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Original research

Proximate Composition Analysis of Beef Sausage

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Abstract:

Meat and meat products make an important nutritional contribution to human diet. Beef sausage is one of the most popular fast food in Egypt. Accordingly, a total of 30 beef sausage samples from market stalls and selected fast-food restaurants in Aswan city, were subjected to proximate analysis then compared with the Egyptian standards to determine their acceptability. The methods used for the determination of proximate composition were AOAC Official Methods 990.19,973.48, 960.39, and 999.11 for moisture, protein, fat, and ash, respectively. The results revealed that the mean values of moisture, protein, fat, ash, carbohydrates and red meat were 62.15±0.96%, 14.34±0.49%, 15.63±1.12%, 2.85±0.10%, 5±0.64%, and 45.01±1.99%, respectively. By comparing the results with the Egyptian Organization for Standardization No. 1972, there were 56.67%, 40%, and 90% of the samples unaccepted based on their moisture, protein, and red meat contents, respectively, while all the samples were accepted based on their fat and ash contents. There were significant differences in the moisture, protein, fat, ash, and carbohydrate content of the beef sausage samples. The findings indicated that the nutritional composition of sausage samples varied among different locations where a variation in preparation method was observed.

Keywords: sausage, meat, chemical composition, analysis

1- INTRODUCTION

Meat as high energy type of food is considered to be the food of choice due to its nutritional value. Meat is well known as an excellent protein and energy source for our daily diets and after digestion, provides excellent nutrition (**Chang and Huang, 1991**).

Sausages are processed meat products that contained a mixture of minced or comminuted meat and fatty tissues combined with numerous non-meat ingredients and additives (salt, herbs, spices, etc.) that stuffed into casings, commonly natural casings from the intestine to be formed into discrete units. The fresh sausages are sold without any heat treatment that is generally stored and commercialized chilled or frozen **(Feiner, 2006)**.

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Sausages are very common and popular productsthat manufactured from lower value trimmed meat to produce a higher-value product. Food additives are used to accomplish certain functions such as coloring, antimicrobial, antioxidant, preservation, improved nutrition, increased emulsification, and altered flavor. The use of non-meat ingredients, or additives, provides the meat industry with the flexibility needed for the development of a wide diversity of products. All processed meat products have an ingredient statement on the product label. The ingredients are listed in order of predominance so that the ingredient present in the greatest quantity is listed first while the ingredient present in the smallest amount is last (**Quasem et al.,2009)**.

Up-to-this-date, various analytical approaches have been documented to determine the functional ingredients of meat products. In this study, the beef sausage from selected market stalls and fast-food restaurants were determined for their proximate content. The generated data compared with the Egyptian Organization for Standardization and Quality No. 1972 **(EOS, 2005)**. Therefore, the study was aimed to determine the proximate composition of beef sausage from market stalls and selected fast-food restaurants in Aswan city.

2- MATERIALS AND METHODS

2.1 Preparation of samples

A total of 30 different beef sausage samples of different companies were randomly collected from market stalls and the fast-food restaurants in various regions in Aswan city, Egypt. All the samples were wrapped, identified then transported in an icebox container to the Central Lab; Faculty of Veterinary Medicine; Aswan University for their analysis according to (**Harrigan, 1998**). The samples were prepared and examined according to the technique recommended by (AOAC, 2003) as follows: 25 gm of product sample was ground using Stomacher then the chopped material was transferred to a suitable container with an airtight cover, identified, and stored in the refrigerator till used.

2.2 Determination of moisture content

Moisture content was determined by using the air oven drying method by AOAC Official Method 990.19 (**AOAC 2016**). The measurement was done by drying the samples in a Model 600 air oven (Memmert, Germany) at 105°C for overnight. The dish was then cooled in a desiccator and weighed and weighed and the process was repeatd until constant weight reached

2.3 Determination of protein content

Kjeldahl Method was used to determine protein content based on the standard procedure in AOAC Official Method 973.48 (**AOAC 2016**). This method is performed based on an automated Kjeltec instrument (Foss, Germany) to determine protein content in sausage samples.

