RETENTION OF VITAMINS AND FATTY ACID CONTENT S OF INDONESIAN BEEF AND SWAM BUFFALO MEAT COOKED IN DIFFERENT WAYS

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ABSTRACT

The increasing volume of package beef products on the market and their potential use in restaurants and foodservice operations indicates the need for more detailed information regarding their quality and nutrient retention. Producers, meat counter employees, health professionals, and consumers should be provided with information as to the vitamin (and other nutrient) composition of meat and cooked meat that they might use in marketing and diet planning. The aim of this study is to evaluate nutrients status (vitamin B1, B6, E, fatty acid (SFA/PUFA)) of meat produced from grazing cattle and swamp buffalo in Indonesia and nutrient retention of these cooked meat. They will be slaughtered in the best right age in order to meet the best nutritious status of the meat. Improved cooking method (grill and steer fry) will be identified to produce the best nutritious meat particularly compare to what currently practice in Indonesia. The samples will be from the Bali cattle, Ongole cattle, Madura cattle and swamp buffalo. Measurements of the vitamins and fatty acids before and after cooking will be conducted. Organoleptic test will be carried out. Statistical analysis will be done using SAS software.

1. INTRODUCTION

Beef is a protein rich food, containing all essential amino acid, and fat. It is as carrier for fat- soluble vitamins such as vitamin A, D, E and K. Beef is also as source of water-soluble vitamins B. Beside high protein content of Beef with high bioavailability, is also has high in fat content, saturated and unsaturated fat (PUFA).

Improper or imbalanced diet which high fat consumed can cause obesity and degenerative disease. Beef should be characterized accurately in terms of its nutritional quality and safety for consumption. Knowledge about the origin, sensorial characteristics, chemical, nutritional and nutraceutical components of beef are important tools to enhance business competitiveness

In Indonesia, 40% of consumed beef is from import (both live cattle kept in feedlots and frozen meat) and 60% is originated from local cattle mainly kept in grazing areas. Indonesian beef and buffalo meat quality are hardly available in literatures. Therefore it is important to record and compare them to imported the beef cattle.

Common practice in meat cooking is either by grill, broil, roast or burn like in *satay* making. Taste is number one whatever risks consumers may take. Stroke and cardiac diseases are serious problem faced by good young generation in Indonesia. It is a national loss.

The superiority of meat from livestock kept grazing is well documented (PUFA, CLA, omega 3 etc) (French *et al.*2000, Rule *et al.*1995, Cordain *et al.* 2002, Varela *et al.*2004). But it mostly be lost because of wrong cooking (Barbantia and Pasquini, 2004; Obuz et al., 2004, Beyza Ersoy, 2009)

Since raw meat is not commonly eaten, cooking techniques becomes important. Nutrition loss or even worse, wrong cooking will increase cancer incident in human (ref).

The cooking process of beef is an important tool for the sensory perception of beef by consumers. Cooking is a process of heating beef at sufficiently high temperatures that denatures proteins and makes it less tough and easy to consume (Garcia-Segovia et al., 2006). It can be achieved either by boiling or by roasting (Shilton et al., 2002) and in all cases losses occur. Cooking loss, which is one of the meat quality parameters that is often ignored by meat scientists and technologists, refers to the reduction in weight of beef during the cooking process (Vasanthi et al., 2006).

The quality of beef that consumed by the Indonesian people has never been determined, and how the effect of cooking process to this product. Many research done were how to increase daily gain of cattle, or fattening. Information of beef quality is very important for healthy life. Data are not available on the vitamins and fatty acid content and retention of local beef in the Indonesian market.

The aim of this study is to evaluate nutrients status (vitamin B1, B6, E, fatty acid (SFA/PUFA) of meat produced from grazing cattle and buffalo in Indonesia and nutrient retention of these cooked meat. They will be slaughtered in the best right age in order to meet the best nutritious status of the meat. Improved cooking method (grill and steer fry) will be identified to produce the best nutritious meat particularly compare to what currently practice in Indonesia

The similar research has been conducted at the University of Nebraska Licoln, USA, using US beef steer fed with wet distiller grain soluble, cooked by grill and broil (submitted JFS, 2009).

Implication of this study is the results of this research will be used by the meat industry for nutritional labeling, which is optional for unprocessed foods according to FDA and BPOM. The data will also be provided and likely listed in the nutrient composition tables, and thus be available to consumers, animal and human nutritional scientists, and healthcare professionals, including registered dietitians.

MATERIALS AND METHODS

CONCEPTUAL FRAMEWORK

<table>
<tr><td>Sample Source</td><td colspan="8">Beef / buffalo from Indonesian market</td></tr>
<tr><td>Sample</td><td colspan="2">Bali cattle</td><td colspan="2">Ongole cattle</td><td colspan="2">Madura cattle</td><td colspan="2">Swamp buffalo</td></tr>
<tr><td>Laboratory Work</td><td colspan="8">Analysis of vitamin content (Thiamine – B_1 , pyridoxine – B_6, Vitamin E),
Fat content</td></tr>
<tr><td>Cooking Method</td><td>Grill</td><td>Stir fry</td><td>Grill</td><td>Stir fry</td><td>Grill</td><td>Stir fry</td><td>Grill</td><td>Stir fry</td></tr>
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</table>

Analysis	Retention Vitamin and fatty acid

Sample description

Sources of meat will be from Bali cattle, Ongole cattle, Madura cattle and swamp buffalo They were slaughtered in the best age where their vitamin and essential fatty acids were in prime content. As control = kobe beef or commercially available beef in Jakarta.

