Animal Science Papers and Reports vol. 21 (2003) no. 4, 265-269
Institute of Genetics and Animal Breeding, Jastrzębiec, Poland

SHORT REPORT

Cholesterol content and fatty acid composition of egg yolk of grey nandu (*Rhea americana*)

Jarosław Olav Horbańczuk[1], Ross Gordon Cooper[2], Artur Jóźwik[1], Józef Klewiec[1], Józef Krzyżewski [1], Wojciech Chyliński[1], Wiesław Kubasik[3], Magdalena Kawka[1]

[1] Polish Academy of Sciences Institute of Genetics and Animal Breeding, Jastrzębiec, 05-552 Wólka Kosowska, Poland

[2] Department of Physiology, School of Medical Sciences, University of Bristol, University Walk, Bristol, Avon, BS8 1TD, England, UK

[3] Ostrich Farm Dąbki, 66-600 Krosno Odrzańskie, Poland

(Received November 10, 2003; accepted December 4, 2003)

In nandu eggs (n = 9) the mean cholesterol content of yolk was 16.41 mg/g. In a sum of 21 fatty acids determined, the considerable share – 33.55% – of polyunsaturated acids was found, and especially of linolenic (C18:3) – 4.95% and arachidonic (C20:4) – 7.59%, both considered essential in human nutrition. It is concluded that nandu eggs are of considerable dietetic value.

KEY WORDS: cholesterol / egg / fatty acid / nandu / yolk

Traditionally, for table consumption, almost exclusively used are chicken eggs. Recently, however, people turn to *Ratitae* eggs [Horbańczuk 1998, 2002] considered fashionable because of their original appearance as compared to eggs of chicken [Sales 1999]. Whereas only few studies have been conducted on the nutritive value of African ostrich eggs [Reiner *et al.* 1995, Noble *et al.* 1996, Horbańczuk *et al.* 1999], almost

no data are available on the quality of eggs of nandu [Lopez *et al.* 1998, Sales 2002]. This report presents an attempt at gaining information on the total cholesterol and fatty acids content of egg yolk of nandu kept on the Polish farm in conditions typical of east-central Europe.

Material and methods

Nine grey nandu (*Rhea americana*) eggs were obtained from nine different females kept on the nandu farm in Dąbki, near Zielona Góra, Poland, under EU standards [Horbańczuk 2002]. Immediately following collection the yolks were carefully removed from the eggs, samples of approximately 5 ml were obtained, vacuum-packed in plastic bags and stored at -20°C until analysed.

For determinations 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 yolks 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 column 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, 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 dibromo-acetophenylacyl esters of fatty acids were identified at 242 nm. The elution of dibromo-acetophenacyl esters of C3:0-C20:5 fatty acids was completed within 40 min at a flow rate of 2.6 ml/min.

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

Results and discussion

The mean cholesterol content of yolk reached 16.41 mg/g (Tab. 1) appearing similar to the value found in guinea fowl (16 mg/g) and intermediate between those reported for chicken (15-19 mg/g) and ostrich (13 mg/g) by Reiner *et al*. [1995], and Horbańczuk *et al*. [1999], respectively.

Total saturated fatty acids (SFA) in egg yolk reached 32.5% (Tab. 1). Higher value (34.4%) including, however, C16:0 and C18:0 only, were given by Reiner *et al*. [1995]

Table 1. Mean and standard deviation (SD) for cholesterol content and fatty acid composition of raw nandu egg yolk from birds farmed in Poland

Item	Mean (n=9)	SD
Cholesterol (mg/g)	10.41	1.79
Fatty acids (% of total fatty acids)		
saturated (SFA)		
8:0	0.08	0.19
10:0	0.07	0.22
12:0	0.42	0.15
13:0	0.02	0.007
14:0	0.02	0.006
15:0	0.35	0.15
16:0	27.83	1.65
17:0	0.13	0.04
18:0	2.39	0.19
total SFA	32.51	2.60
monounsaturated (MUFA)		
10:1	0.12	0.01
12:1	0.01	0.008
14:1	0.009	0.003
16:1	14.74	0.78
18:1 ω9 [1]	18.80	0.88
18:1 ω7 [2]	0.16	0.035
total MUFA	33.84	1.71
polyunsaturated (PUFA)		
18:2	19.12	3.33
18:3	4.95	0.32
20:3 ω6 [3]	0.13	0.09
20:3 ω3 [4]	0.05	0.03
20:4	7.59	0.34
20:5	1.71	0.119
total PUFA	33.55	4.23
PUFA/SFA	1.03	0.14

[1] Oleic acid
[2] Elaidic acid
[3] ω6 – linoleic acid
[4] ω3 – linolenic acid

for chicken eggs.