2.4 Determination of fat content

Fat content was determined based on the Soxhlet extraction method by using AOAC Official Method 960.39 (**AOAC 2016**). Instead, Fat content was measured by weight loss of the sample or by weight of the fat removed.

2.5 Determination of ash content

Ash content of the samples was determined using the dry ashing method AOAC Official Method 999.11 (**AOAC 2016**). Ashing of sausage sample (10 g) was done in a Thermo Scientific Thermolyne 62700 muffle furnace at 550°C. Before ashing, the crucible was dried in an oven at 105°C for 3 hrs.

2.6 Determination of carbohydrate content

The carbohydrate content was calculated using the differential weight of all compounds (**Ramadhan *et al*., 2012**). The value was obtained by subtracting with the percentages of all other components such as moisture, protein, fat, and ash.

2.7. Determination of Meat Content

Red meat content was calculated according to (**McLean, 2007**) by the following equation: Fat-Free Meat Content % $= \frac{\text{Total Nitrogen \% } - \text{Non}-\text{Meat Nitrogen\%}}{\text{NF}} \times 100$

Where NF is the Nitrogen Factor (**AMC, 2014**) = 3.50

2.8 Statistical Analysis

Means and standard error were calculated among samples using One-way Analysis of Variance (*ANOVA*) was done for significant differences between the samples using the Microsoft Office Excel 2007 and *GraphPad InStat 3* for Windows software. A statistically significant difference was set at $p<0.05$.

3. RESULTS AND DISCUSSION

The data in **Table (1)** and **Fig. (1)** show the mean value of proximate compositions of beef sausage samples. The moisture content had a mean value of 62.15±0.96%. While the protein content with a mean value of 14.34±0.49%. Also, the fat content with a mean value of 15.63±1.12%. Additionally, the ash content had a mean value of 2.85±0.10%. While the carbohydrate content with a mean value of 5±0.64%. Finally, the red meat content with a mean value of 45.01±1.99%. Based on the ANOVA result, there were significant differences ($p<0.05$) in the percentage of total moisture, protein, fat, ash, carbohydrate, and meat contents of the examined samples.

Based on the results obtained from a previous study, the current results nearly agreed with the results of **Schmid *et al.* (2009)**, **Nada (2012)**, **Cunningham *et al.* (2015),** and **Rehab (2017) for** moisture content which were 61.5%, 62.98%, 62.5% and 62.56%, respectively. Also, it agreed with the results of **Cunningham *et al.* (2015), and Rehab (2017)** for protein content which 14.0%, and 15.56%. As well as agreed with the results of **Quasem *et al.* (2009),** and **Cunningham *et al.* (2015)** for fat content which was 16.7, and 14.9%, respectively. Also, **Ambrosiadis *et al.* (2004)**, **Kamkar *et al.* (2005)**, **Dharmaveer *et al.* (2007), Quasem *et al.* (2009)**, **González-Tenorio *et al.* (2012),** and **Nada (2012)** reported nearly similar results for ash content which were 2.99%, 2.98%, 3.00%, 2.27%, 2.9% and 3.08%, respectively.

However, lower results for moisture contents were stated by studies conducted by **Maha and Sohad (2005)**, **Dharmaveer *et al,* (2007)**, **Iordan *et al.* (2012)**, **González-Tenorio *et al.* (2012),** and **Talib (2015)** which were 55.6%, 55.48%, 40.15%, 42.8%, and 55.18%, respectively. Similarly, other researchers reported lower results of protein contents as **Schmid *et al.* (2009)**, **Nada (2012)**, and **El Zahaby (2013)** which were 13.5%, 10.37%, and 10.08%, respectively. Additionally, lower results of fat contents were achieved by **Ahmed *et al.* (2013)** and **Alamin (2016)** which were 4.5% and 3.45%, respectively. Furthermore, lower results of ash contents were found by **Alamin (2016),** and **Rehab (2017)** which were 1.33%, and 3.13%, respectively. As well as **González-Tenorio *et al.* (2012),** and **Rehab (2017)** reported lower results for carbohydrate content which were 2.7%, and 1.5%, respectively.