Bali beef were fed finishing rations containing 0% and 40% WDGS with and without supplemental vitamin E (500 IU/steer top-dressed daily) for 140 days at the University of Nebraska-Lincoln Agricultural Research and Development Center research feedlot (near Mead, NE). The diets met the nutrient requirements of beef cattle (NRCNAS 2000). All animal care procedures were conducted in accordance with the University of Nebraska-Lincoln Institute for Animal Care and Use Committee.

Six steers from each of the following four feeding groups were available for the present study: 1) 0% WDGS and basal vitamin E, 0% WDGS and supplemental vitamin E, 40% WDGS and basal vitamin E, and 40% WDGS and supplemental vitamin E. Initial body weights, hot carcass weights, and final body weights of the steers were recorded. The steers were slaughtered on d 140 at a commercial abattoir (Greater Omaha Pack, Omaha, NE); the steers were approximately 17 months of age. Shoulder clods were removed, vacuum packed, kept at 5 ºC, and transported to the University's Loeffel Meat Laboratory and aged for 7 days at 1 ºC. Flat iron steaks (North American Meat Processors Association #114D) were fabricated from both shoulder clods. Petite tenders (North American Meat Processors Association #114F) were filleted from both shoulder clods and the connective tissue that runs through the middle was removed. Both meat cuts were then stored at -80 ºC.

Cooking of steaks

The flat iron steaks and petite tenders from each steer were thawed to 5 ºC. Prior to cooking, representative samples were homogenized with liquid nitrogen, and stored at -80 °C for future vitamin analyses. Flat iron steaks were cooked to medium doneness (70 ºC internal temperature) by broiling and grilling while petite tenders were cooked by broiling as sufficient sample was not available for cooking by two methods. The internal temperatures of the steaks were measured during cooking using thermocouples (Polder original cooking timer and thermometer, Oxford, CT) that were centrally placed. For broiling, samples were turned at 34 °C and removed from the oven at 58 ºC (Magtag Electrical Schematic FP860-910A, Benton Harbor, MI); samples reached 70 ºC in 5 min. For grilling, samples were cooked on an electric grill (Presto Series 0702 griddle, Eau Claire, WI), turned at 38 ºC, removed from the grill at 68 °C, and the samples reached 70 ºC in 5 min. Samples were weighed immediately 109 before and after cooking to determine cooking yield. Cooking time was also measured. Immediately after cooking, representative cooked samples were homogenized with liquid nitrogen, and aliquots frozen at -80 °C for future vitamin analyses.

Vitamin analyses

Meat aliquots were thawed to 5 ºC prior to each of the vitamin analyses. Selected vitamins found in flat iron steaks and petite tenders were quantitated. The α-tocopherol content of the meat samples was analyzed using HPLC techniques (Kim and others 2007; Chun and others 2006). Thiamin, riboflavin, and niacin were analyzed using the HPLC procedure of

Dawson and others (1988). The vitamin B_6 and vitamin B_{12} concentrations of the samples were determined by microbiological assays (Sauberlich 1967; AOAC 2006) using *Saccharomyces uvarum* (ATCC 9080) and *Lactobacillus leichmannii* (ATCC 7830), respectively. These methods or similar methods had been used previously in our laboratory for determining the selected vitamin content of several cuts from bison (*Bison bison*) (Driskell and others 1997, 2000).

The identities of the vitamins were confirmed by standard addition (spiking) of beef samples with the appropriate vitamin prior to extraction; vitamin recoveries were >90%. The extraction method and the HPLC or microbiologic analytic methods were also validated using Standard Reference Material 2383 (baby food composite, National Institute of Standards and Technology, Gaithersburg, MD). The coefficients of variance for all vitamins were <10%. All content values are expressed on a wet weight (w/w) basis.

Statistical analyses

All data were analyzed by using the mixed model ANOVA procedure (Dowdy and others, 2004) using SAS software (Statistical Analysis Software version 9.1, 2002-2003, Cary, NC). The model was treatment, vitamin E supplementation, and WDGS*vitamin E supplementation interaction. The vitamin content of the two meat cuts were also compared using the mixed model ANOVA implemented in PROC MIXED (Statistical Analysis Software version 138 9.1, 2002-2003, Cary, NC); the individual cut was the experimental unit, and animal was treated as a random block effect. The data are given as LS mean ± SE. Differences were considered significant at $P < 0.05$.

