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Short Communication

Nutrient Content of Rabbit Meat as Compared to Chicken, Beef and Pork Meat

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Abstract

Meat is a major source of proteins, essential amino-acids, complex-B vitamins, minerals, and other bioactive compounds. Recommended by nutritionists over other meats, rabbit meat is valued for its nutritional properties because is lean, rich in proteins of high biological value, low in cholesterol content and high in linolenic acid. In the present study, meat samples, collected from rabbit, chicken, beef and pork, were subjected to chemical analysis for moisture, protein, fat, ash, calcium, phosphorus, sodium and cholesterol, to identify differences in nutrient content among these animal species. Rabbit meat was richer in calcium (21.4 mg/100 g) and phosphorus (347 mg/100 g) than other types of meat and lower in fat (9.2 g/100 g) and cholesterol (56.4 mg/100 g). Beef had the highest cholesterol content (114.5 mg/100 g), almost double than rabbit meat, while pork was rich in fat (28.2 g/100 g). It can be concluded that rabbit meat is healthier over other meats frequently used in human nutrition, high in protein and low in fat.

Keywords: Rabbit, meat, quality, composition.

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Introduction

World rabbit meat production increased up to 1.68 million tonnes in 2010 (FAOSTAT, 2012). Currently the leading producer of rabbit meat in the world is China with 669.000 t/year, while, in Europe, the main producer is Italy (255.400 t/year), followed by Spain (66.200 t/year), France (51.665 t/year), Czech Republic (38.500 t/year) and Germany (37.500 t/year) (FAOSTAT, 2012).

In an efficient breeding, rabbits convert up to 20% of the protein consumed in meat, more than for pigs (15-18%) and cattle (9-12%) (Suttle, 2010). Rabbit meat is high in protein, low in calories and low in fat and cholesterol contents, being considered as a delicacy and a healthy food product, easy to digest, indicated in feeding children and old people (Dalle Zotte, 2000). Rabbit meat is one of the best white lean meats available on the market, very tender and juicy. There is no religious taboo or social stigma regarding the consumption of this meat. Content in calcium and phosphorus are higher than in other meats as well as the nicotinic acid (13 mg/kg meat) (Williams, 2007). Also, rabbit meat does not contain uric acid and has a low content of purines (Hernández et al., 2007). The ash content is similar or higher than that of other livestock, while many studies shown that rabbit meat is poor in potassium and phosphorus (Hermida et al., 2006).

Rabbit meat is a source of B vitamins (B_2, B_3, B_5, B_{12}) as reported by Combes (2004). In rabbits, carcass quality, quantity and proportion of fatty acids in meat composition and fat tissue are changing with diet and animal age (mainly intramuscular fat content is increasing) (Cobos et al., 1993). Data regarding the chemical composition of rabbit meat is variable – especially in fat content – for each section of carcass (Pla et al., 2004). Thus, the objective of this study was to assess rabbit meat quality as compared with chicken, beef and pork meat.

Materials and Methods

Rabbit, chicken, beef and pork meat samples (a part of the hind leg) were purchased at the supermarket, two meat samples from each species from three different retail sources (6 samples for each species, 24 meat samples totally). Each sample was hand-boned and dissected from the fat surface, and the lean part was then finely minced. From each meat sample, eight subsamples were prepared for chemical analysis (192 meat samples were analyzed totally). Each raw sample was analyzed in duplicate for moisture, protein, fat, ash, calcium, phosphorus, sodium and cholesterol content.

Meat chemical composition was determined according to the procedures of AOAC (1990; 2000; 2003). Moisture content of meat samples was determined by oven drying 2 g of meat at 105°C for 24 hours until a constant weight results. The protein content was calculated as nitrogen amount multiplied by 0.625 per 100 g of meat. The nitrogen content was determined by the Kjeldahl procedure. Fat from meat samples was determined with Soxhlet extraction method using petroleum ether. Ash content was obtained by igniting 2 g of meat samples in a muffle furnace set at 570°C for 4-6 h depending on the samples. Calcium was determined by EDTA method, phosphate compounds in meat by 31-Phosphorus Nuclear Magnetic Resonance spectroscopy with methylenediphosphonic acid after alkaline extraction, while sodium was determined photometrically using the iron (III)/mercury thiocyanate method after extraction (AOAC, 1990). For cholesterol analysis, about 2 g of each sample were saponified. Before direct saponification was proposed and tested, lipid extraction had been the first step of sample preparation. After saponification, samples were analyzed by high-performance liquid chromatography (HPLC). Data processing was performed using the SPSS Statistical Software Package (2008).

