Ostrich meat shows nutritional advantages

Abstract

Having been faced with the fact that the mankind feeds less healthy and the number of people with cancer and cardiovascular diseases increases as a result of inappropriate diet, the nutritionists' advice is to decrease the fat and cholesterol in the nutrition, and as for the meat, they suggest low fat meat rich in protein. The World Health Organization is the cheerleader in emphasizing the slogan "healthy food". Taking into consideration the healthy meat alternatives, this paper determines the chemical structure of the meat from ostrich grown and slaughtered in Macedonia, compared to the chemical structure of the chicken and beef.

Ostrich meat contains 74.52 % water, chicken 75.58 % and beef 74.21 %. The protein amounts 22.62 % in the ostrich meat, 17.57 % in the chicken and 21.22 % in the beef; the fats quantity is 0.34 % in the ostrich meat, 5,20 % in the chicken and 1,89 % in the beef, and the minerals take 1,22 % of the ostrich meat, 0,91 % of the chicken and 1,09 % of the beef. The protein percentage difference between the ostrich meat and the beef is statically significant ($P<0,01$), as well as the difference between the ostrich meat and chicken and between the chicken and the beef ($P<0,01$). The difference of the fat quantity among the three types of meat are significant ($P<0,01$), as well as the difference of the quantity of minerals ($P<0,01$). The water percentage is not significantly different between the ostrich meat and the beef, and the difference between the ostrich meat and the chicken, as well as the chicken and the beef is highly significant ($p < 0,01$).

Introduction

The contemporary way of human life and its dynamics, made the people part of a „fast food"generation, with unhealthy habits and unhealthy way of life. As a result of the inappropriate nutrition and insufficient physical activity, nowadays the cardiovascular diseases and cancer are becoming prevalent, having a large part of the total mortality.

Taking into consideration the tendency of producing "healthy food" and healthy way of life, people aim at consuming meat with high biological value, high percentage of full protein, and low percentage of fat and cholesterol. The ideal solution is the ostrich meat.

In the countries with developed ostrich farming (South African Republic, USA, Canada, Israel, Australia, China, France) a lot of attention is paid to this branch of animal husbandry, but the maximum experience in growing these birds is not achieved yet.

Almost all parts of the ostrich can be utilized – meat, skin, feathers, eggs, fat, eyelashes (Sales и сор., 1996). Depending on the wittiness of the breeders and processers, even the bill and the nails can be used for different types of ornaments. The people in China use the inner part of the ostrich nail as an aphrodisiac, and the researches made in USA show that the human iris can be successfully replaced by an ostrich iris (Sales and Franken, 1996; Sales, 1999). The first farm for artificial, commercial breeding of ostrich was established in South Africa in 1863, mainly for feathers for the fashion icons (Smit, 1963). In 1869 Arthur Douglas constructed the first incubator for ostrich eggs starting an industrial revolution (Joy, 2005; Smit, 1963). Nowadays, the ostrich feathers do not have any role regarding the ostrich breeding. The ostriches are mostly grown for the skin and the meat. The skin contains a lot of oil, making it resistant to breaking and drying. The tanned ostrich skin is of a top quality according its design, softness and high durability. Together with the crocodile, ostrich leather stands at the top of the world leather market. The ostrich meat became important at the end of the 80's, and today there is no high reputation restaurant or hotel not serving ostrich meat (Cooper, 2001).

The average ostrich live weigh is 103.72 kg. The average weight of processed carcass is 52,93 kg, and the average weight of the chilled carcass is 51,33 kg. Thus, the average loss of weight after chilling is 1.59 kg (3,04 %), and the dressing percentage 51,03 % of warm carcass and 49,49 % chilled carcass (Naseva et al., 2010).

On the average, 36.20 kg of meat can be obtained from one ostrich. The greatest quantity of meat is contained in the back of the ostrich (21.37 kg), the thighs contain 12,39 kg, and the thorax contains very little meat (2.44 kg) (Naseva et al., 2012). The thorax contains 5.28 kg bones, the back 4.18 kg, and the thighs have the least bones (3,62 kg). The best ratio of meat and bones was established in the back (83,64 % - 16,36 %), then the thighs (77,33 % - 22,61 %), and the thorax contains more bones than meat (68,39 % bones, 31,61 % meat) (Naseva et al., 2010).

Material and methods

The experimental examinations related to this research were performed on twelve ostriches bred on farms in the Republic of Macedonia. All of them were African Black Neck ostriches.