References

BARBANTIA D, PASQUINI M (2004). Influence of cooking conditions on cooking loss and tenderness of raw and marinated chicken breast meat. LWT-Food Sci. Tech. 38 (8): 895–901.

BEYZA ERSOY , AKIF ÖZEREN; 2009. The effect of cooking methods on mineral and vitamin contents of African catfish; Food Chemistry xxx xxx–xxx

CUNDIFF, L.V., GREGORY, K.E., KOCK, R.M. AND DICKERSON, G.E.1986. Genetic diversity among cattle breeds and its use to increase beef production efficiency in a temperature environment. In *Proceedings 3rd World Congress on Genetics Applied to Livestock Production* (G.E.Dickerson and R.K. Johnson, eds.) pp. 271–282, University of Nebraska, Lincoln, NE.

CORDAIN, L., WATKINS, B.A., FLORANT, G.L., KEHLER, J., ROGERS, L. AND LI, Y. 2002. Fatty acid analysis of wild ruminant tissues: Evolutionary implications for reducing diet-related chronic disease. Eur. J. Clin. Nutr. *56*, 181–191.

DRISKELL JA, MARCHELLO MG, GIRAUD DW. 2000, Riboflavin and niacin concentrations of bison cuts. J Anim Sci ;78:1267-1271.

DRISKELL JA, YUAN X, GIRAUD DW, HADLEY M, MARCHELLO MJ.1997. Concentrations of selected vitamins and selenium in bison cuts. J Anim Sci ;75:2950-2954.

FRENCH, P., STANTON, C., LAWLESS, R., O'RIORDAN, E.G., MONAHAN, F.J., CAFFREY, P.J. AND MOLONEY, A.P. 2000. Fatty acid composition, including conjugated linoleic acid, of intramuscular fat from steers offered grazed grass, grass silage, or concentrate-based diets. J. Anim. Sci. *78*, 2849–2855.

GARCIA-SEGOVIA P, ANDRES-BELLO A, MARTINEZ-MONZO J (2006). Effect of cooking method on mechanical properties, colour, and structure of beef muscle (*M. pectoralis*). J. Food Eng. 80 (3): 813–821.

GERBER N., SCHEEDER M.R.L., WENK C. 2009. The influence of cooking and fat trimming on the actual nutrient intake from meat; Meat Science 81- 148–154

GERRISH, J. 2004. *Management-intensive Grazing: The Grassroots of Grass Farming*, pp. 22, 308, Green Park Press, Ridgeland, MS.

JAMA.N, MUCHENJE V.,CHIMONYO M., STRYDOM P.E., DZAMA K., AND RAATS J.G. 2008. Cooking loss components of beef from Nguni, Bonsmara and Angus steers. African Journal of Agricultural Research ;3;416-420.

MARCHELLO MJ, DRISKELL JA. RES 2001. Nutrient composition of grass- and grain-finished bison. Great Plains;11:65-82.

MARCHELLO M.J., SLANGER WD, HADLEY M, MILNE DB, DRISKELL JA. 1998. Nutrient composition of bison fed concentrate diets. J Food Comp Anal;11:231-39.

MELLOVA. A. MASRIZAL, GIRAUD D.W., DRISKELL J.A., 1997. Retention of Vitamin C, Iron, and β-Carotene in Vegetables Prepared Using Different Cooking Methods; J.of Food Quality; 20:403-418.

MUCHENJE V., DZAMA K., CHIMONYO M., STRYDOM P.E., HUGO A., RAATS J.G.; 2009. Some biochemical aspects pertaining to beef eating quality and consumer health: A review; Food Chemistry 112 ;279–289

OBUZ E, DIKEMAN EM, GROBBE PJ, STEPHENS WJ, LOUGHIN MT (2004). Beef *longisimus lumborum, bicepts femoris, and deep pectoralis* Warner-Bratzler shear force is affected differently by end-point temperature, cooking method, and USDA quality grade. Meat Sci., 68 (2): 243-248.

RULE, D.C., BROUGHTON, K.S., SHELLITO, S.M. AND MAIORANO, G. 2002. Comparison of muscle fatty acid profiles and cholesterol concentrations of bison, beef cattle, elk, and chicken. J. Anim. Sci *80*, 1202–1211.

VARELA, A., OLIETE, B., MORENO, T., PORTELA, C., MONSERRRAT, L., CARBALLO, J.A. AND SANCHEZ, L. 2004. Effect of pasture finishing on the meat characteristics and intramuscular fatty acid profile of steers of the Rubia Gallega breed. Meat Sci. *67*, 515–522.

YANG, J., SULAEMAN, A., SETIAWAN, B., ATUGHONU, A., GIRAUD, D.W., DRISKELL, J.A., 1994. Sensory qualities and nutrient retention of beef strips prepared by different household cooking techniques. Journal of the American Dietetic Association 94 (2), 199–201.

YU LH, LEE ES, JEONG JY, PAIK HD, CHOI J H, KIM C J (2005). Effects of thawing temperature on the physicochemical properties of pre-rigor frozen chicken breast and leg muscles. Meat Sci. 71 (2): 375- 382.