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CHEMICAL COMPOSITION OF MODERN AND TRADITIONALLY PROCESSED SAUSAGES

Osman A. A. Khadija[1] and El Bagir [2]M. Nabiela

[2 ,1]Department of Biochemistry Faculty of Veterinary medicine University of Khartoum

المستخلص

فحصت بعض الحتويات البيوكيميائية لنوعين من النقانق التى تم اعدادها آليا فى شركتين محليتين وقورنت بنقانق معدة يدويا بالطريقة التقليدية كعينة شاهدة . قيست درجة الرطوبة ,البروتين الكلي ,الدهون الكلية والكوليستيرول. جمعت العينات من سوق امدرمان المحلي ولاية الخرطوم,جمهورية السودان . اوضح التحليل الإحصائي, ان هناك فرق معنوى ($P < 0.001$) في كمية المياه بالنقانق التقليدية والمصنعة حديثا. كما اتضح ان هناك فرق معنوي ($P< 0.05$)في كمية الدهون الكلية بين النوعين المصنعين آليا اما كمية البروتينات والكوليسترول لم تسجل فروقات معنوية في الثلاثة مجموعات التي تمت مقارنتها. من المرجح ان تكون الفروقات المعنوية في كمية الماء والدهون بأنواع النقانق الثلاثة, بسبب استخدام المواد المالئة بالنقانق المصنعة آليا. خلصت الدراسة الى اثبات ان هناك فروقات معنوية في المكونات البيوكيميائية للنقانق المصنعة آليا مقارنة بالمصنعة تقليدياً مما يحتم تكثيف الدراسات على الاغذية المصنعة آليا بغرض ضبط النسب المختلفة للمكونات الغذائية بها لتناسب مستلزمات الغذاء الصحي. ودراسة الفروقات التي يمكن ان تساعد على تقييم وتصنيف النقانق بالسودان ضمن الاغذية الصحية.

Abstract

This study was conducted to compare the chemical composition of sausage samples from two local modern processing plants and a third traditionally prepared samples as control.All samples purchased from Omdurman market ,Khartoum State, Sudan. A proximate analysis was measured for the three samples of the sausages as moisture, crude protein , total lipids and cholesterol content.

. The statistical analysis of the data revealed clear differences between

n the two modern processed samples and traditionally processed one. A significant ($P < 0.001$) high moisture content in traditionally made sausage was observed compared to the two modern processed sausage samples. Also the study showed

significantly ($P < 0.05$) higher level of total lipids in one of the modern processed samples compared to the traditionally processed sausage. No significant differences were recorded for the contents of crude protein and cholesterol within all types of sausages. The study showed significant differences in water and fat contents, within the modern processed sausages, which was suggested to be due to the addition of expanders in the modern plants. These findings implied that further extensive studies are needed to show the actual differences in the composition of fats or proteins in modern processed sausages. This can evaluate their nutritional values and show how modern processed sausages, in Sudan, can be ranked as healthy food.

Introduction

The origin of meat processing is lost in antiquity but probably began when primitive humans first learned that salt is an effective preservation and that cooking prolongs the keeping quality of fresh meat. In any case meat processing had its origin before the dawn of civilization (Pearson and Gillett, 1999). The basis for meat processing was preservation by inhibiting or deterring microbial composition. Early meat processing developments were based on this concept (drying or curing meat produced by house wives). At the turn of the century pork was the only meat processed in quantity. Today, beef, mutton and fish are also used in large amounts in a variety of processed products. Recent advances have resulted in the use of large quantities of bone less poultry meat in processed meat products (Pearson and Tauber, 1984). Sausages are one of the oldest forms of processed meat popular and admirable for it's easily prepared and stored, its exclusive taste and flavor makes it widely accepted usually as snacks and the main factor which make sausage spread all over is the fact that it saves a lot of time and more effort. Also it's more feasible for consumers compared with all other meat products (Jasim, 1986). There are hundreds of different sausage products available to consumers to day (e.g. fresh beef sausage, frankfurters, liver sausage and salami) and consumers eat sausage because of convenience, variety, economy and good nutritional value. This reason leads to an increase of the production of processed sausage (Gerrard and Mallion, 1980). In Sudan traditionally processed meat was mainly made by drying or salting. Later traditionally made sausages were produced in limited quantities by butchers. But now many companies started to produce processed meat of different qualities for marketing. Studies on the quality of the modern manufactured processed meat are very little or lacking and processed meat products particularly sausage are very largely consumed. The present study was designed to investigate proximate analysis of two types of processed sausage to measure the chemical composition (moisture, protein, total lipids and cholesterol) in two modern and the traditionally processed sausage to compare their constituents so as to provide information for further studies to evaluate the nutritive content of the products, as this is very much related to human nutrition and health.

