daily diets (Chang and Huang, 1991). In most countries, meat consumption increases as economic situation improves (Fuller, 1996). Meat can be processed and preserved. In Sudan processing of food especially meat was started 2-3 decades ago (Mohamed, 1987). Meat processing includes processes and activities used in altering fresh meat properties. This includes curing, smoking, canning, cooking, freezing, dehydration, production of intermediate moisture and the use of certain additives such as chemicals and enzymes (Karmlich *et al.*, 1975). Processing provides scope to mix desirable parts of several materials in addition, it is a mean of incorporating food stuff such as cereal in meat products (FAO, 1992). Elkreeny (2000) reported that processing of meat provides high nutritional value product, rich in protein and fat at a cheap or low price and facilitates the preparation of meals in an easy and quick state. Processed meat as a category is a continuum of products ranging from meat products with a minimum of 30% meat to products that are all meat flesh. Different types of sausage were created all over the world, and each region developed their own distinctive style of sausage influenced by the availability of local ingredients, spices, and casings. Climate was another important factor for the development of region-specific fresh and dry sausages. Regions with distinct seasons used different techniques to preserve meat. In the cold seasons, fresh sausage was able to keep for short periods of time without refrigeration. The smoking process was developed to preserve sausages during the

warmer seasons (Basic Sausage-Making, 2004).

Burgers and other comminuted meat products have become popular food items worldwide and efforts have been concentrated on reducing their fat content while also minimizing meat costs. The use of binders to replace meat in burger formulations is commonly practiced and can improve the cooking and sensory characteristics of the product. For example, toasted wheat crumb is commonly used as a binder in burger production in Canada (CFIA, 2009).

Justifications

The formula for burger were differ from country to another and from company to another also, accordingly the profiles of these products will differ. Hence, standardization of the formula of burger should be done scientifically.

The objective of this study were:

1. Determination of the nutritive value of beef burger processed locally comparing with three commercial companies.
2. Evaluation of macro-minerals of beef burger processed locally and compare with three commercial companies.

Materials and Methods

General Experimental Strategy

This study was conducted to evaluate and investigate the similarities and differences in nutritive value and macro-minerals of processed beef product (burger) among three Commercial companies (looli, Al-goussi and Al-arabi) and locally manufactured Burger in Meat Manufacture unit, Department of Meat Production and Technology, Faculty of Animal Production, University of Gezira.

Table 1: Burger Formula

ingredients	Percentage (%)
Lean meat	65
Fat	5
Ice water	2
Salt	1.5
Potatoes and rice	4
Milk powder	4
Chickpea	11
Bread crumb	5.5
Onion	0.3
Spices	1.7
Total	100

Burger preparation

Lean meat grade I and II and fat were purchased from Elmanagil market. Then, meat and fat were cut and grounded by using grinder separately, salt (powder) was sprayed on meat before grinding, rice and chickpea were soaked in water overnight and dried then minced and added to the mixture. spices (garlic and pepper) and bread crumb were minced and cooked potatoes and onion were minced separately and added, ice water was added. Then, the minced fat was added to mixture. And the mixture was remixed. After that, mixed together until the components completely homogenized. Finally, the mixed batter was formed and shaped round about 100 grams and 8 mm thick and packed into plastic bags. The product was refrigerated in refrigerator immediately.

Ingredients of Sausages and burgers in Commercial companies

Looli burger

Pure beef, table salt, pepper, Cinnamon, plant protein, and starch.

Al-goussi burger

Beef's meat, soy protein, salt, spices, sodium phosphate E450, E451 Vit, and C E300.

Al-arabi burger

Beef's meat, soy protein, onion, starch, carbohydrates, hydrated vegetable oil, spices Mix, paprika, sodium chloride, binder E450

and E451 improver, flavour enhancer, E621, ascorbic acid salts E300 and E301, curing salts sodium nitrite E250, and colouring agents E122.

All commercial companies were not appeared their percentages of the ingredients used for the products.

Sampling

A total of 48 samples of beef burger were taken from Locally processed unit and commercial companies (Looli, Algoussi and Alarabi), 6 representative samples were taken from burger from each group and subjected to analysis.

Analyses of samples

Chemical Composition

The proximate analysis which include (Moisture %, Crude protein (CP %), lipid% and ash%) was done using standard (AOAC, 2000) methods. The analyses were done in laboratory of Food Technology, Faculty of Engineering and Technology, University of Gezira.