Otherwise, higher findings of moisture content were obtained by **Ahmed, *et al* (2013)**, and **Alamin (2016)** which were 68% and 70.32%, respectively. While higher results for protein

contents were reported by **González-Tenorio *et al.* (2012)**, **Talib (2015),** and **Alamin (2016)** which were 18.2%, 27.07%, and 18.53%, respectively. The high moisture content could be due to the presence of fresh vegetables added to the sausage which contained a high level of moisture. As well the low protein content could be due to adding too much filling of non-proteinaceous materials in the formulation of the product like the wheat flakes, root beet as a coloring and filling material which is consequently reflected in the final protein and meat content of the product **(Fath El-Bab *et al.* 2006)**.

Currently, higher results of fat contents were found by **Iordan *et al.* (2012)**, **Nada (2012)**, **González-Tenorio *et al.* (2012)** and **El Zahaby (2013), and Rehab (2017)** which was 29.7%, 24.61%, 33.4%, 25.13%, and 19.14%, respectively. The high-fat content of samples reported could be due to the unhealthy way of processing and extra fat-containing spread added to the burger samples. Finally, higher results for ash content were found by **Hamed (2001), Nouman *et al.* (2001),** and **Rehab (2017)** which were 3.53%, 4.6%, and 3.13%, respectively. The high ash value could be due to the addition of spices as a seasoning, high fiber vegetables, starches, cereals, soy proteins, and salt. Soft bone and other chicken parts in the patty could also increase the ash content due to the presence of calcium and other macrominerals (**Babji *et al*., 2000**).

Additionally, the increase in carbohydrate content might be attributed to the increase in starch content as extender to substitute the raw meat in manufacturing meat products by the inclusion of high amounts of binders and fillers such as rusk, cereals, breadcrumbs and soy protein, in addition to hydrocolloids (gums, starches, dextrins). The main reason behind this might be the manufacture plans to reduce the cost and increase the marginal profit **(Lukman *et al.*, 2009)**.

The legal requirements of sausage were established by the Egyptian Organization for Standardization and Quality No. 1972 **(EOS, 2005)**, where moisture, protein, fat, ash, and meat contents are 60%, 15%, 30%, 5%, and 60%, respectively. By comparing the results with the Egyptian Organization for Standardization No. 1972 (**EOS, 2005)**, there was 56.67%, 40%, and 90% of the samples unaccepted based on their moisture, protein, and red meat contents, respectively, while all the samples were accepted based on their fat and ash contents as shown in **table (2**).

Similarly, **Nada (2012)** found the unaccepted samples were 28% and 36% according to the protein and fat contents, respectively. As well, **El Zahaby (2013)** revealed that all the samples (100%) were unaccepted based on protein and fat contents when compared with the Egyptian standards. Likewise, **Rehab (2017)** reported that there were 50%, 30%, and 25% of the samples unaccepted based on their moisture, protein, and meat contents, respectively, while all the samples were accepted based on their fat and ash contents compared with the Egyptian standards.

Table (1): Statistical Analytical Results of Proximate Compositions of Beef Sausage

	Minimum	Maximum	Mean ± S.E.*
Moisture %	**53.83**	**72.5**	**62.15 ± 0.96**
Protein %	**9.6**	**18.75**	**14.34 ± 0.49**
Fat %	**7.8**	**27.47**	**15.63 ± 1.12**
Ash %	**1.8**	**4.1**	**2.85 ± 0.10**
Carbohydrate %	**0.72**	**12**	**5.00 ± 0.64**
Red Meat Content %	**25.97**	**66.63**	**45.01 ± 1.99**

