International Journal of Chemical and Biomolecular Science
Vol. 1, No. 3, 2015, pp. 129-133
http://www.aiscience.org/journal/ijcbs

Effects of Water Soaking on the Nutritional Compositions of Beef in Nigeria: A Review

M. T. Usman[1, *], A. S. Tanko[2], A. J. Alhassan[3]

[1]Department of Pure and Industry Chemistry, Bayaro University Kano, Kano State, Nigeria
[2]Biochemistry Department, Bauchi State University, Bauchi State, Nigeria
[3]Biochemistry Department, Bayaro University Kano, Kano State, Nigeria

Abstract

Effects of butcher men attitudes of increasing bulk by water soaking, on nutritional and mineral composition of beef was evaluated. The beef sample was grouped into five (I-V) and soaked at different time intervals of 30 minutes for 2hrs (0 - 2 hrs). The % moisture content of soaked blots sample was determine and the % proximate composition (protein, fat, ash and carbohydrates) and vitamins (B_2 and B_6) were determined as dry weigh matter (DWM) including the elemental compositions. The moisture content was found to increased significantly ($P<0.05$) with soaking periods. The nutritional contents were significantly ($P<0.05$) decrease with increase in soaking periods, this may be associated with lost to soaking water. Despite significant decrease in cumulative mineral index (% ash) there was no significant decrease in concentration of individual mineral content of the beef with increase in soaking period, this may be associated with existence of these element in form of matrix. Soaking was found to significantly reduce the nutritional quality of beef with great effects on its mineral element contents because only moisture content of the sample A (control) was found to be (28.5%) which was lower than that of other samples when compared. The difference or variation is due to their different time interval of soaking. But the carbohydrate, protein, Lipid, Ash, vitamins and minerals contents of the sample A (control) was found to be higher than that of other sample when compared. The Management concerned who are working in meat processing house (abattoir) should make sure that all the meat at the butcher or in the supermarket meet health and food safety regulations and must check that hygienic conditions and work practices and animal welfare standards are maintained during meat processing, packing and storage by doing tests, developing quality assurance systems and conducting internal audits.

Keywords

Abattoir, Beef, Soaking, Time Intervals, Proximate Compositions, Vitamins and Mineral Elements

Received: July 1, 2015 / Accepted: August 6, 2015 / Published online: August 17, 2015

1. Introduction

Meat is normally regarded as the edible parts (muscle and offal) of the food animals that consume mainly grass and other arable crops. The major conventional meat yielding species of the world are: cattle, sheep, goats, pigs, horse, deer, buffalo, camel, moose etc. Meat is animal flesh that is eaten as food. Humans are omnivorous, and have hunted and killed animals for meat since prehistoric times. Meat is mostly the muscle tissue of an animal. Most animal muscle is roughly 75% water, 20% protein, and 5% fat, carbohydrates, and assorted proteins. Muscles are made of bundles of cells called *fibers.* Each cell is crammed with filaments made of two proteins: Actin and myosin. In a live animal, these protein filaments make muscles contract and relax. Both actions require enormous amounts of energy, which they get from the energy-carrying molecule ATP (adenosine triphosphate). The most efficient generation of ATP requires oxygen, which muscles get from circulating blood (Charles

* Corresponding author
E-mail address: ussy180@gmail.com (M. T. Usman), ussy360@yahoo.co.uk (M. T. Usman)

and Guy, 1991). Meat can be broadly classified as "red" or "white" depending on the concentration of myoglobin in muscle fibre. When myoglobin is exposed to oxygen, reddish oxymyoglobin develops, making myoglobin-rich meat appear red. The redness of meat depends on species, animal age, and fibre type: Red meat contains more narrow muscle fibres that tend to operate over long periods without rest, while white meat contains more broad fibres that tend to work in short fast bursts. Generally, the meat of adult mammals such as cows, sheep, goats, and horses is considered red, while chicken and turkey breast meat is considered white (Milligan *et al*, 2001).

Red or dark meat is made up of muscles with fibers that are called *slow-twitch*. These muscles are used for extended periods of activity, such as standing or walking, and need a consistent energy source. The protein myoglobin stores oxygen in muscle cells, which use oxygen to extract the energy needed for constant activity. Myoglobin is a richly pigmented protein. The more myoglobin there is in the cells, the redder, or darker, the meat (Nelson and Cox, 1990). The figure below shows how myoglobin is reduce to oxymyoglobin in the present of oxygen which will loss electron to form metmyoglobin and reduced back to myoglobin by gaining an electron.

