Advanced Journal of Microbiology Research Vol. 2017
Available online at http://internationalscholarsjournals.org/journal/ajmr

Short Communication

Cholesterol concentration in different parts of bovine meat sold in Nsukka, Nigeria: Implications for cardiovascular disease risk

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Accepted 10 February, 2017

Cardiovascular disease (CVD) is a leading cause of mortality globally. Reducing dietary fat and cholesterol intake is central to the reduction in the risk of CVD. In Nigeria and other developing countries, meat is a good source of protein and other nutrients, and its consumption is increasing. This study investigates the cholesterol concentration of ten parts of bovine meat – rib muscle, fore-limb muscle, hind-limb muscle, lungs, large intestine, small intestine, colon, liver, kidney and heart. Standard biochemical methods were used for all assays. The results show that cholesterol concentration was highest in the liver (6.5 ± 0.15 mg/g) and lowest in the large intestine (1.0 ± 0.01 mg/g). Organ meats had more cholesterol per 85 g serving than the daily recommendations of the American Heart Association. Considering that meat has some beneficial effects, we conclude that while bovine meat should not be avoided completely, its consumption (especially bovine organ meats consumption) should be minimized particularly by individuals and populations at risk of CVD and its co-morbid conditions.

Key words: Bovine meat, cardiovascular disease, cholesterol concentration.

INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of mortality and is associated with such risk factors as genetics, cigarette/tobacco smoking, abnormal blood lipid levels (high total cholesterol and low density lipoprotein cholesterol (LDL-C), low high density lipoprotein cholesterol (HDL-C) and high triglyceride (TG) levels), obesity, physical inactivity and over-consumption of alcohol (Lichtenstein et al., 2006; Rosamond et al., 2007). Reduction in the dietary fat intake is central in the recommendations for a reduced risk of CVD and an improved overall health. The American Hearts Association (AHA) recommends a total fat intake in the range of 25 to 35% of calories, <7% of calories from saturated fatty acids (SFA's), <1% of calories from trans fat and <300 mg/day of cholesterol (Lichtenstein et al., 2006). The expert panel of the US National Cholesterol

Education Programme (NCEP) had earlier put forward similar recommendations except for cholesterol where it recommended <200 mg/day (NCEP, 2002) . Other recom-mendations similar to the above are those of the Institute of Medicine (2002) and US Department of Health and Human Services (2005).

Meat provides a good proportion of the dietary protein in most parts of Nigeria and the developing world (Bender, 1992). Among the available meat options, bovine meat is the most available and affordable option for the generality of the population. Bovine meat is sold as muscle (lean meat) or as organ (kidney, colon, intestines, liver etc) meats. This study investigates the concentration of cholesterol in different parts of bovine meat sold in a typical Nigerian market. We believe the results could guide choices of foods consumed by indivi-duals especially as CVD is already a leading cause of mortality in the developing world (WHO, 2003).

MATERIALS AND METHODS

Ten (10) bovine meat parts - rib muscle, fore-limb muscle, hind-limb muscle, lungs, large intestine, small intestine, colon, liver, kidney and heart were obtained by excision of the relevant parts from a freshly killed cow in the abattoir section of the Ogige Market,

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Table 1. Concentration of cholesterol in the different bovine meat parts.

Meat part	Cholesterol (mg/g)	*Cholesterol per daily serving (mg/85g)
Rib Muscle	1.9 ± 0.04	161.5
Fore-limb Muscle	1.7 ± 0.04	144.5
Hind-limb Muscle	1.4 ±0.02	119.0
Large Intestine	1.0 ± 0.01	85.0
Small Intestine	1.3 ± 0.05	110.5
Colon	5.1 ± 0.10	433.5
Liver	6.5 ± 0.15	552.5
Kidney	5.6 ± 0.25	476.0
Lungs	2.4 ± 0.05	204.0
Heart	2.1 ± 0.05	178.5

*Estimated

Nsukka, Enugu state, Nigeria. Each collected tissue was carefully washed, blotted and chopped into small pieces. One gram of each tissue was then weighed out and stored in ice until used.

Cholesterol was extracted from each tissue by the method of Folch et al. (1957). Briefly, the tissue (1 g) was homogenized with chloroform/methanol (2:1) to a final volume of 20 ml. After dispersion, the whole mixture was agitated for 20 min in an orbital shaker at room temperature. The homogenate was then centrifuged, using a Labofuge 1 centrifuge (Heraeus Christ, Osterode Am Harz, Germany), to recover the liquid phase. The solvent was washed with 4 ml of 0.9% NaCl solution. After vortexing for few some seconds, the mixture was centrifuged at low speed (2000 rpm) to separate the two phases. After centrifugation and siphoning of the upper phase, the lower chloroform phase containing lipids was evaporated under vacuum in a rotary evaporator.

Total cholesterol concentration was determined spectrophotometrically according to the method of Zlatkis et al . (1953). The assay involved the addition of a fixed volume of concentrated sulphuric acid, glacial acetic acid and ferric chloride solution to 0.1 ml of the sample. The sample (0.1 ml) was pipetted into 3 ml of glacial acetic acid in a test tube followed by the addition of 2 ml of colour reagent. The absorbance of the solution was read at 560 nm using a spectrophotometer (Novaspec, LKB Biochrom, Cambridge, UK). The total cholesterol concentration was then determined from a standard curve.