***S.E.**= Standard error*
The P value is < 0.01, considered extremely significant by using One way ANOVA test.

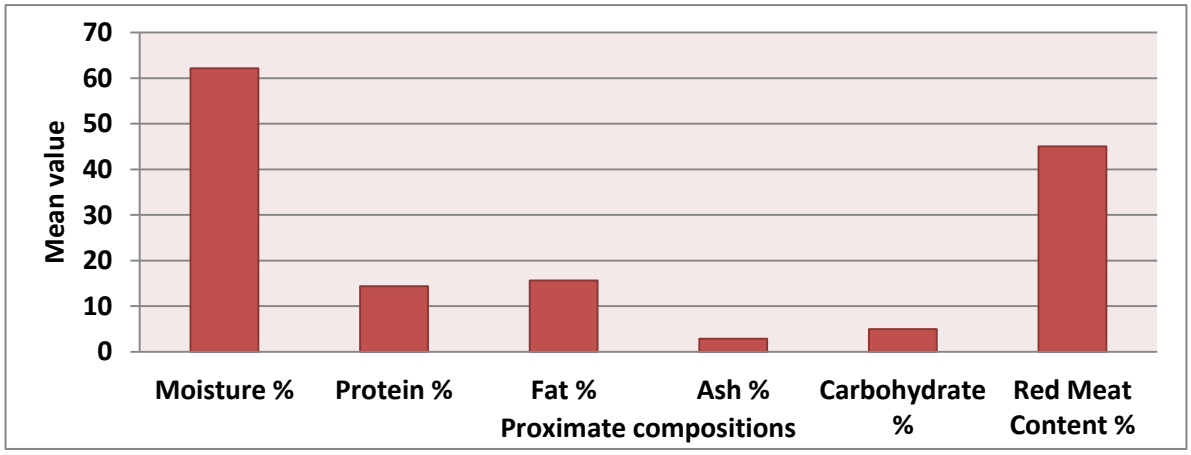

Fig. (1): Mean Values of Proximate Compositions of Beef Sausage Samples

Table (2): Acceptability of Beef Sausage Samples According to the Egyptian Standards for their Proximate Compositions (n=30):

	EOS* (1972/2005)	Accepted Samples		Non-Accepted Samples	
		No.	%	No.	%
Moisture%	**Not more than 60%**	**13**	**43.33**	**17**	**56.67**
Protein%	**Not less than 15%**	**18**	**60**	**12**	**40**
Fat%	**Not more than 30%**	**30**	**100**	**0**	**0.00**
Ash%	**Not more than 5%**	**30**	**100**	**0**	**0.00**
Red Meat Content%	**Not less than 60%**	**3**	**10**	**27**	**90**

EOS * = Egyptian Organization for Standardization

4. Conclusion

The nutritional values of the selected beef sausage samples from market stalls and the fast-food restaurants were showed wide varieties of proximate compositions due to the different methods of preparation. Nevertheless, most of the beef sausage is unaccepted by the Egyptian Organization for Standardization, especially in moisture, protein, and meat content. This study is important in providing insights into the nutrient composition of beef sausage from market stalls and fast-food restaurants in Aswan. The information may be useful for the public in choosing a healthier beef sausage. Available data on the proximate composition of beef sausage also assist consumers to make healthier choices for maintaining a healthy lifestyle. Lastly, this finding gives a better and clearer understanding of the proximate composition of beef sausage available in Aswan.

References

Ahmed, W. A.; Ahmed, D. A.; Ahmed, H. E., and Eltaib, W. A. (2013). Study on the wholesomeness of beef sausage processed by butcheries in Khartoum State and conformity to Sudanese Standards and metrology. Sudan Journal of Science and Technology, 14(1): 25-32.

Alamin, S. A. (2016). Chemical composition of different types of sausage. American International Journal of Research in Humanities, Arts and Social Sci.,13(2): 151-154.

Ambrosiadis, J.; Soultos, N.; Abrahim, A. and Bloukas, J. (2004). Physicochemical, microbiological and sensory attributes for the characterization of Greek Traditional sausages. Meat Science, 66(2): 279- 287.

AMC (2014): Analytical Methods Committee, Meat and poultry nitrogen factors, Anal. Methods, 2014,6, 4493.

AOAC (2003): Association of Analytical Communities, International Official methods of analysis. 17th edition. 2nd revision. Gaithersburg, MD, USA.

AOAC (2016). Association of Official Agricultural Chemists, Official Methods of Analysis of AOAC International. 20th ed. Rockville, USA: AOAC International.

Babji, A. S., Nuri, M. N., Suherman, J., & Chempaka, M. S. (2000). Quality assessment of local and franchise beef and chicken burgers. Pertanika Journal of Tropical Agricultural Science, 23(2), 103-112.