Results and Discussion

The chemical composition of rabbit meat, in comparison to chicken, beef and pork meat is presented in Table 1. As results shows, rabbit meat was richer in calcium (21.4 mg/100 g) and phosphorus (347 mg/100 g) than other types of meat and lower in fat (9.2 g/100 g) and cholesterol (56.4 mg/100 g). Beef had the highest cholesterol content (114.5 mg/100 g), almost double than rabbit meat, while pork was rich in fat (28.2 g/100 g).

Rabbit carcass and meat quality is influenced by breed, age of animals, their diet, ante and post mortem factors, etc. (Klont et al., 1998). Rabbit meat doesn't have a very strong flavour, being comparable but not identical to chicken (Ghosh and Mandal, 2007). Tenderness varies with age and is tenderer in the younger rabbits (Lebas et al., 1997). Juiciness depends much on the fat content of the carcass; the fatter the carcass the lower its water content (Hoffman et al., 2004).

Table 1: Comparative nutritional composition of different meats.

	Rabbit	Chicken	Beef	Pork
Moisture (g/100 g)	68.5 ± 1.05	68.1 ± 1.19	53.2 ± 1.21	43.7 ± 2.13
Protein (g/100 g)	21.2 ± 0.79	20.1 ± 0.27	26.3 ± 0.16	27.3 ± 0.22
Fat (g/100 g)	9.2 ± 0.38	10.8 ± 0.08	19.6 ± 0.09	28.2 ± 0.13
Ash (g/100 g)	1.1 ± 0.08	1.0 ± 0.05	0.9 ± 0.07	0.8 ± 0.11
Calcium (mg/100 g)	21.4 ± 0.09	12.1 ± 0.04	10.9 ± 0.38	9.3 ± 0.47
Phosphorus (mg/100 g)	347 ± 0.26	252 ± 0.06	179 ± 3.62	176.4 ± 3.36
Sodium (mg/100 g)	40.5 ± 0.89	71.4 ± 0.92	63 ± 0.90	67.3 ± 0.91
Cholesterol (mg/100 g)	56.4 ± 0.92	68.3 ± 2.14	114.5 ± 11.68	108.4 ± 10.31

Number of samples/species = 6. Values represent duplicate assays of eight subsamples (mean ± SD) for each meat sample.

Mohamed (1989) found in New Zealand White rabbit meat moisture of 77.3 g/100 g, protein 21.5 g/100 g and ash 1.6 g/100 g. In the same breed, Metzger et al. (2003) found a protein content in rabbit meat between 21.3 and 21.5 g/100 g, moisture 73.9-75.0 g/100 g, fat 2.5-3.4 g/100 g and ash 1.3 g/100 g. Moreover, Baiomy and Hassanien (2011) found in New Zealand breed a moisture content of 70.2 g/100 g, 20.35 g/100 g protein, 7.87 g/100 g fat and 0.99 g/100 g ash, while in Californian breed values for the same components were: 69.6 g/100 g moisture, 20.40 g/100 g protein, 8.11 g/100 g fat and 1.07 g/100 g ash. They also found that females had more moisture than males in both breeds, but less protein and fat. Mean values of meat chemical composition of the broiler rabbits from Soviet Chinchilla and Grey Giant breed, on dry matter basis, found by Ghosh and Mandal (2007) were of close value compared to our study in moisture (69.8 g/100 g), and lower in protein (20.2 g/100 g), fat (7.9 g/100 g) and ash (1.0 g/100 g). In contrast, moisture content higher than our results (68.5 g/100 g) was reported by Rafay et al. (1999; 74.84 g/100 g), Rafay et al. (2008; 71.50 g/100 g), Chrenek et al. (2012; 74.25 g/100 g) and Mertin et al. (2012; 72.48 to 72.98 g/100g). In addition, Polak et al. (2006) measured a higher intramuscular fat content influenced by the genotype, age, and sex of rabbits. Hernández and Gondret (2006) reported that fat content varies widely in the carcass, from 0.6 to 14.4 g/100 g (intramuscular and intermuscular) with an average value of 6.8 g/100 g with the loin being the leanest part of the carcass (1.2 g/100 g). Except for poultry (67 g moisture/100 g), which is similar to rabbit, Lebas et al. (1997) found a higher content of moisture in rabbit (70 g/100 g) than in beef (66.5 g/100 g) and pork meat (61 g/100 g), while protein and fat contents were similar or below the values found in our study.

Rabbit meat is characterized by its low contents in sodium and iron, while the phosphorus level is high. As compared to our study, Hernández (2008) found similar sodium content (37 to 49 mg/100 g) in rabbit meat and a lower level for phosphorus (222 to 230 mg/100g). The high potassium and low sodium concentration may make rabbit meat particularly recommended for hypertension diets. Hermida et al. (2006) found the following average concentrations of minerals in the rabbit meat: ash 1.21 g/100 g, potassium 388 mg/100 g, phosphorus 237 mg/100 g, sodium 60 mg/100 g, and calcium 8.7 mg/100 g. Rabbit meat is rich in phosphorus, and 100 g provide approximately 30% of the recommended daily intake for human.