Macro-minerals analysis

Calcium (Ca) mg/g., Iron (Fe) mg/g. and Phosphorus (P) mg/g. were analysed by calibration in a GallenRamP Flame Analyser and Spectrophotometer according to (Vogel, 2000). The analyses were done in laboratory of Food Technology, Faculty of Engineering and Technology, University of Gezira.

Statistical analysis

The statistical package for Social Science Computer Software (SPSS version 17.00, zo) was used to analyze data. A Completely Randomized Design (CRD) was used with Analysis Of Variance (ANOVA) to test the differences among Studied fixed factors. A P-value of ≤ 0.05 was considered indicative of a statistically significant difference.

The similarities and differences in nutritive value (moisture, Carbohydrate, CP, total fat, and ash%) and macro-minerals (Calcium 'Ca' mg/g, iron 'Fe' mg/g and phosphate 'P' mg/g) of beef burgers were investigated among three companies (Looli, Algoussi and Alarabi) and compared with locally made

Results and Discussion

Table 2: Profile of chemical composition ((mean \pm SE)) of burgers through this study.

burger	Moisture	Carbohydrate	Protein	Lipids	Ash
Locally	67.46 ^c \pm 0.06	1.18 ^a \pm 0.01	21.76 ^a \pm 0.08	3.49 ^a \pm 0.01	5.71 ^a \pm 0.03
Looli	71.02 ^a \pm 0.06	1.02 ^b \pm 0.01	19.13 ^b \pm 0.08	3.33 ^b \pm 0.01	5.20 ^b \pm 0.03
Algoussi	69.29 ^b \pm 0.06	0.97 ^b \pm 0.01	21.10 ^b \pm 0.08	3.21 ^c \pm 0.01	5.21 ^b \pm 0.03
Alarabi	67.46 ^c \pm 0.06	1.18 ^a \pm 0.01	21.76 ^a \pm 0.08	3.49 ^a \pm 0.01	5.71 ^a \pm 0.03
Overall	68.78 \pm 0.03	1.09 \pm 0.01	21.00 \pm 0.04	3.38 \pm 0.01	5.45 \pm 0.02
Sig.	**	**	**	**	**

a,b,c means for each independent having different manuscript are significantly different.

** \equiv significant at (P \leq 0.01).

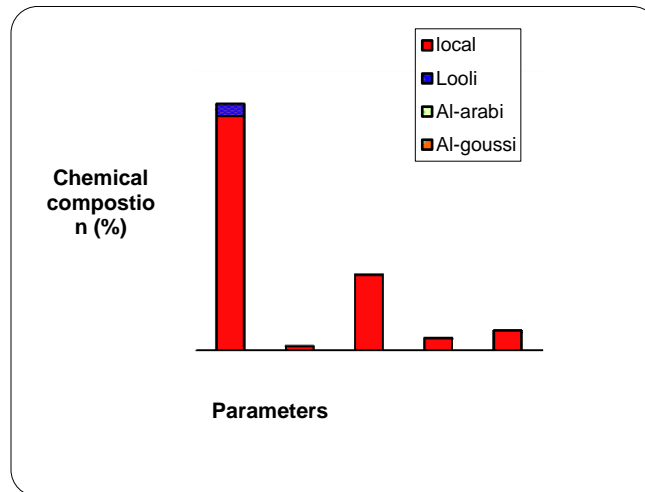


Figure 1: Profile of chemical composition ((mean ± SE)) of burgers

Chemical composition of burgers

Moisture

Table 2: showed that moisture of burgers processed locally, Looli, Al-goussi, and Al-arabi were 67.46%, 71.02%, 69.29%, and 67.46%, respectively. There were highly significant differences ($P \leq 0.01$) in moisture among all types of burgers. The higher moisture content was found in Looli burger, while the lower moisture content was recorded in local and Al-arabi burger. These findings were disagreed with Karema *et al.* (2011) who studied the quality characteristics of beef burger formulated with partial replacement of beef fat olive oil and wheat brand fibre and they were mentioned that, moisture was from (58.70 – 60.00%), while the findings were agreed with Teye *et al.* (2012) who investigated the effect of cowpea (*vigna unguiculata*) flour as an extender on the physico-chemical properties of beef burger and they found that, moisture was ranged from (76.37 – 78.11%).