The age of the ostriches varied from 12 – 14 months. This is the common age for slaughtering of this race, as a period for obtaining the best meat, in terms of the quality and quantity.

Twenty-four hours before slaughtering, the ostriches received minimal quantity of food and water.

The slaughtering and the complete primary processing of the ostriches were performed on an adapted line for ostrich slaughtering.

Meat from the right thigh of each ostrich was removed with a scalpel in order to perform chemical analyses made according the standard methods:

- Determination of the water quantity, by drying it at 105 ºC to constant mass;
- Determination of the protein quantity, according to Kjeldahl;
- Determination of the fat quantity, according to the method of Soxhlet;
- Determination of the minerals, by heating the meat at 525 ºC.

Same chemical analyses, according the same methods were performed on beef and chicken. The chemical analyses of the meat were performed 24 hours *post mortem*.

In order to obtain COBB 500 meat, 12 chickens of a hard line of broilers were utilized. They were slaughtered at the age of 42 days. The average live weight of the chickens amounted 1.75 kg. The chicken exposed to chemical analyses was taken from the right thigh, with removed bones and skin.

The meat for chemical analyses was taken from the East-Friesian bullocks, slaughtered at the age of 16-18 months. The examined meat was taken from 12 bullocks. *m. longisimusdorsi*.

The data received from the experiment was variably, statistically processed, according to the method STAT Graphics plus, academic version. The statistical data processing covered calculation of the arithmetical mean value (X), standard deviation (Sd) and variation coefficient (Cv). At the same time, the chemical structure of the chicken, beef and ostrich meat was compared, including an analysis of the variant of three variables and LSD test.

In order to perform the variant of the three variables, the statistical method ANOVA was used.

Results and discussion

The data regarding the chemical structure of the ostrich, chicken and the bullock muscle tissue, examined 24 hours post mortem, is presented in table 1.

Table 1. Chemical composition of ostrich, chicken and beef meat (%)

Meat type	Statistical indicators	Water	Proteins	Fats	Minerals
Ostrich	X	74,52	22,62	0,34	1,22
	Sd	0,45	0,28	0,05	0,1
	Cv	0,60	1,24	14,7	8,2
Chicken	X	75,58	17,57	5,2	0,91
	Sd	0,29	0,32	0,27	0,08
	Cv	0,38	1,81	5,11	8,79
Beef	X	74,21	21,22	1,89	1,09
	Sd	1,13	0,44	0,26	0,05
	Cv	1,53	2,09	13,75	4,27

The amount of water in the beef and the ostrich meat is almost identical (74.52 %, i.e. 74.21 %), but in the chicken is little higher (75.58 %). The statistical processing demonstrated that statistically there is no significant difference in the amount of water between the beef and the ostrich meat, but the difference between the ostrich meat and the chicken, as well as the chicken and beef is significant ($p < 0,01$).

Table 1 presents that ostrich meat contains the greatest quantity of protein (22,62 %), then, the beef (21.22 %) and the least quantity of protein can be found in the chicken (17.57 %). The difference of protein amount between the ostrich meat and the beef is statistically significant ($p < 0,01$), as well as the difference between the ostrich meat and the chicken, and between the beef and the chicken ($p < 0,01$) (Chart 1).

The fats percentage is the least in the ostrich meat (0,34 %), more in the beef (1,89 %), and the most in the chicken (5,2 %). Statistically significant difference was determined in the amount of the fats between the ostrich meat and the beef, between the ostrich meat and the chicken, as well as between the beef and chicken ($p < 0,01$) (Chart 2).

Table 1 shows that the greatest quantity of minerals is contained in the ostrich meat 1,22 %, less in the beef (1,09 %) and the least in the chicken (0,91 %). The performed statistical processing proved that there is statistically significant difference ($p < 0,01$) in the amount of the minerals between the ostrich meat and the beef, the ostrich meat and the chicken and between the chicken and the beef.

The amount of water in the meat obtained from the ostriches bred in Macedonia (74,52 %) has slight difference comparing the results of Sales (1996) - 76,6 %. The amount of water in the results of Harris and cop., (1994) ranges from 65,75 to 68,46 %, which is almost 10 % less than 74,52 %.

The quantity of protein in this research (22,62 %) is lesser referring the quantity of protein obtained as a result of the examinations of Harris and coop., (1994) where the amount of protein is in the range from 23,34 to 26,25 %. This research showed greater amount of protein, compared to the results of Sales (1996), which were 20,9 %.