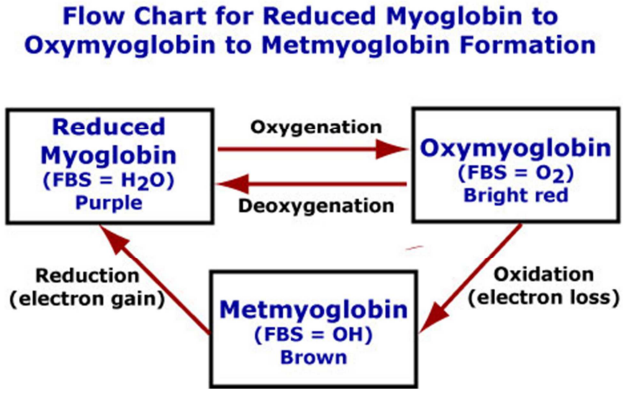

Figure 1. Shows the interconversion of meat pigments, myoglobin is reducing to oxymyoglobin in the present of oxygen.

All muscle tissue is very high in protein, containing all of the essential amino acids, and in most cases is a good source of zinc, vitamin B_{12}, selenium, phosphorus, niacin, vitamin B_6, chorine, riboflavin and iron. Several forms of meat are also high in vitamin K (Milligan *et al*, 2001). Muscle tissue is very low in carbohydrates and does not contain dietary fiber (Nelson and Cox, 1990). While taste quality may vary between meats, the proteins, vitamins, and minerals available from meats are generally consistent. The fat content of meat can vary widely depending on the species and breed of animal, the way in which the animal was raised, including what it was fed, the anatomical part of the body, and the methods of butchering and cooking. Wild animals such as deer are typically leaner than farm animals, leading those concerned about fat content to choose game such as venison. Decades of breeding meat animals for fatness are being reversed by consumer demand for meat with less fat. The fatty deposits that exist with the muscle fibers in meats soften meat when it is cooked and improve the flavor through chemical changes initiated through heat that allow the protein and fat molecules to interact. The fat, when cooked with meat, also makes the meat seem juicier. However, the nutritional contribution of the fat is mainly calories as opposed to protein. As fat content rises, the meat's contribution to nutrition declines. In addition, there is cholesterol associated with fat surrounding the meat. The cholesterol is a lipid associated with the kind of saturated fat found in meat. The increase in meat consumption after 1960 is associated with, though not definitively the cause of, significant imbalances of fat and cholesterol in the human diet.

Meat is generally considered to be one of the prime protein sources and in the eyes of western consumers is considered to be essential to health and well being. In addition, poultry have become a major meat producing species while; rabbits, guinea pigs, capybara and various game reserves animals and birds provide a substantial amount of protein particularly in localized areas (Gracey and Colling, 1992). Fish and other sea foods have also been an important part of man's diet since earliest time. Theoretically hundreds of animals could supply meat for human consumption. In practice most Voucher Men are soaking meat to increase mass and profits. This research is to evaluate the effect of soaking on the nutritional values of beef.

2. Aim

The research work is aimed at estimating the effect of water soaking on the minerals and nutritional compositions of beef.

3. Sampling and Sample Preparation

Sample of fresh meat was source from Kofar Mazugal Abattoir, Dala Local Government, Kano State. The sample was placed into five groups and soaked at different time intervals (0 - 2 hrs minutes) as shown below.

4. Work Design

Group I control fresh meat soak for 0 minutes,

Group II test fresh meat soaks in water for 30 minutes,

Group III test fresh meat soaks in water for 60 minutes,

Group IV test fresh meat soaks in water for 90 minutes,

Group V test, fresh meat soaks in water for 120 minutes.

The samples were removed and then cut into pieces, dried, ground with mortar and pestle and stored in dry plastic containers. The proximate content was determine as described by (Egan Kirk and sawyer, 1981), unless as indicated elsewhere.

5. Statistical Analysis

The data was statistically analyzed using one – way Analysis of Variance (ANOVA) with P value < 0.05 considered significant, using a component of GraphPad Instat3 Software (2000) version 3.05 by GraphPad Inc.

6. Results

Results:

The results of the nutritional compositions of meat are shown in the table1 below according to soaking periods, where as the results of the mineral elements analyzed and extract - release – volume are also showed in the table2 below.

Table 1. The percentage proximate composition and vitamins of beef soak in water at interval of 30 minutes for 2 hours.