We took a standard daily serving of beef to be 85 g and with that, we estimated the concentration of cholesterol in each daily serving of the different meat parts. The results are presented as means and standard deviations (of three separate experiments).

RESULTS/DISCUSSION

Cholesterol was found to be highest in the liver (6.5 ± 0.15 mg/g) followed by the kidney (5.6 ± 0.25 mg/g) and colon (5.1 ± 0.10 mg/g), and lowest in the intestines (small intestine, 1.3 ± 0.05 mg/g, and large intestine, 1.0 ± 0.01 mg/g). The distribution of cholesterol in the meat parts studied is shown in Table 1.

Only meat from the liver, kidney and colon had more cholesterol per estimated daily serving than the recommendations of AHA (2007). Meat from the lungs had higher cholesterol content per estimated daily serving than is desired based on the NCEP recommendations (NCEP, 2002), but not that of AHA (AHA, 2007). Meats from the bovine muscles and the intestines were clearly within the desirable zones in terms of cholesterol content per estimated daily serving.

These findings suggest that meat from bovine liver, kidney, colon and to some extent lungs, when consumed (frequently) may increase an individual's risk of CVD. However, a look at the other nutrients in beef makes it difficult to recommend abstinence from beef.

Beef is an excellent source of vitamins B_6, B_{12} and folic acid which are necessary in homocysteine metabolism (Lichtenstein et al., 2006). Increasing intake of these vitamins can lower blood levels of homocysteine which in turn lowers CVD risk (McKay et al., 2000). This has been shown to be true in populations consuming beef (Mann et al., 1999; Gao et al., 2006). Other minerals in beef include iron and zinc (USDA, 2006). It may therefore be wrong to summarily dismiss beef consumption as dangerous as there is no "one-size-fits-all" dietary recommendation for the prevention and treatment of CVD (Krauss, 2001).

We conclude that though beef should not be avoided completely in human nutrition, its consumption (especially organ meats consumption) should be minimized by individuals and populations at risk of CVD and its associated sequelae.

REFERENCES

Bender AK (1992). Meat and meat products in human nutrition in the developin countries. FAO Food and Nutrition Paper No 53, FAO Rome.

Flores-Mateo G, Navas-Acien A, Pastor-Barriuso R, Guallar E (2006). Seleniu and coronary heart disease: a meta analysis. Am. J. Clin. Nutr. 84: 762-773

Folch J, Lees M, Stanley GHS (1957). A simple method for the isolation an purification of total lipids from animal tissues .J . Biol .Chem. 226: 497-509

Gao X, Yao M, McCrory MA, Ma G, Li Y, Roberts SB, Tucker KL (2003). Dieta pattern is associated with homocysteine and B vitamin status in an urba Chineese population. J . Nutr. 133: 3636-3642

Institute of Medicine of the National Academies (2002). Dietary reference intake Energy, carbohydrates, fibre, fat, fatty acids, cholesterol, protein and amin acids. The National Academies Press, Washington D.C.

Krauss RM (2001). Dietary and genetic effects on low density lipoprote heterogeneity. Annu. Rev. Nutr .21: 283-295

Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Frankl B, Kris-Etherton P, Harris WS, Howard B, Karanja N, Lefevre M, Rudel L, Sack F, Van Horn L, Winston M, Wylie-Rosett J, American Heart Association Nutritio Committee (2006). Diet and lifestyle recommendations revisions 2006. A

scientific statement from the American Heart Association Nutrition Committee. Circulation 114: 82-96

Mann NJ, Li D, Sinclair AJ, Dudman NP, Guo XW, Elsworth GR, Wilson AK, Kelly FD (1999). The effect of diet on plasma homocysteine concentrations in healthy male subjects. Eur. J. Clin. Nutr .53: 895-899

McKay DL, Perrone G, Rasmussen H Dallal G, and Blumberg JB (2000). Multivitamin/mineral supplementation improves plasma B-vitamin status and homocysteine concentration in healthy older adults consuming a folate-fortified diet. J. Nutr. 130: 3090-3096

National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult

Treatment Panel III) (2002). Third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Final report. Circulation 106: 3143-3421

Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, Haase N, Ho M, Howard V, Kissela B, Kittner S, Lloyd-Jones D, McDermott Sorlie P, Steinberger J, Thom T, Wasserthiel-Smoller S, Hong Y; American Heart Association Statistics Committee and Stroke Statistics Subcommittee (2007). Heart disease and stroke statistics-2007 update: a report from the American Heart Association M, Meigs J, Moy C, Nichol G, O'Donnell CJ, Roger V, Rumsfeld J, Statistics Committee and Stroke Statistics Subcommittee. Circulation 115: e69-e171. Erratum in: Circulation, 2007;115:e172

US Department of Agriculture, Agricultural Research Service (2006). USDA Nutrie database for standard reference. Release 19, available www.usda.gov/nutrientdata

US Department of Health and Human Services, US Department of Agricultur (2005). Dietary guidelines for Americans, (2005). Home and Garden Bulletin N 232. US Government Printing Office, Washington D.C.

WHO (2003) The world health report (2003). Shaping the future. WHO, Genev Switzerland

Zlatkis A, Zak B, Boyle AJ, Mich D (1953) A new method for the dire determination of serum cholesterol .J. Lab. Clin. Med. 41:486 – 492.