Taking into consideration the amount of fats, the received results (0,34 %) are almost identical to the results of Sales (1996), where the fats amounted 0,48 %, and Viljoen and cop., 2005, where the fats were in the range from 0,99 – 0,29. The values are lower than the results of Chizzolini and coop., (1999) where the amount is 0,91g/ 100 g meat, and Horbanczuk and coop., (1998) 1,43 g/100 g meat.

The quantity of minerals in this paper (1.22 %) is almost identical to the results of Sales (1996) - 1,14 % and Harris and cop., (1994), where the amount of minerals ranges from 1,21 to 1,28 %.

The results from the analyses of the chicken showed that the amount of water is 75.58%. This is almost one percent higher than the amount of water (74,54 ± 0,15 %) in the group of dark muscles regarding the results of Quiao and coop. (2002), and almost identical to the results for the normal group (74,45 ± 0,24 %) and the light group (74,85 ± 0,27 %). Compared to the results of Probst (2009), the amount of water in the obtained results from this research is almost identical to the results referring to the whole leg (75,2 g /100 g) and for the thigh only (75,0 g /100 g). Almost 2% more water was stated in the paper of de Almeida and coop. (2006) - 77.49 ± 1.04 %.

The quantity of protein in the chickens amounts 17,53 %, which is less compared to the research of Quiaoand coop.,(2002), where the dark muscles have 23,27 ± 0,09 %, the normal have 22,96 ± 0,17 % and the light muscles have 22,58 ± 0,16 % protein. Almost 6 % less protein were resulted in this research compared to the results of Berri and coop. (2001) – 23,73 ± 0,69 %. The closest results were the ones of Probst (2009), where the tests of the whole leg resulted in 18,5 g /100 g of protein, and for the thigh 18,3 g /100 g of protein, then the results of de Almeida and coop., (2006) with 18,83 ± 0,09 %. Simsek and coop., (2009) which were 18,72 ± 0,04 g/ 100 g of protein in the thigh meat, for the control and 19,39 ± 0,09 g/ 100 g protein for the test group.

The fats in the broilers' thighs amounted 5,2 %. This result is almost identical to the result of Probst (2009) - 4,8 g /100 g fats for the meat from the leg and 5,0 g /100 g fats for the meat taken only from the thigh. The results are 1 % higher compared to the results of de Almeida and coop.,(2006) – 4,08 ± 0,60 %, and the researches of Simsek and coop., (2009) which showed that the thigh has 6,85 ± 1,38 g/ 100 g for the control and 5,31 ± 0,75 g/ 100 g fats for the test group.

The minerals in the chicken take 0.91 %. Quiao and coop.,(2002) for the dark muscle group received 1,35 ± 0,04 %, for the normal group, and 1,24 ± 0,04 % for the light group. Even closer values were obtained by Probst (2009), 1,0 g /100 g minerals for the samples taken from the leg and the thigh.

The amount of water in the beef according to this paper is 74,21 %. The research of de Almeida and coop.,(2006) presented 74,48 ± 1,08 % for *m. semimembranosus* and 72,48 ± 1,57 % for *m. biceps femoris*, with a conclusion that the amount of water in *m. longissimusdorsi* is almost identical to the amount of water in *m. semimembranosus* and 2 % greater from the amount of water in *m. biceps femoris*. Compared to the results of Chambaz and coop.,(2001) almost identical values were obtained for the *m. bicepsfemoris* (74,40 g/ 100 g) and the *m. longissimusdorsi* (74,03 g/ 100 g). The results of Probst (2009) were also identical, and showed that the beef contains 75,00 g/ 100 g water, and according to Williams (2007) it contains 73,1 g/ 100 g water, which is only 1 % less than the results obtained in this paper.

The beef contains 21.22 % protein, which is identical to the results of de Almeida and coop.,(2006) – 21,17 ± 0,16 %. Almost identical are the results of Chambaz and coop., (2001) for the protein in *m. longissimusdorsi*(21,47 g/ 100 g), and in the *m. biceps femoris*– 19,80 g/ 100 g, which is 1,4 % less than the results obtained in this research. Migdal and coop., (2009) present wide range of protein 18 – 23 %, including the results gained in this research. Almost 2% is the difference with Williams (2007), where the amount of protein is 23.2 g/ 100 g, and the difference with the work of Probst (2009) - 22,30 g/ 100 g is 1%.