Carbohydrates

Table 2: showed that the carbohydrates of burgers processed locally, Looli, Al-goussi, and Al-arabi were 1.18%, 1.02%, 0.97%,

and 1.18%, respectively. There were highly significant differences ($P \leq 0.01$) in carbohydrates between (local and Al-arabi) versus (looli and Al-goussi). And neither local and Al-arabi nor Looli and Al-goussi were significantly differ ($P > 0.05$). The higher carbohydrates were found in local and Al-arabi burger, at the same time the lower ones were recorded in Looli and Al-goussi burger. These results were less than that of Karema *et al.* (2011) who found that, carbohydrates of beef burger formulated partial with olive oil instead of beef fat was from (1.54 – 5.38%), and the reason might be due to the differences in binders and fillers used in these products. Also, the findings were agreed with Abdul Salam *et al.* (1995) when he were researched the nutritional value of locally processed burger in Malaysia and who were pointed-out that, carbohydrates were range from (0.70 – 23.50%).

Protein

Table 2: showed that the protein of burger processed locally, looli, Al-goussi, and Al-arabi were 21.76%, 19.13%, 21.10%, and 21.76%, respectively. There were highly significant differences ($P \leq 0.01$) in protein between (local and Al-arabi) versus (looli

and Algoossi). In contrast, there was no significant difference ($P>0.05$) observed between local and Al-arabi nor looli and Algoossi. The higher protein was observed in local and Al-arabi burger, while Looli and Al-goussi burger were recorded the lower protein. Clearly, these differences portably might be returned to the quantity of the meat which was used 65% in the local burger, and the an other reason that, the grade of meat may be lower in commercial burgers than ours . The findings were greater than Karema *et al.* (2011) they were pointed-out that, the average protein level of burger was 15.67 – 16.67% and Abdul Salam *et al.* (1995) figured-out that, Malaysian burger protein was from 10.80 – 15.90%. And in agreement with Teye *et al.* (2012).

Lipids

Table 2: showed that the fat of burger processed locally, looli, Al-goussi, and Al-arabi were 3.49%, 3.33%, 3.21%, and 3.49%, respectively. There were highly significant differences ($P\leq 0.01$) in fat among all types of the product. The higher fat was observed in local and Al-arabi burger, while the lower fat was found in Al-goussi burger. The findings were less than that obtained by

Karema *et al.* (2011) who were pointed-out that, beef burger fat was (7.33 – 20.20%), Teye *et al.* (2012) (4.80 – 6.73%), and Abdul Salam *et al.* (1995) (14.90 – 28.70%).

Ash

Table 2: showed that the ash contents of burger processed locally, looli, Al-goussi, and Al-arabi were 5.71%, 5.20%, 5.21%, and 5.71%, respectively. There were highly significant differences ($P\leq 0.01$) in ash between (local and Al-arabi) versus (looli and Algoossi). In contrast, there was no significant difference ($P>0.05$) observed between local and Al-arabi nor looli and Algoossi. The higher ash was observed in local and Al-arabi burger, while Looli and Al-goussi burger were recorded the lower ash. The findings were greater than that obtained by Karema *et al.* (2011) whom figured out that the ash of burger ranged from (2.72 – 3.61%) and Neven and Abd.El Haleam (2009) who were studied Chemical and Physical Characteristics of Beef Burger Served in Some Hotels and pointed-out that the ash content of beef burger was averaged 3.62%.

Noticeably that, chemical composition of burger were similar for local and Al-arabi.

Table 3: Profile of macro-minerals (mean \pm SE mg/g) of burgers

Burger source	Calcium (Ca)	Iron (Fe)	Phosphate (P)
Locally	49.00 ^a \pm 0.40	1.35 ^{ab} \pm 0.02	151.00 ^{ab} \pm 0.50
Looli	47.33 ^b \pm 0.40	1.40 ^a \pm 0.02	152.00 ^a \pm 0.50
Algoossi	45.00 ^c \pm 0.40	1.29 ^b \pm 0.02	147.00 ^c \pm 0.50
Alarabi	49.00 ^a \pm 0.40	1.36 ^{ab} \pm 0.02	150.00 ^b \pm 0.50
Overall	47.58 \pm 0.21	1.35 \pm 0.01	150.00 \pm 0.26
Sig.	**	*	**

^{a,b,c} means for each independent having different manuscript are significantly different.

* \equiv significant at ($P\leq 0.05$).