Among polyunsaturated fatty acids (PUFA), considerable shares of linolenic (C18:3 – 4.95%) and arachidonic (C20:4 – 7.59%) acids (Tab. 1) are markedly different from the figures preliminarily given by Lopez *et al*. [1998] who, for seven eggs of nandu from semi-captive populations in Argentina, reported the share of the two acids reaching 1.7 and 1.2%, respectively.

As shown in Table 1 the mean ratio PUFA/SFA in nandu egg yolk exceeded 1 whereas Lopez *et al*. [1998] determining only seven acids, found the ratio of 0.54.

The ratio SFA : MUFA : PUFA in nandu eggs yolk in the present study was found 1:1:1, what is very important from a dietetic point of view.

The data presented here constitute the first report on the content of as many as 21 fatty acids of the yolk of nandu eggs. As compared to chicken eggs, the egg yolk of nandu appears to contain similar level of cholesterol and shows higher share of PUFA, indicating its considerable dietetic value.

It is well known that the fatty acid composition of animal products can easily be altered by nutrition. Thus, apart from genetic factors, especially the influence of feeding regimen on cholesterol content and fatty acid composition of nandu eggs need further investigation.

REFERENCES

1. CZAUDERNA M., KOWALCZYK J., 2001 – Separation of some mono-, di- and tri-unsaturated fatty acids containing eighteen carbon atoms by high-performance liquid chromatograpy and photodiode array detection. ***Journal of Chromatography*** B 760, 165-178.
2. CZAUDERNA M., KOWALCZYK J., CHOJECKI G., 2001 – An improved method for derivatization of fatty acids for liquid chromatography. ***Journal of Animal and Feed Sciences*** 10, Suppl., 2, 369-375.
3. FOLCH J., LEES M., STANLEY G.H.S., 1957 – A simple method for the isolation and purification of total lipides from animal tissues. ***Journal of Biological Chemistry*** 226, 497-509.
4. HORBAŃCZUK J., 1998 – Consumption of ostrich eggs. ***The Ostrich News*** (USA) 11 (117), 9.
5. HORBAŃCZUK J.O., 2002 – The Ostrich. Published by European Ostrich Group, Denmark, 176 pp.
6. HORBAŃCZUK J.O., SALES J., ZIĘBA G., REKLEWSKI T., CELEDA T., KOZACZYŃSKI K., 1999 – Lipid cholesterol content and fatty acid composition of ostrich eggs as influenced by subspecies. ***Archiv für Geflügelkunde*** 63 (5), 234-236.
7. LOPEZ M.L., MAESTRIL D.M., NAVARRO J.L., 1998 – Comparative physical and chemical characteristics of Greater Rhea (*Rhea americana*) eggs from semi-captive populations. ***The Ostrich News*** (USA), 12 (121), 19-21.
8. NOBLE R.C., SPEAKE B.K., MCCARTNEY R., FOGGIN C.M., DEEMING D.C., 1996 – Yolk lipids and their fatty acids in the wild and captive ostrich (*Struthio camelus*). ***Compartive Biochemistry and Physiology*** 113B (4), 753-756.
9. REINER G., DORAU H.P., DZAPO V., 1995 – Cholesterol content, nutrients and fatty acid profiles of ostrich (Struthio camelus) eggs. ***Archiv für Geflügelkunde*** 59, 65-68.
10. SALES J., 2002 – Ostrich meat research: an update. Proceedings of the World Ostrich Congress, Warsaw, 26-29 September, 148-160.
11. SALES J., 1999 – Slaughter end products. In: The Ostrich Biology, Production and Health. CAB International Cambridge, 231-274.
12. SEARCY R.L., BERQUIST L.M., 1960 – A new color reaction for the quantitation of serum cholesterol. ***Clinica and Chimica Acta*** 5, 192.

Jarosław Olav Horbańczuk, