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SHORT REPORT

Cholesterol content and fatty acid composition of fat from culled breeding ostriches (*Struthio camelus*)

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Culled breeding ostriches weighing 130-160 kg yield about 25 kg fat tissue that could possibly be used for supplementing human and animal diet.
Cholesterol content of breast fat – 80 mg/100 g tissue – from the breeding ostrich females (n = 6) culled and slaughtered at the age of five years appeared similar to that reported of beef and lamb adipose tissue. In a sum of 17 fatty acids (FA) determined, the mono- and polyunsaturated FA accounted for 37.51 and 38.84%, respectively. The ratio polyunsaturated/saturated FA in breast fat of culled breeding ostrich females appeared higher than reported for other avian species.
It is concluded that fat from culled breeding ostriches can be used as an additive to human or animal diet, thus allowing the farmer to gain more from ostrich production. Further research is needed on composition and properties of adipose tissue of ostriches, including slaughter, as well as breeding

birds culled at different ages.

KEY WORDS: / cholesterol / culling / fat / fatty acids / ostrich

Over the last several years further development of ostrich farming is being observed and a number of ostrich farms as well as breeding stock still increase [Horbańczuk 2002]. Up to 10% of mature breeding birds (breeders) are culled every year due to various permanent disorders such as egg retention, egg-peritonitis, prolapse of the cloaca or fallus, aspermic yield, sperm abnormalities, behavioural problems (permanent unwillingness to mate), mechanical disorders (breaking legs), or overfeeding [Huchzermeyer 1998]. Culled breeders with the live weight of 130-160 kg, and especially those fed an improper diet high in oat or barley can, after slaughter, yield about 25 kg of fat (Horbańczuk, unpublished data).

Ostrich farmers often inquire whether the fat from culled breeder ostriches can be used to supplement animal or human diet, thus gaining returns from ostrich keeping and increasing the efficiency of farming. However, current knowledge regarding the composition of fat tissue obtained from culled ostriches in Poland is too scarce to make any recommendations. This report presents an attempt at evaluating the cholesterol content and fatty acid composition of adipose tissue obtained from culled breeder ostriches kept on the Polish farm in conditions characteristic of east-central Europe.

Material and methods

Ostriches were kept on a farm at Rowiska, near Warsaw, according to EU standards [Horbańczuk 2002]. Fat samples (approximately 15 g from each bird) were collected after slaughter from breast region of six breeding females culled at the age of five years. The samples were immediately vacuum-packed in plastic bags and then stored at -20°C until analysed.

For determination of cholesterol the total lipid fraction was extracted with chloroform-methanol mixture (2:1, v/v) after Folch *et al.* [1957]. Total cholesterol was determined colorimetrically according to Searcy and Berquist [1960].

For determination of fatty acids the samples of frozen fat were freeze-dried and extracted with chloroform-methanol-water mixture (4:2:1,v/v). Derivatization reaction was carried out according to Czauderna and Kowalczyk [2001] and Czauderna *et al.* [2001]. The derivatized samples were filtered through a 0.2 μm membrane filter (WHATMAN). The filtrates were injected onto chromatographic columns on Spheri-5 RP-18, 5 μm, 220 × 4.6 mm (PERKIN ELMER, USA). Dibromoacetophenacyl esters of fatty acids were identified on a HPLC system Series 200 (PERKIN ELMER, USA). The development of the gradient elution system, collection, and data integration were performed with TURBOCHROM Workstation Ver. 6.1.2 software. All eluents were degassed under vacuum and then flushed with helium (99.996%, PRAXAIR, Warsaw, Poland). Elution was performed using methanol (MeOH) and acetonitryl-water (ACN: H_2O, 40:60, v/v) 9:1, v/v mixture. The column temperature was maintained at 35°C

and the eluted dibromoacetophenylacyl esters of fatty acids were identified at 242 nm. The elution of dibromoacetophenacyl esters of C3:0-C20:4 fatty acids was completed within 40 min at a flow rate of 2.6 ml/min.

Cholesterol content was presented in mg/100 g adipose tissue, while individual fatty acids as per cent of their sum. Both were expressed as means and standard deviations.