Materials and Methods

Thirty samples were collected randomly from the local market in Omdurman as three groups (A, B and C) ten bags each, for proximate analysis all are within the same dates of production. Groups A and B were sausages from modern processing plants and group C was traditionally processed sausages from local butcher shops. Approximately 100 gm portions were taken from different places of each finger just after removal of the casing and mixed to insure representative samples for proximate analysis. Moisture, crude protein, total lipids and cholesterol content of the raw sausage were determined according to the AOAC (1990) methods. Moisture contents determination was based on weight loss from 5 gm of sausage meat samples, dried over night in drying oven at 105^{o}C. The samples were cooled in desiccators, weighed and moisture loss was calculated as a percentage of fresh sample weight. The kjeldahl method was used to determine the total nitrogen. Crude protein was calculated as 17.5 times kjeldahl nitrogen. Lipid was extracted in chloroform methanol (2:1 V/V) according to the method of Folch *et al.*, (1957) as modified by Overturp and Dryer, (1969). Then total lipid in tissue was determined as described by Fringes *et al.*, (1972).The total cholesterol was determined according to the method of Kim and Godberg (1969) using Lieberman-Burchard reagent. All samples were analyzed in the department of Biochemistry faculty of veterinary medicine university of Khartoum.

Statistical analysis: Statistical analysis was performed as described by Little and Jackson, (1978). Randomized Complete Blocked Design (RCBD) with three replications and random sampling was used to perform a comparative study between traditionally processed sausages and the modern processed plant sausages, using analysis of variance and Tukey's test (Daniel, 1988) to calculate significant differences among means.

Results

The moisture content of the sausage samples was presented in Table (1) The results of moisture content in the three types of sausages indicated that samples (A) and (B) did not differ significantly when the moisture contents were compared. Group (C) sausages showed very high moisture content compared to group (B) ($P< 0.001$).

Group (B) sausages showed the lowest moisture content of the three samples. The results showed that traditionally made sausage contained significantly higher moisture than the modern processed sausages (Table 3).

Table (1): Moisture and protein (%) of the sausage samples (means ± SE)

Independent variables (%)	Samples		
	A	B	C
Moisture	69.86± 2.20^{ab*}	61.44± 0.48^{b**}	71.47± 0.52^{a}
Crude protein	17.33± 0.55^{a}	17.15± 0.97^{a}	15.93± 0.88^{a}

Means (±SE) in the same row haring different superscripts are significantly different.
(A) Sausage from modern processing plant1 (B) Sausage from modern processing plant2 (C) Traditionally processed sausages. (P< 0.01) * (P< 0.001) **

Table (2): The levels of total lipid and total cholesterol of the sausage samples

Independent variables (%)	Samples		
	A	B	C
Total lipid	132.68± 9.24^{a}	189.14± 10.52^{b*}	151.05± 17.22^{a}
Cholesterol	0.46± 0.00^{a}	0.46± 0.00^{a}	0.55± 0.00^{a}

Means ± SE in the same row having different superscript are significantly different.
(A) Sausage from modern processing plant1 (B) Sausage from modern processing plant2 (C) Traditionally processed sausages.(P< 0.05) *

Table (3) Chemical composition of Modern processed sausages compared to traditionally made ones.

Independent variables (%)	traditionally processed sausages	Modern processed sausages
Total lipids	151.05±17.22^{a}	160.91±9.88 ^{b*}
Total Cholesterol	0.55± 0.00^{a}	0.46±00 ^{a}
Moisture	71.47± 0.52^{a}	65.65±2.5 ^{b*}
Crude protein	15.93± 0.88^{a}	17.23±0.76 ^{a}

Means ± SE in the same row having different superscript are significantly different.(P< 0.05) *

The contents of the crude protein in the three groups were presented in Table (1). The findings in the present work indicated that the three samples did not differ significantly in crude protein content. Though, the traditionally prepared sausages showed lower protein contents compared to the modern processed samples. The contents of total lipids in the three different sausage samples are presented in table (2). The results indicated that samples (A) and (C) did not differ significantly in total lipid content. Nevertheless group (B) sausage contained the highest total lipid contents compared to the other two groups ($P< 0.05$). Group (A) showed the lowest total lipid content compared to group (B) and (C). Though groups (A) and (B) were collected from modern processing plants, it was noticed that, (A) samples showed significantly lower fat content ($P< 0.05$) compared to (B) samples and even lower than the traditionally processed sausages. The modern processed sausage showed lower lipid contents compared to the traditionally processed samples (Table 3)

The contents of total cholesterol in the three different sausage samples were presented in Table (2). The results indicated that the three samples did not differ significantly in total cholesterol content. Though, the traditionally processed sausage showed obviously higher total cholesterol contents compared to the modernly processed samples.