** \equiv significant at ($P\leq 0.01$).

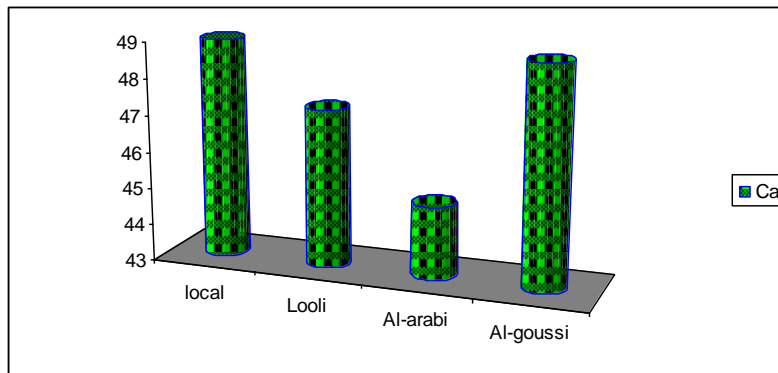


Figure 2: Calcium (mg/g) profile of burger

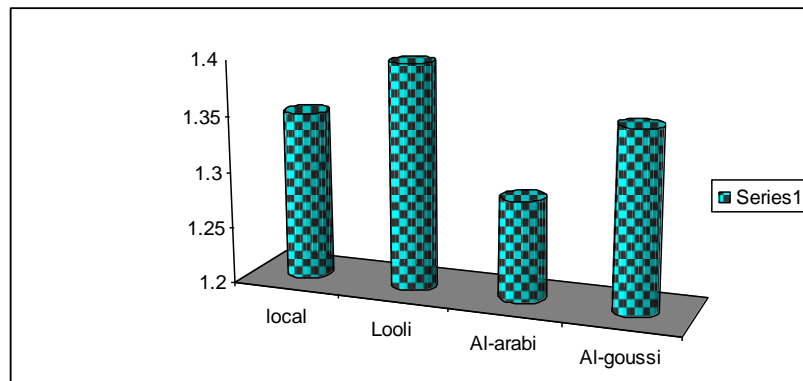


Figure 3: Iron (mg/g) profile of burger

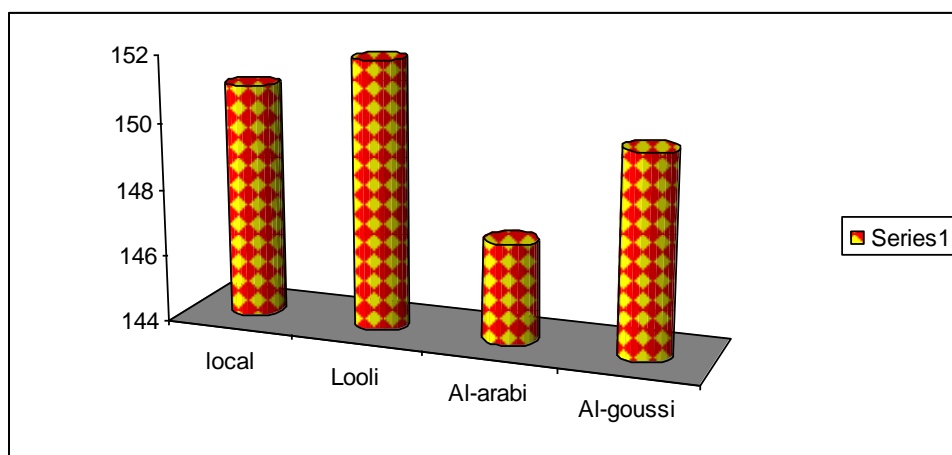


Figure 4: Phosphate (mg/g) profile of burger

Profile of macro-minerals (mean \pm SE mg/g) of burgers

Calcium (Ca) content

Table 3: showed that the (Ca) of burger processed Locally, Looli, Al-goussi, and Al-arabi were 49.00, 47.33, 45.00, and 49.00 mg/g, respectively. There were highly significant differences ($P \leq 0.01$) in (Ca) among burgers. Whereas, the Local and Al-arabi burgers showed no significant difference ($P > 0.05$). The higher (Ca) was observed in Local and Al-arabi burger, while Al-goussi burger was recorded the lower (Ca) content. The similarity was found between Local and Al-arabi burgers, this might illustrated that the meat and ingredients used in the processing probably in the same quantities. The findings were lesser than Neven and Abd.El Haleam et al. (2009) who were studied Chemical and Physical Characteristics of Beef Burger Served in Some Hotels and reported that calcium of beef burger was averaged 60 (mg/g).