Parameters / Samples	Moisture (% fresh weight)	Crude protein (% DM)	Carbohydrate (% DM)	Lipid (% DM)	Ash (% DM)	Vit.B2 mg/100	Vit.B6 mg/100
Group I	28.5 ± 0.52	21.0 ± 0.21	31.50 ± 0.31	10.60 ± 0.20	8.40 ± 0.12	0.80 ± 0.10	0.70 ± 0.10
Group II	43.2 ± 0.40	19.0 ± 0.18	20.90 ± 0.22	09.70 ± 0.32	7.20 ± 0.20	0.70 ± 0.12	0.60 ± 0.12
Group III	50.9 ± 0.16	17.0 ± 0.20	18.00 ± 0.20	08.30 ± 0.21	5.80 ± 0.13	0.60 ± 0.09	0.50 ± 0.03
Group III	70.9 ± 0.31	15.0 ± 0.15	08.10 ± 0.14	03.90 ± 0.22	4.50 ± 0.14	0.40 ± 0.10	0.40 ± 0.06
Group IV	80.8 ± 0.30	10.0 ± 0.12	04.90 ± 0.22	02.20± 0.21	2.10 ± 0.21	0.30 ± 0.12	0.20 ± 0.03

Table 2. Mineral elements content of beef soak in water at interval of 30 minutes for 2 hours.

Samples	Na+ mg/100g	K+ mg/100g	Cu2+ mg/100g	Cu+ mg/100g	Zn+ mg/100g	Fe+ mg/100g
Sample A	3.71	2.33	2.15	0.42	1.58	1.51
Sample B	3.45	2.23	2.10	0.26	1.53	1.36
Sample C	3.37	1.73	1.74	0.19	0.94	1.16
Sample D	3.18	1.58	1.72	0.18	0.72	1.11
Sample E	2.92	1.23	1.70	0.16	0.57	1.01

7. Discussion

Meat is part of the human diet in most cultures, where it often has symbolic meaning and important social functions. Many people, however, choose not to eat meat (this is referred to as vegetarianism) or any food made from animals (veganism). The reasons for not eating all or some meat may include ethical objections to killing animals for food, health concerns, environmental concerns or religious dietary laws (Nelson and Cox, 1990). The spoilage of meat occurs, if untreated, in a matter of hours or days and results in the meat becoming unappetizing, poisonous or infectious. Spoilage is caused by the practically unavoidable infection and subsequent decomposition of meat by bacteria and fungi, which are borne by the animal itself, by the people handling the meat, and by their implements. Meat can be kept edible for a much longer time , though not indefinitely, if proper hygiene is observed during production and processing, and if appropriate food safety, food preservation and food storage procedures are applied. Without the application of preservatives and stabilizers, the fats in meat may also begin to rapidly decompose after cooking or processing, leading to an objectionable taste known as warmed over flavour. Meat has exerted a crucial role in human evolution and is an important component of a healthy and well balanced diet due to its nutritional richness (Shubbhangin, 2002). The present review attempts to sum up meats role and importance in human nutrition as well as examine some pejorative beliefs about meat consumption. Meat is a valuable source of high biological value protein, iron, vitamin B12 as well as other B complex vitamins, zinc, selenium and phosphorus (Milligan *et al*, 2001). Fat content and fatty acid profile, a constant matter of concern when referring to meat consumption, is highly dependent on species, feeding system as well as the cut used. Pork meat can have the highest fat content but poultry skin is not far behind. It is also crucial to distinguish meat cuts from other meat products especially regarding its association with disease risk. As in other dietary components, moderation is advisable but meat has been shown to be an important component of a balanced diet. Only moisture content of the sample A (control) was found to be (28.5%) which was lower than that of other samples (i.e B, C, D and E) when compared. The difference or variation is due to their different time interval of soaking (Charles and Guy, 1991). But the carbohydrate, protein, Lipid, Ash, vitamins and minerals contents of the sample A (control) was found to be higher than that of other sample (i.e. B, C, D and E) when compared as shown in the table above.

8. Conclusion

Meat is a rich source of nutrients which human nutrition often lacks. It is a rich and most important source of essential amino acids, vitamins, minerals and also long chain polyunsaturated fatty acids. Moderate intake of lean meat enables easier composition of balanced diet. On the other hand, excessive meat intake supersedes from the diet foodstuffs which supply dietary fibers, vitamins, and also non-vitamin antioxidant active substances and minerals. Not meat itself but imbalanced nutrition with too much fat and saturated fatty acids and deficient intake of ω-3 fatty acids, antioxidant vitamins and phytochemicals, minerals and dietary fiber present a risk for the development of cardiovascular disease and cancer. Because of its distinct and high nutritional value meat preserves its role in a rational human nutrition (Shubbhangin, 2002). Soaking seriously affect the nutritional compositions of beef, butchers normally soaked beef in water in order to increased the bulkiness of the beef by gaining weight which increases their profit not knowing that it affected the nutritional contents especially mineral elements while the molecules of life are not inert (Andrew and Stephen, 1987). They undergo various transformations by which some of them are broken down to generate energy for life processes to take place (Nelson and Cox, 1990).

