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Contact

Publishing director
Dr. Clemens Knoll

Editorial office
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Dipl.oec.troph. Renate Kühlcke (kck) +49 69 7595-1551
Editor-in-chief
Gerd Abeln MA (abe) +49 69 7595-1571
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Dipl.-Des. Marcel Möbius +49 69 7595-1555

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Deutscher Fachverlag GmbH
Mainzer Landstrasse 251
60326 Frankfurt am Main / Germany
Postal address 60264 Frankfurt am Main
Phone +49 69 7595-01
Fax +49 69 7595-1570
Email red-flw@dfv.de
Internet www.fleischwirtschaft.com

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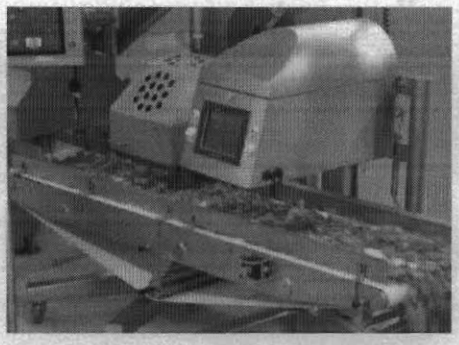
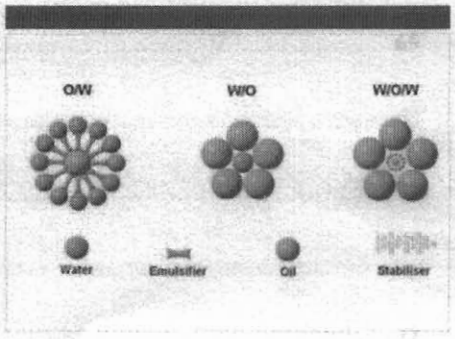
This year's trade fair Anuga FoodTec from 27 to 30 March in Cologne offers the international food business an information and purchasing platform that covers the entire spectrum of technology and investment requirements for production in all segments of the food industry.



Whereas accurate fat analysis was primarily the domain of large meat processors who could afford and accept the limitations of dual energy X-ray, a new NIR system makes inline fat analysis accessible to all meat processors.



Emulsification is required in many food systems like cooked sausages, creams or sauces to create characteristic physical and sensory properties. Stabilisers help to achieve this properties.

Research & Development

Anuga FoodTec 2012

Meat Analysis

Processing

Stabiliser

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Columns

Cover Photo: Ingo Wagner

Seasonings, additives and ingredients have a dramatic influence on the sensory characteristics of meat and meat products and other foods.

Ostrich – yield and chemical composition

Ostrich meat as an alternative meat source is worth being included in human nutrition more often

Faced with the fact that the world's population is increasing year over year and that it is faced with the lack of food, especially meat, the alimentary technology should necessarily consider each source for nutrition. This article studies the quality and quantity of ostrich meat. The results of the live weight, slaughter weight, dressing percentage and losses of weight under chilling, the content of meat and bones in the main parts (thighs, back, thorax) and the chemical composition of ostrich meat are expressed.

By Dijana Naseva, Zlatko Pejkovski and Aco Kuzelov

The production and consumption of meat in the world is increasing each year. Experts from all over the world envisage that in 2050 the production of meat would amount more than 465 million tons. Approximately 42 kg meat per citizen is produced in the world. The consumption varies depending on the region and the socioeconomic status (HALWEIL, 2008).

Year over year, the number of the world's population is more and more increasing. On the other hand the energetic and food resources are constantly decreasing. Considering the fact that the animal technology is constantly trying to nurture the increased population, none of the alimentary sources and none of the source for meat should be disregarded.

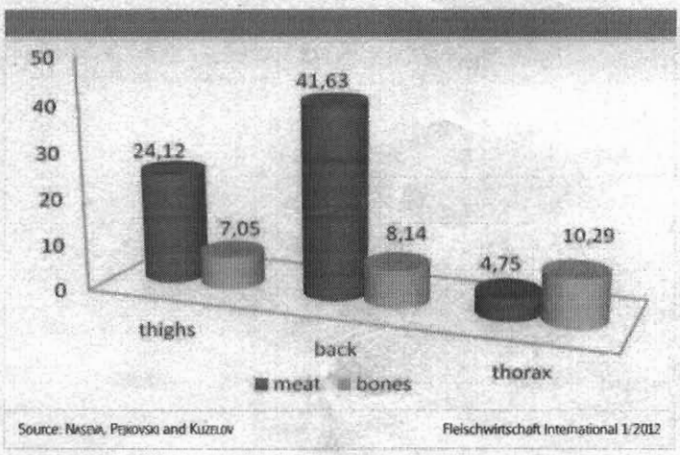

Fig.: Participation of meat and bones from the main parts in the slaughter weight of ostriches, in %.