According to this research, the fats in the beef take 1.89 %. This is 1.11 % less than the results of Probst (2009) - 3 g/ 100 g, and identical to the results for *m. semimembranosus* in the research of de Almeida and coop., (2006), where the fats take 3.08 ± 0,07 %, and a lot lesser than the results for the m. *biceps femoris*(8,75 ± 1,12 %). Greater amount of fats were presented in the results obtained from the researches made by Chambaz and coop., (2001), where 3,50 g/ 100 g were received for the *m. longissimusdorsi*, and 4,0 g/ 100 g for *m. biceps femoris*. Serdaroğlu and Bağdatlioğlu(2005) determined that the manually deboned beef contains 9,6 ± 0,57 % fats, which is 7,7 % more than the results obtained from this examination. The beef analyzed by Williams (2007), contained 1 % more fats.

According to the analyses covered by this paper, the beef contains 1,09 % minerals. This result is almost identical to the result of Chambaz and coop., (2001), showing that the quantity of minerals is 1,01 g/ 100 g for the *m. longissimusdorsi, and* 0,97 g/ 100 g for *m. biceps femoris*. According to the researches of Migdal and coop., (2009) the quantity of minerals is 1 %.

Conclusion

The pure muscle tissue from the ostrich thigh contains: water 74.52 %, protein 22.62 %, fats 0.34 %, and minerals 1.22 %. The meat from the chicken thighs – broilers contains: 75.58 % water, 17.57 % protein, 5.2 % fats and 0.91 % minerals. The beef (*m. longissimusdorsi*) contains: water 74.21 %, 21.22 % protein, 1.89 % fats and 1.09 % minerals.

The beef and ostrich meat contain significantly ($p < 0.01$) more water, protein and minerals, and less fats than the chicken. The beef contains significantly ($p < 0.01$) less protein and minerals, and more fats than the ostrich meat.

According to the chemical composition, the ostrich meat can be referred as "healthy food", rich in protein, with low fats, thus representing a good alternative of the chicken and beef, and is advised to be frequently included in the people's diet.

References

Berri, C., N. Millet and E. le Bihan – Duval (2001): Effect of Selection for Improved Body Composition on Muscle and Meat Characteristics of Broilers from Experimental and Commercial Lines, Poultry science 80 pp. 833 – 838.

Chambaz Alain, Kreuzer Michael, Martin R. L. Scheeder and Pierre – Alain Dufey (2001): Characteristics of steers of six beef breeds fattened from eight monts of age and slaughtered at a target level of intramuscular fat. Arch. Tierz., Dummerstorf 44, 5, 473 – 488.

Chizzolini R., Zanardi E., Dorigoni V and Ghidini S (1999): Chaloric value and cholesterol content of normal and low-fat meat and meat products, Trends in Food Science & Techology. Vol. 10, issue 4 – 5, pp. 119 – 128.

Cooper, R.G., (2001): Nutritive value of ostrich meat, World Poultry, Vol.17, No. 8, pp. 42 – 43.

De Almeida, J.C., Perassolo, M.S., Camargo, J.L., Bragagnolo, N., Gross, J.L., (2006): Fatty acid composition and cholesterol content of beef and chicken meat in Southern Brazil. Brazilian Journal of Pharmaceutical Sciences. Vol. 42, n. 1, 109 – 117.

Harris S.D, Morris C.A., Jackson T.C., May S.G., Lucia L.M., Hale D.S., Miller R.K., Keeton J.T., Savell J.W and Acuff G.R. (1994): Ostrich Meat Industry Development, Report to American Ostrich Association from Texas Agricultural Extension Service.

Horbanczuk, J., J. Sales, T. Celeda, A. Konecka, G. Ziêba and P. Kawka (1998): Cholesterol content and fatty acid composition of ostrich meat as influenced by subspecies**,** Meat Science, Volume 50, Issue 3, November 1998, Pages 385-388.

Joy, A., (2005): Ostrich farming then and now. World poultry. 21 (3). 33 – 35.

Migdal W., Živković B., Migdal L. (2009): Health promoting values of beef, Biotehnology in Animal Husbandry 25 (5 - 6), pp 591 – 596.

Naseva D., Pejkovski Z. and Kuzelov A. (2012): Ostrich – yield and chemical composition. Fleischwirtschaft International 27 (1) 53 – 58.

Naseva D., Pejkovski Z. and Lilic S., (2010): Evaluation of the ostrich carcass reared and slaughtered in Macedonia. Meat technology. 51 (2) 143 – 148.

Probst Yasmine (2009): Nutrient composition of Chicken Meat, Rural Industries Research and Development Corporation.