Therefore, now I want to educate or inform the world, butches should avoid or stop soaking of beef in water before selling it because the nutritional compositions, sweetness and taste of the beef are affected or decreased remarkable. In general, the authority concerned should make sure in every beef abattoir there is standard and maintained of safety of meat calls for control throughout the food chain from the farm of origin, and inspection before and after slaughter, to the handling and storage of meat and the products until the time it is consumed. The responsibility for the production of safe and wholesome meat is shared by the industry and the controlling authority. This requires a controlling authority that is adequately resourced and has the legal power to enforce the requirements and which should be independent of the management of the establishment where the meat is produced. Meat Quality Assurance Officers work in meat processing house (abattoir) to make sure that all the meat we buy at the butcher or in the supermarket meet health and food safety regulations. They must check that hygienic conditions and work practices and animal welfare standards are maintained during meat processing, packing and storage by doing tests, developing quality assurance systems and conducting internal audits (Nelson and Cox, 1990). The authority concerned make sure that in each abattoir there is Hazard Analysis and Critical Control Point (HACCP) which is a preventive system that tries to guarantee the safety and food innocuousness, anticipating the protection and correction of failures, improving the quality costs for faults of microbiological, physical and chemical type, and saving almost the final super control, which though it allows a relative guarantee of the product, its consequence will be the destruction of the product in case of detection of the failure too much late, with the consequent incremental cost. In this work, the specific hazards which can be found in the slaughter line of beef, the preventive measurements that can be applied in the slaughterhouse(abattoir), the surveillance systems to implement, the corrective actions foreseen and the control records to be kept by the plant are described in detail. Putting in practice these knowledge will allow, to any slaughterhouse of beef, a self-control of its productions based on the HACCP system (WHO, 1990).

The major challenges we are facing are poor state of our national abattoirs, meat processing plants, ineffective meat inspection service and the resultant risk of consuming unwholesome meat have been issues of public health and global environmental concerns. Abattoir inspection of live animals (ante–mortem) and the carcass (post–mortem) are crucial towards surveillance network for animal diseases and zoo noses as well as ensuring the suitability of meat and byproducts for their proposed use. The nations desire to achieve high level of food safety and quality of life may be a mirage if the current challenges militating against the establishment, operations and management of abattoirs are not given attention. In the next paper we are going to reviews the current state of the Nations abattoir operations and waste management and also discussed the challenges and prospects of the industry in respect of environmental quality and public health. I conclude that, both federal, state, local governments and private entrepreneurs should be encouraged to establish and manage abattoirs, slaughter houses and slabs nationwide for a more effective management.

Reference

[1] H. McGee (2004), the science and Lore of the Kitchen. New York, Scribner pp.148

[2] G.A Ordway and D.J Garry (2004), Myoglobin an essential hemoprotein in striated muscle. J. Exp. Biol. Pp. 207

[3] A, J Shubbhangin (2002), Nutrition and Diabetic. 2nd Edition. Tale McGraw – Hill Companies, New York pp. 417

[4] H. Milligan, G. Cunningham and L. Travisan (2001), Minerals in Australian: Fruits and Vegetables Food Standards in Australia. Pp. 223

[5] J, F Gracey, D.S Collins (1992), Meat Hygiene 9th Edition. ELBS founded by the British Government. pp. 1-70, 290

[6] M, N Hamilton, E.N whitney and F.S size (1991), Nutrition, concepts and controversies. 5th Edition, ES publishing company, paul new York, los Angeles and san Francisco pp.178

[7] Charles Alais, Guy Linden (1991), Food Biochemistry, 1st Edition. Aspen publisher pp.174

[8] L, O Nelson, M, M Cox (1990), Lelinnger Principle of Biochemistry, 3rd Edition. McMillan worth Publishers, New York pp. 293

[9] W.H.O Geneva (1990), Diet Nutrition and the prevention of chronic Diseases. Report of a WHO study group series 797 Switzerland pp.33-50

[10] J. Andrew, Mc common, Stephen C Harvey (1987). Dynamics of proteins Nucleic Acids. 1st Edition, New York pp. 22-30

[11] H.J Egan Kirk, R.S sawyer (1981), the chemical Analysis of Food 8th Edition, Churchill living stone medical Division of Longman Group Limited pp. 122