Ostrich and different uses in history

In the past, ostriches were mostly reared for their quality skin and feathers. The qualities of the meat were not sufficiently valorised and recognised. However, this meat has become a gastronomic discovery in the recent

years. Nowadays, in the rich countries of the world, there is hardly any restaurant or hotel with high reputation that does not serve this type of meat. Human-ostrich relation is at least 5000 years old (COOPER, 2001). In the distant 1863, the first farm for artificial and commercial rearing of ostrich was founded in South Africa in order to obtain feathers for fashion above all (SMIT, 1963). In 1869, Arthur Douglas built the first incubator for ostrich eggs, which led to revolution of the industry (JOY, 2005).

In the First and Second World War, the market for feathers significantly decreased, but the industry survived in several small farms in South Africa (JOY, 2005). In the middle of the 1980s, the rearing of ostriches in farms experienced its renaissance, even though the number of ostrich rearing farms was still low (DEEMING and ANGEL, 1996). Outside South Africa, there was an unsatisfactory number of farms, as well as in the processing capacities of USA, Australia and Europe. In the same period, the technology for rearing and processing of ostrich was well enough developing in Israel that takes the second place, right after South Africa.

Ostrich as a meat source

Nowadays, the focus is on slaughtering ostrich and obtaining ostrich meat. Ostrich industry in Europe is being developed since the beginning of 1990, with pairs imported from South Africa and Israel (DEEMING and ANGEL, 1996).

As a product from ostrich, the meat became important in the end of the 1980s from the previous century (COOPER, 2001). Ostrich produce red meat which is entirely unique thanks to the exceptional softness, tenderness, frailty and amazing taste of game.

Rearing and estimation of ostriches is very difficult and requires functional management. This regards the slaughterhouse, where meat is obtained. As in every other industry, the quality of the product i.e. the raw-material is the result of the efficiency of production as well as the quality of the product. Therefore, attention should be paid during the processing of slaughtered ostriches, so that efficient methods are applied (COOPER, 2000b).

Ostriches were mostly reared for fashion products like skin and feathers.

Set-up of the study

12 ostriches from the breed African black-neck ostrich were analysed. They were reared in farms of the Republic of Macedonia. Their age at slaughter was between 12 and 14 months. 24 hours before slaughtering, the ostriches received a minimal amount of food and water. Slaughtering and the entire primary processing of ostrich were carried out on an adapted slaughter line.

First, live weight of ostrich was measured. After primary processing, the slaughter weight of warm carcass was recorded, without head and internal organs. Afterwards, carcasses were placed in a cold storage room at a temperature of 0 to 1 C for 24 hours. After chilling, the carcasses were weighted again one by one on a hanging scale. On the basis of the difference in the carcasses' weight before and after chilling, the losses of weight under chilling were calculated in kg and percentage. The dressing percentage of ostrich was calculated as ratio between slaughter and live weight. From the ratio of live and slaughter weight of ostrich before and after chilling of carcasses, the following points were calculated: dressing percentage of warm carcass and dressing percentage of chilled ones.

The following step was breaking the ostrich carcasses. The main parts were separated to: thigh, back and thorax and than weighted on a digital scale, afterwards a dissection of these parts was performed in order to estab-

Ostriches have an unexpectedly high yield

Tab. 1: Live weight, slaughter weight, dressing percentage and losses of weight under chilling of ostriches

Examined parameters	X	SD	CV
Live weight, kg	103.72	9.22	8.89
Slaughter weight, kg	52.93	6.01	11.36
Slaughter weight chilled, kg	51.33	5.93	11.56
Losses of weight kg	1.59	0.29	18.41
under chilling %	3.04	0.55	17.99
Dressing percentage of warm carcass, %	51.03	3.05	5.98
Dressing percentage of chilled carcass, %	49.49	2.99	6.07

X – mean value, SD – standard deviation, CV – coefficient of variation

Source: NASEVA, PEKOVSKI and ACO

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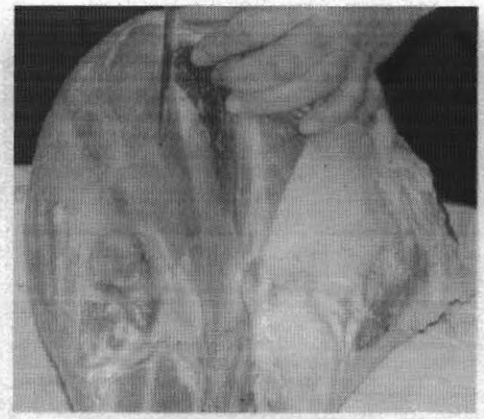
lish the content of meat and bones in the main parts and to establish the total amount of meat obtained by one ostrich.