Results and discussion

In this report the cholesterol content of breast fat in culled breeder ostriches (80.00 mg/100 tissue – Tab. 1) was similar to those in beef and lamb adipose tissue (75 mg/100 g), but higher than in the abdominal fat of broiler chickens (65 mg/100 g), both cited after Mandigo [1991]. The breast fat of culled breeders contained more cholesterol

Table 1. Means and their standard deviations (SD) for cholesterol content and fatty acid composition in ostrich fat from culled breeding females

Item	Mean (n=6)	SD
Cholesterol (mg/100 g)	80.00	11.59
Fatty acids (% of total fatty acids)		
saturated (SFA)		
3:0	0.15	0.13
4:0	0.03	0.02
8:0	0.13	0.05
10:0	1.62	0.43
12:0	0.04	0.01
14:0	0.73	0.14
16:0	20.25	0.92
17:0	0.01	0.003
18:0	0.55	0.10
total SFA	23.63	0.92
monounsaturated (MUFA)		
12:1	0.62	0.18
14:1	0.03	0.01
16:1	0.41	0.13
18:1 O*	36.39	1.16
total MUFA	37.51	1.17
polyunsaturated (PUFA)		
18:2	16.20	1.36
18:3	15.98	1.18
20:4	6.65	1.17
total PUFA	38.84	1.28
PUFA/SFA	1.65	0.10

*Oleic acid.

than breast (49.5 mg/100 g) and back fat (74.3 mg/100 g) of 14-month-old slaughter ostriches [Horbańczuk *et al*. 2003], suggesting that cholesterol content of ostrich fat increases with age.

In this report the share of saturated fatty acids (SFA) in the breast fat reached 23.63% appearing lower than in the abdominal fat of sample ostriches in South Africa – 35% [Sales and Franken 1999], geese – 32.9% [Borys *et. al.* 2001] and broiler chickens – 27.8% [Balcerak 2003]. The monounsaturated fatty acids (MUFA), accounted for 37.51% of the sum of fatty acids, whereas polyunsaturated fatty acids (PUFA), the most desired in human diet, for as much as 38.84 % (Tab. 1). The PUFA/SFA ratio in culled breeder ostriches (1.65) appeared higher than in the chicken (0.77) and geese (0.3), as reported by Balcerak [2003] and Borys *et. al*. [2001], respectively.

It is interesting, that the share of SFA and MUFA in the total sum of fatty acids of ostrich breast fat from culled birds reported here was by 5 and 9 per cent units lower, than in external fat (breast and back) of 14-month-old slaughter ostriches [Horbańczuk *et al.* 2003]. On the other hand, the share of PUFA of fat in culled breeders was by 4-6 per cent units higher than of fat of slaughter birds.

It may be strange that adipose tissue, obtained from culled ostriches, contained less SFA, but more PUFA, as well as higher PUFA/SFA ratio than that from 14-months old slaughter ostriches [Horbańczuk *et al*. 2003].

Apart from the factor of age (that normally decreases the quality of fat) this phenomenon may be associated with the diet. Culled breeder ostriches had *ad libitum* access to grass (3-3.5 kg/day), whereas daily forage intake by slaughter birds was limited to1 kg.

Further research is necessary on cholesterol content and fatty acid composition of breast fat in various groups of ostriches, including slaughter birds as well as culled breeders. Age should not be limited to 5 years as by this age ostriches in natural conditions normally achieve sexual maturity [Horbańczuk, 2002]. Valuable would be studies on really old breeder ostriches, culled at 15-20 years.

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Zawartość cholesterolu i skład kwasów tłuszczowych tkanki tłuszczowej pochodzącej z okolicy mostka wybrakowanych strusi hodowlanych

S t r e s z c z e n i e

Wybrakowane strusie hodowlane o masie ciała 130-160 kg mogą po uboju dostarczać około 25 kg tkanki tłuszczowej.

Zawartość cholesterolu, która wyniosła 80 mg/100 g tkanki tłuszczowej sześciu samic hodowlanych, wybrakowanych i ubitych w wieku 5 lat, okazała się podobna do podawanej dla tkanki tłuszczowej wołowiny i baraniny. W sumie 17 oznaczonych kwasów tłuszczowych stwierdzono 37,51% kwasów jedno- i 38,84% kwasów wielonienasyconych. Stosunek kwasów wielonienasyconych do nasyconych był wyższy niż podawany dla tkanki tłuszczowej innych gatunków drobiu.

Wnioskuje się o możliwości stosowania tłuszczu młodych strusi hodowlanych, które wybrakowano z przyczyn niezwiązanych z wiekiem, jako dodatku wzbogacającego dietę ludzi i zwierząt. Postępowanie takie mogłoby prowadzić do wzrostu dochodów producentów strusi. Potrzebne są dalsze badania składu i właściwości tkanki tłuszczowej strusi w różnym wieku, włącznie z ptakami rzeźnymi, a także starymi, wybrakowanymi w wieku nawet 15-20 lat.