Chang, S.F and Huang T.C (1991). Some parameters involved in production of Zousoon-Asemi-dry, long fiberedpork product. Meat Sci., Volume 2 pp 303-325.

Cunningham, J.; Nguyen, V.; Adorno, P. and Droulez, V. (2015). Nutrient composition of retail samples of Australian beef sausages. Nutrients, 7(11): 9602-9617.

Dharmaveer, S.; Rajkumar, V. and Mukesh, K. (2007). Quality and shelf life of smoked chevon sausages packed under vacuum and stored at 4±1o C. American Journal of Food Technology, 2: 238-247.

El Zahaby, D. I. M. (2013). Chemical evaluation of some food additives in meat products. Ph.D. Thesis, Meat hygiene Department, Faculty of Veterinary Medicine, Moshtohor, Benha University.

EOS, (2005). Egyptian Standards No. 1972 for sausage, Egyptian Organization for Standardization and quality, Arab republic of Egypt.

Fath El-Bab, G. F. A.; Sayed, E. M. and Ismail, T. H. (2006). Bacteriological and chemical studies of frozen sausage in Giza Province. Zagazig Veterinary Journal, 34 (1): 156-163.

Feiner, G. (2006). Meat products handbook: Practical science and technology, Elsevier.

González-Tenorio, R.; Fernández-Diez, A.; Caro, I. and Mateo, J. (2012). Comparative assessment of the mineral content of a Latin American raw sausage made by traditional or non-traditional processes. Atomic Absorption Spectroscopy,12:167-82.

Hamed, M. I. A. (2001). Chemical evaluation of non-meat ingredients in some meat products. MV Sc. Thesis, Food Control Department. Facul. of Vet. Med. Cairo Unv.

Harrigan, W. (1998). Laboratory methods in food microbiology. 3rded. Academic Press, San Diego, Calif. pp. 43–70.

Iordan, M.; Popescu, E. C.; Stoica, A. and Bărăscu, E. (2012). Quality assessment of some raw-dried sausages offers consumers from Dâmbovița county. Annals. Food Science and Technology, 13(2):118-121.

Kamkar, A.; Hosieni, H. and Bahonar, A. R. (2005). Evaluation of the chemical composition of sausages produced in Iran. Pajouhesh-Va- Sazandegi, 18(4):36-41.

Lukman, I.; Huda, N. and Ismail, N. (2009): Physicochemical and sensory properties of commercial chicken nuggets. Asian Journal of Food and Agro-Industry, 2(2): 171-180.

Maha, I. and Sohad, H. (2005). Some chemical and mycological examinations of meat and fish products. Veterinary Medical Journal-Giza, 53(4): 941.

Mclean, B. (2007). Meat and Meat products: The calculation of meat content, added water and connective tissue content from analytical data. Campden and Chorleywood Food Research Association Group.

Nada, S. M. M. (2012). Chemical indices as quality measures in some meat products. Ph.D. Thesis, Food Control Department, Facult. of Vet. Med., Benha University.

Nouman, T.; Darwish, A.; Niazi, Z. and Aiedia, H. (2001). The traditional Alexandria semidry sausage. 1.-Quality attributes of market product.Vet.Med. J., 49 (2):225-235.

Quasem, J. M.; Mazahreh, A. S. and Al-Shawabkeh, A. F. (2009). Nutritive value of seven varieties of meat products (sausage) produced in Jordan. Pakistan Journal of Nutrition, 8(4): 332-334.

Ramadhan, K., Huda, N. and Ahmad, R. (2012). Physicochemical and sensory characteristics of burger made from duck surimi-like material. *Poultry Science*, 91(9), 2316-2323.

Rehab El-Sayed Mosaad Gaafar (2017). Thesis (PhD) Suez Canal University. Faculty of veterinary medicine. Department of Food Hygiene and Control.

Schmid, A.; Ampuero, S.; Bütikofer, U.; Scherrer, D.; Badertscher, R. and Hadorn, R. (2009). Nutrient composition of Swiss cooked sausages. Fleischwirtschaft, 89(10): 98-102.

Talib, A. H. (2015). Microbiological studies on some processed meat products. MV Sc. Thesis, Department of Microbiology, Faculty of Agriculture, Mansoura University.