From each individual ostrich, a part of the right thigh meat was taken using a scalpel, in order to perform chemical analyses in accordance with the standard methods:

- determination of the amount of water, by desiccation at 105 C to constant weight;
- determination of the amount of proteins, according to Kjeldahl;
- determination of the amount of fats, in accordance with the method of Soxhlet;
- determination of the minerals (ash), by heating to 525 C.

Considering that the ostrich's rearing is not sufficiently studied, and that yield and quality of ostrich meat are not sufficiently researched, the findings of this research show that out of one ostrich, approximately 36.20 kg meat can be obtained.



The slaughter weight is around 50 kg.

Yield

The live weight, slaughter weight (warm and chilled), dressing percentage (warm and chilled) and losses of weight under chilling (in kilos and percentage) are shown in Table 1. The live weight is a starting parameter for establishing the slaughter weight of ostrich. Data from weighting the live weight of the examined ostrich show that the average live weight of ostrich reared in farms of the Republic of Macedonia, from the Black-neck ostrich breed, amounts to 103.2 kg. Out of one 14 months old ostrich, the slaughtering weight is around 100 kilograms (COOPER, 2000a). Ostriches reared in Texas, Louisiana, Oklahoma and Indiana had weights of 95.54 kg (MORRIS et al., 1995). The average is obtained out of 14 ostriches at the age of 10 to 14 months. Ostriches, which were examined by POLLOK et al. (1997), were reared in Texas, and it was established that the average weight of 25 ostriches at the age of 10 to 11 months amounted to 99.73 kg. According to KREIBICH and SOMMER (1994), the live weight of ostriches at the age of 14 months amounts to 105 to 125 kg.

The weighted warm slaughter weight amounts to 52.93 kg, and the chilled slaughter weight is 51.33 kg. The results of MORRIS et al. (1995) show that the slaughter weight of warm carcass is 55.91 kg, that of chilled carcass is 54.57 kg, and according to POLLOK et al. (1997), the weight of warm carcass amounts to 48.82 kg and the weight of chilled carcass is 47.55 kg. Losses of weight under chilling amount to 1.59 kg or 3.04%, which is 0.25 kg higher than the losses of weight under chilling stipulated in the results of MORRIS et al. (1995) and 0.32 kg higher than losses of weight under chilling stipulated in the results of POLLOK et al. (1997).

Dressing percentage of ostrich amounts to 51.03% of warm carcass, i.e. 49.49% of chilled ones. These values are close to those (51%) that were established by BALOG and ALMEIDA (2007) and POLLOK et al. (1997), and are a little higher than the finding (58.6%) of MORRIS et al. (1995).

With this research, it is established that out of one ostrich 70.50% meat and 25.48% bones can be obtained in average. In comparison to the results of HARRIS et al. (1994), where 64.5% lean meat and 26.9% bones were obtained, it can be concluded that in this experiment 6% more meat and 1.42% less bones are obtained. The average yield of meat of ostrich in Macedonia is 36.20 kg meat or 34.90% regarding the live weight, which is almost identical to the result of HARRIS et al. (1994), where 35.7% lean meat was obtained regarding the live weight. COOPER (2000a) obtained that the meat yield of ostriches is 35 kg lean meat.

The largest amount of meat is located in the back of the ostrich (21.37 kg), it is lower in thighs (12.39 kg), and the thorax has very little amount of meat (2.44 kg) (Tab. 2). The participation of the meat and bones expressed in percentage in the chilled carcass of ostrich is graphically shown in Figure 1. The best proportion of meat and bones has the back (83.64% versus 16.36%), the next is thigh (77.33% versus 22.61%) and thorax contains more bones than meat (68.39% bones, 31.61% meat).

Chemical composition

According to the analyses carried out for the chemical compo-

Thoraces of ostriches have the least amount of meat

Tab. 2: Content of meat and bones in the main parts of ostriches, in kg

Examined parameters		X	SD	CV
Slaughter weight of chilled carcass		51.33	5.93	11.56
Thighs	Meat	12.39	0.896	14.49
	Bones	3.62	0.23	12.66
Back	Meat	21.37	3.233	15.12
	Bones	4.18	0.567	13.57
Thorax	Meat	2.44	0.318	13.07
	Bones	5.28	0.54	10.14

X – mean value, SD – standard deviation, CV – coefficient of variation

Source: NASEVA, PEJKOVSKI and ACO — Fleischwirtschaft International 1/2012

sition of ostrich meat, the following results, shown in the Table 3, are obtained.