Major sources of cholesterol in the human diet are meat from domestic livestock. Cholesterol content of raw and cooked meat and poultry products ranges from 40 to 90 mg/100 g (Dinh et al., 2011). The amount of cholesterol in rabbit meat found by Combes (2004) was about 59 mg/100 g of

muscle, similar to the value we found in the present study (56.4 mg/100 g), but lower than those reported for meat from other species (61 mg in pork, 70 mg in beef and 81 mg in chicken/100 g) by Dalle Zotte (2004). Chizzolini et al. (1999) reported that cholesterol content of raw bovine meats ranges from 43 to 84 mg/100 g. Cholesterol content of beef is affected by multiple factors such animal breed, gender, animal maturity, degree of marbling, subcutaneous fat thickness, dietary energy level, feeding and type of cut. Cholesterol content of pork, from 30 to 81 mg/100 g for raw pork (Sinclair et al., 2010), is generally lower than that of beef, although some studies indicated no significant difference between the two types of meat (Bohac and Rhee, 1988; Bragagnolo, 2009). Cholesterol in pork is influenced by maturity, type of cut, fat thickness, animal diet, degree of marbling, and genetic variation (Kellogg et al., 1977; Harris et al., 1993; Fernandez et al., 1995; Hernandez et al., 1998; Fernandez, 1999; Bragagnolo, 2009). Due to the presence of skin, cholesterol content of poultry is difficult to compare with beef, pork or rabbit. In general, raw poultry meat has approximately 27 to 90 mg cholesterol/100 g (Chizzolini et al., 1999).

Conclusion

Analyzing the rabbit meat comparatively with other kinds of meat that are frequently used in human nutrition, it can be concluded that is healthier, high in protein and low in fat. Rabbit meat does not have a very strong flavour, being comparable but not identical to chicken.

References

Association of Official Analytical Chemists (1990). Official Methods of Analysis of the AOAC. Helrich, K. (Ed.), 15th ed. Arlington, VA, USA.

Association of Official Analytical Chemists (2000). Official Methods of Analysis of AOAC International. Horwitz, W. (Ed.), 17th ed. Gaithersburg, MD, USA.

Association of Official Analytical Chemists (2003). Official Methods of Analysis of AOAC International. Horwitz, W. (Ed.), 17th ed., rev. 2. Gaithersburg, MD, USA.

Baiomy AA, Hassanien HHM (2011). Effect of breed and sex on carcass characteristics and meat chemical composition of New Zealand white and Californian rabbits under upper Egyptian environment. Egypt. Poult. Sci., 31: 275–284.

Bohac CE, Rhee KS (1988). Influence of animal diet and muscle location on cholesterol content of beef and pork muscles. Meat Sci., 23: 71–75.

Bragagnolo N (2009). Cholesterol and cholesterol oxides in meat and meat products. In: Nollet, L.M.L., Toldra, F. (Eds.), Handbook of Muscle Foods Analysis, pp. 187–219. CRC Press, Boca Raton, FL, USA.

Chizzolini R, Zanardi E, Dorigoni V, Ghidini S (1999). Calorific value and cholesterol content of normal and low-fat meat and meat products. Trends Food Sci., 10: 119–128.

Chrenek P, Makarevich A, Kozelová D, Rafay J (2012). Meat quality of transgenic rabbit. Slovak J. Anim. Sci., 45: 60–62.

Cobos A, Cambero MI, Ordonez JA, de la Hoz L (1993). Effect of fat enriched diets on rabbit meat fatty acid composition. J. Sci. Food Agric., 62: 83–88.

Combes S (2004). Valeur nutritionnelle de la viande de lapin. Prod. Anim., 17: 373–383.

Dalle Zotte A (2000). Main factors influencing the rabbit carcass and meat quality. In: Proceedings of the 7th World Rabbit Congress (Valencia, Spain), pp. 1–32.

Dalle Zotte A (2004). Dietary advantages: Rabbit must tame consumers. Viandes et Produits Carnés, 23: 161–167.

Dinh TTN, Thompson LD, Galyean ML, Brooks JC, Patterson KY, Boylan LM (2011). Cholesterol content and methods for cholesterol determination in meat and poultry. Compr. Rev. Food Sci. Food Saf., 10: 269–289.

FAOSTAT (2012). http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor. Access: Production / Livestock Primary, 2012.

Fernandez X (1999). Influence of intramuscular fat content on the quality of pig meat - 1. Composition of the lipid fraction and sensory characteristics of muscle *Longissimus lumborum*. Meat Sci., 53: 59–65.