Discussion

As shown in the table (1), significant differences were recorded among the three treatments in moisture values. The difference in moisture results from sausages of the modern processing plants (1) and (2) was suggested to be due to the use of non meat protein in the contents of sausages as expander (e.g. Soya bean, chickpea). The traditional sausage had the highest moisture content compared with modern processed sausages. This finding also agrees with that reported by Shakelford *et al*. (1990) who analyzed a processed cooked pork sausage, which showed similar moisture contents to the modern sausage in the present work and much lower than that of the traditional sausages, also the present finding is similar to a study of Verma *et al*. (1988) who compared the composition of English fresh sausage which prepared in some meat of pork, beef and mutton, their result in pork and beef meat was similar to modern processed sausages but the moisture content in mutton meat was higher and of the same level of the content of moisture in traditional sausage in the present study. This finding can be explained by the fact that the contents of traditional sausage, in the Sudan can not set constant principles or formula to be manufactured and may contain mutton meat. However, the moisture levels of

traditionally prepared sausages were similar to Gerrard and Mallion (1980) and Abuqoch *et al*. (1999) who reported higher moisture content in modern processed pig meat sausages but with similar protein content to the findings in this study. Babiker and Mohamed (2000) evaluated the moisture in sausages containing chick pea flour and found that the control sample had higher moisture content compared to the present study. So it is suggested that the differences in moisture content in the present work could be due to the use of legumes in processed sausage whereas traditionally prepared samples were usually made of meat only which could also be a mixture of different meat types of different animal species.

When protein content was measured, no significant difference was reported among the three sausage samples in this study. These findings agree with the findings reported by Rao *et al*. (1984). The similar levels of protein in the present study could be due to the higher protein content of legumes usually used in manufactured sausage. Shakelford *et al*. (1990) studied the composition of cooked pork sausage of different percentage of fat content and they found high protein content in control sample and decrease when increase fat formulation in the content of sausage. However, in the present work similar protein contents were found, though there were significant differences in fat content.

The Chemical analysis indicated that there was a significant difference between the three sausage samples in total lipid. The difference between the modern processed sausage plant (1) and plant (2) may be due to the use of different non meat product as extender or fillers included in sausage formulation. The higher content of lipid in traditional sausage may be due to the use of some fat tissue incorporated in sausage formulation. The levels in groups (A) and (C) were similar to the value reported by Verma *et al*. (1988), but group (B) showed higher lipid content compared to them. These findings disagree with those reported by Rao *et al*. (1984), who showed that the fat content in the control sample is lower and increase when added different level of soya in the sample. The differences between the two results could be due to the high fat content of soya bean (17.7%) compared to other legumes which could be used in sausages manufactured in the Sudan.

There was no significant difference between the three sausage samples in total cholesterol content, this may be due to the fact that, the fat of manufactured sausage is made mainly from triglycerides. The levels of cholesterol were a little bit higher in traditionally processed sausage, this might be because of using only natural meat and fillers are not usually added to traditionally processed sausage. These findings also

agree with the result of Wilson *et al*. (1981) who measured the level of cholesterol by enzymatic method in dark meat in chicken and beef to compare them, they found no difference between the two kinds of meat. This study showed clear differences in the chemical composition of the modern processed sausage samples when compared to the traditionally processed ones as follows: Moisture is significantly lower in modern manufactured samples than in the traditionally processed samples; this was explained to be due to the addition of expanders in modern processed sausage. Fat contents are significantly very high in modern manufactured sausage. Protein levels were higher and cholesterol levels were lower in modern processed sausages compared to traditionally processed samples but with no significant differences.

Conclusions:

Significant differences in some chemical constituents were confirmed in this study, which strongly recommends that further work should be conducted to investigate about the chemical composition of all manufactured and processed meat products in Sudan, so as to put very strict laws, to govern the correct levels and types of all nutrients in these products and to evaluate their values as healthy food.

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