Quiao, M., D. L. Fletcher, J.K. Northcutt and D.P. Smith (2002): The Relationship between Raw Broiler Breast Meat Color and Composition. Poultry science 81 pp. 422 – 427.

Sales, J. (1996): Histological, biophysical, physical and chemical characteristics of different ostrich muscles. Journal of the science of food and Agriculture 70, pp. 109 – 114.

Sales, J., Franken, L., (1996): Ostrich fat. Australian Ostrich Association Journal 37, 39 – 45.

Sales, J., Marais, D., Kryger, M., (1996): Fat content, caloric value, cholesterol content and fatty acid composition of raw and cooked ostrich meat. Journal of food composition and analysis. 9 (1). 85 – 89.

Sales, J. (1999): Slaughter and products. U: The ostrich Biology, Production and Health. D.C.Deeming. CAB Publishing Oxon – UK, New York – USA. University Press, Cambridge, 1999. 231 – 274.

Serdaroğlu M., Bağdatlioğlu H. (2005): Effects of Deboning Methods on Chemical Composition and Some Properties of Beef and Turkey Meat, Turk J Vet Anim Sci 29 pp. 797 – 802.

Simsek Ulku Gulcihan, Bestami Dalkilic, Mehmet Ciftci, Ibrahim Halil Cerci, Muammer Bahsi (2009): Effects of Enriched Housing Design on Broiler Performace, Welfare, Chicken Meat Composition and Serum Cholesterol. Acta Vet. Brno 78: 67 – 74.

Smit, D.J.v.Z., (1963): Ostrich farming in the Little Karoo. Bulletin No. 358, Department of Agricultural Technical Services, Pretoria, South Africa.

Viljoen, M., Hoffman, L.C., Brand, T.S., (2005): Prediction of the chemical composition of freeze dried ostrich meat with near infrared reflectance spectroscopy. Meat science. 69 (2). 255 – 261.

Williams P.G., (2007): Nutritional composition of red meat. Nutrition & Dietetics, 64 (4), pp 113 – 119.

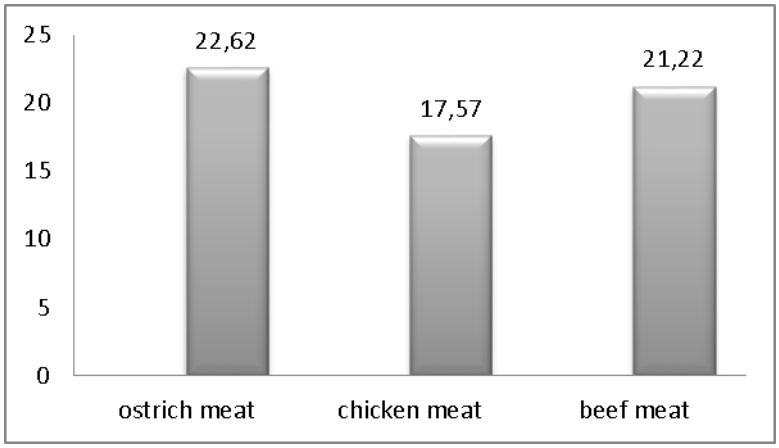

Chart 1: Comparison of the amount of protein in ostrich chicken and beef

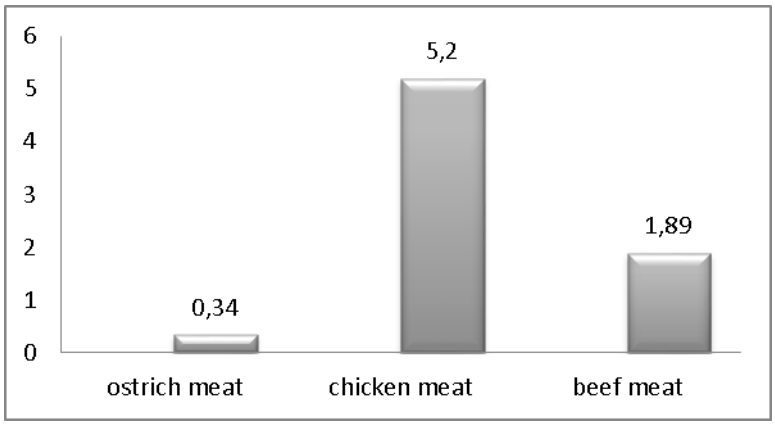

Chart 2: Comparison of the amount of fat in ostrich chicken and beef