Fernandez X, Mourot J, Mounier A, Ecolan P (1995). Effect of muscle type and food deprivation for 24 h on the composition of the lipid fraction in muscle of Large White pigs. Meat Sci., 41: 335–343.

Ghosh N, Mandal L (2007). Carcass and meat quality traits of rabbits (*Oryctolagus cuniculus*) under warm-humid condition of West Bengal, India. In: Proceedings of the 6th All India People's Technology Congress, Forum of Scientists, Engineers and Technologists (10-11 February 2007, Kolkata, India).

Harris KB, Cross HR, Pond WG, Mersmann HJ (1993). Effect of dietary fat and cholesterol level on tissue cholesterol concentrations of growing pigs selected for high or low serum cholesterol. J. Anim. Sci., 71: 807–810.

Hermida M, Gonzalez M, Miranda M, Rodríguez-Otero JL (2006). Mineral analysis in rabbit meat from Galicia (NW Spain). Meat Sci., 73: 635–639.

Hernández P (2008). Enhancement of nutritional quality and safety in rabbit meat. In: Proceedings of 9th World Rabbit Congress "Meat Quality and Safety" (10-13 June 2008, Verona, Italy), pp. 1287–1299.

Hernández P, Cesari V, Pla M (2007). Effect of the dietary fat

on fatty acid composition and oxidative stability of rabbit meat. In: Proceedings of the 53rd International Congress of Meat Science and Technology (August 2007, Beijing, China), pp. 367–370.

Hernández P, Gondret F (2006). Rabbit Meat Quality. In: Maertens, L., Coudert, P. (Eds.), Recent Advances in Rabbit Sciences, pp. 269–290, ILVO, Merelbeke, Belgium.

Hernández P, Navarro JL, Toldra F (1998). Lipid composition and lipolytic enzyme activities in porcine skeletal muscles with different oxidative pattern. Meat Sci., 49: 1–10.

Hoffman LC, Nkhabutlane P, De Schutte W, Vosloo C (2004). Factors affecting the purchasing of rabbit meat: A study of ethnic groups in the Western Cape. J. Family Ecol. Consumer Sci., 32: 26–35.

Kellogg TF, Rogers RW, Miller HW (1977). Differences in tissue fatty acids and cholesterol of swine from different genetic backgrounds. J. Anim. Sci., 44: 47–52.

Klont RE, Brocks L, Eikelenboom G (1998). Muscle fibre type and meat quality. Meat Sci., 49 (Suppl. 1): S219–S229.

Lebas F, Coudert P, de Rochambeau H, Thébault RG (1997). The rabbit: Husbandry, health and production. FAO Animal Production and Health Series No. 21, Rome, Italy.

Mertin D, Slamečka J, Ondruška Ľ, Zaujec K, Jurčík R, Gašparík J (2012). Comparison of meat quality between European brown hare and domestic rabbit. Slovak J. Anim. Sci., 45: 89–95.

Metzger SZ, Kustos K, Szendrõ ZS, Szabó A, Eiben CS, Nagy I (2003). The effect of housing system on carcass traits and meat quality of rabbit. World Rabbit Sci., 11: 1–11.

Mohamed KI (1989). Studies on some production traits in rabbits under the environmental condition on El-Minia Governorate. M.Sc. Thesis, Faculty of Agriculture, El-Minia University, Egypt.

Pla M, Pascual M, Ariño B (2004). Protein, fat and moisture content of retail cuts of rabbit meat evaluated with the NIRS methodology. World Rabbit Sci., 12: 149–158.

Polak T, Gašperlin L, Rajar A, Žlender B (2006). Influence of genotype lines, age at slaughter and sexes on the composition of rabbit meat. Food Technol. Biotechnol., 44: 65–73.

Rafay J, Mojto J, Palanská O (1999). Characteristics of meat quality in broiler rabbit. Agriculture 45: 388–396.

Rafay J, Novotná K, Mojto J, Bozic A, Chrenek P (2008). Some meat utility and quality traits of transgenic rabbit. Slovak J. Anim. Sci., 41: 121–125.

Sinclair AJ, Barone S, Stobaus T, Tume R, Beilken S, Muller W, Cunningham J, Barnes JA, Greenfield H (2010). Lipid composition of Australian pork cuts 2005/2006. Food Chem., 121: 672–681.

Statistical Package for the Social Sciences (2008). Release 17.0. SPSS Inc., Chicago, IL, USA.

Suttle NF (2010). Mineral Nutrition of Livestock. 4th ed. CAB International, Oxfordshire, UK.

Williams PG (2007). Nutritional composition of red meat. Nutr. Diet., 64 (Suppl. 4): S113–S119.