The content of water (74.52%) has a little difference compared to the results of SALES (1996) – 76.6%, and the results of HARRIS et al. (1994) range between 65.75 and 68.46%.

The content of proteins in these researches (22.62%) is lower regarding protein levels obtained by KREIBICH and SOMMER (1994) – 26%, as well as in comparison to the researches of HARRIS et al. (1994) where the content of proteins was between 23.34 and 26.25%. It is also higher compared to the results of SALES (1996) where 20.9% was obtained.

Regarding the content of fats, the results obtained (0.34%) are identical to the results of KREIBICH and SOMMER (1994), where the content of fats in the tissues of ostrich amounts to 0.3%. It can also be compared to the results from SALES (1996), where the fats were 0.48% and VILJOEN et al. (2005) where fats ranged from 0.99 to 0.29%. The values obtained are lower in comparison to the results of CHIZZOLINI et al. (1999), where the content was 0.91 g/100 g meat and HORBANCZUK et al. (1998) – 1.43 g/100 g meat.

The content of minerals (1.22%) is almost identical to the results of SALES (1996) – 1.14% and HARRIS et al. (1994), where the content of minerals ranged from 1.21 to 1.28%.

Characeristics of ostrich meat

On the basis of the results obtained from the quantitative estimation of carcass, i.e. the slaughter weight of ostrich (live weight, slaughter weight, dressing percentage, losses of weight

The carcass of ostrich contains around 25% of bones.

under chilling, weight and tissue composition of the main parts of carcass), the following conclusions can be drawn:

- The average live weight of ostrich from the African black-neck ostrich breed, slaughtered at the age of 12 to 14 months, amounts to 103.72 kg. The slaughter weight of warm carcass amounts to 52.93 kg, and of chilled ones to 51.33 kg. The losses of weight under chilling are 3.04%, and dressing percentage of warm carcass is 51.03% and of chilled carcass 49.49%.
- Out of one ostrich, 36.20 kg lean high-quality meat is obtained.
- The carcass of ostrich contains 70.50% meat and 25.48% bones. The thigh contains 77.39% meat and 22.61% bones, the back 83.64% meat and 16.36% bones, the thorax 31.61% meat and 68.39% bones.
- The pure muscle tissue of the ostrich's thigh contains 74.52% water, 22.62% proteins, 0.34% fats and 1.22% minerals.
- According to the chemical composition, the ostrich meat represents a food rich in proteins and poor in fats, therefore it is a good alternative of any type of meat and it is recommended to be included in human nutrition more often.

Ostriches are rich in proteins and poor in fats

Tab. 3: Chemical composition of ostrich meat, (%)

Type of meat	Statistical indicators	Water	Proteins	Fats	Minerals
Ostrich meat	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

X – mean value, SD – standard deviation, CV – coefficient of variation

Source: NASEVA, PEJKOVSKI and ACO

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Author's addresses

Dijana Naseva, Goce Delcev University – Stip, Faculty of Agriculture, Street Krste Misirkov bb, 2000 Stip, Macedonia, dijana.naseva@ugd.edu.mk; Zlatko Pejkovski, St Cyril and Methodius University – Skopje, Faculty of agricultural sciences and food – Skopje, boulevard Aleksandar Makedonski bb, 1000 Skopje, Macedonia, zpejkovski@zf.ukim.edu.mk; Aco Kuzelov, Goce Delcev University – Stip, Faculty of Agriculture, Street Krste Misirkov bb, 2000 Stip, Macedonia, aco.kuzelov@ugd.edu.mk

MSc Dijana Naseva is working as teaching assistant at the Faculty of Agriculture in Stip, Macedonia. Her lecturing subject is meat and meat products. In October 2010 she defended her master thesis about ostriches in Macedonia. She is researching about ostrich meat as healthy replacement and alternative of other types of meat.

Prof. Dr. Zlatko Pejkovski is working as a regular professor at the Faculty of Agricultural Sciences and Food in Skopje, Macedonia. His lecturing subjects are: Meat and meat products and Technology of ready to eat meals. In November 2000 he defended his Ph.D thesis about possibilities for nitrite substitution in boiled sausages. His fields of interests are reduction and substitution of certain harmful to health food ingredients.

PhD Aco Kuzelov is working as Professor at the Faculty of Agriculture in Stip, Macedonia. His lecturing subject is meat and meat products. He is interested in food safety and meat technology.