Iron (Fe) content

Table 3: showed that the (Fe) of burger processed locally, looli, Al-goussi, and Al-arabi were 1.35, 1.40, 1.29, and 1.36 mg/g, respectively. There were significant differences ($P \leq 0.05$) in (Fe) between Looli and Al-goussi burgers. The higher (Fe) was recorded in Looli burger, while Al-goussi burger was recorded the lower (Fe) content. All products were looked similar and this similarity might return to the possibility that, the meat and ingredients used in the processing probably in the same quantities. The findings were agreed with **Abd-elhak et al. (2014)** who found that the (Fe) content was averaged 1.28 (mg/g) when investigated innovative modification of traditional burger.

Phosphate (P) content

Table 3: showed that the (P) in burger processed locally, Looli, Al-goussi, and Al-

arabi were 151.00, 152.00, 147.00, and 150.00 mg/g, respectively. There were high significant differences ($P \leq 0.01$) in (P) among the burgers. The higher (P) was found to be in Looli burger, while the lower (P) was recorded by Al-goussi burger.

Conclusion

The findings of this study revealed that, chemical composition of burger had highly significant differences ($P \leq 0.01$) in all the parameters among types of burger. Minerals profile revealed that, burger showed highly significant difference ($P \leq 0.01$) in (Ca) and (P), while (Fe) had significant difference ($P \leq 0.05$) among the samples.

Recommendations

According to the findings, we recommended that:

- (1) Consumers should consume processed burger manufactured in scientific meat laboratories because the quantities of ingredients were significantly formulated.
- (2) Other formulas for burger should be tried in order to test their sensory attributes.

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دراسة مقارنة في جودة البيرقر البقري المُصنَّع محلياً مع نظيراته من الشركات التجارية

رويدا سيد موسى الفكي¹، عمر أبوالحسن عثمان إيدام²، ياسر هلال عبد الله الهاشمي³ و رمزي أحمد يوسف⁴

^{1,3} قسم إنتاج وتقانة اللحوم، كلية الإنتاج الحيواني، جامعة الجزيرة، السودان. بريد إلكتروني: rowaidamusa88@gmail.com ،

² قسم إنتاج وتقانة الأسماك، كلية الإنتاج الحيواني، جامعة الجزيرة، السودان. بريد إلكتروني: omerabimido@gmail.com

⁴ قسم علوم الأسماك والحياة البرية، كلية الإنتاج الحيواني للعلوم والتكنولوجيا، جامعة السودان للعلوم والتكنولوجيا، الخرطوم، السودان.

بريد إلكتروني: ramzy173@gmail.com

المستخلص

اللحوم ومنتجاتها مكونات أساسية في غذاء الإنسان، يتأثر إستهلاكها بعوامل مختلفة. والعوامل الأكثر أهمية هي خصائص المنتج (الحسية، الغذائية، السلامة، السعر، الملائمة ... ألخ.) والمستهلك والخصائص ذات العلاقة بالبيئة (النفسية، الصحة، العائلة أو المظاهر التعليمية، الحالة الإقتصادية العامة، المناخ، التشريع ... ألخ.). أجريت هذه الدراسة لتقييم ومقارنة التشابه والإختلاف في منتج لحوم الأبقار (البيرقر) المصنوع محلياً بمصانع اللحوم التجارية (لولي، القوصي والعربي) من حيث القيمة

الغذائية (الرطوبة، الكربوهيدرات، البروتين الخام، والرماد) والعناصر المعدنية الكبرى (الكالسيوم، الحديد والفسفور). تم أخذ 48 عينة من البيرقر المصنع محلياً في المعمل والشركات التجارية (لولي، القوصي والعربي) وأُرسلت للمعمل للتحليل الكيميائي وتحديد العناصر المعدنية الكبرى. تم تحليل البيانات ببرنامج الحزم الإحصائي للدراسات الإجماعية (SPSS) نسخة (17) باستخدام التصميم العشوائي الكامل (CRD). أظهرت نتائج التحليل الكيميائي للبيرقر أنّ هناك فرق معنوي كبير ($P \leq 0.01$) في كل القياسات بين أنواع البيرقر. وأظهر البيرقر إختلاف معنوي كبير ($P \leq 0.01$) في كل من الكالسيوم والفسفور بينما أظهر الحديد فرق معنوي ($P \leq 0.05$) بين كل أنواع البيرقر. أوصت الدراسة إلى أنّ يجب على المستهلك أن يستهلك منتجات لحوم الأبقار (السجق والبيرقر) المصنّعة في المعامل العلمية وذلك لأن كميات المواد المُدخلة في المنتج معلومة.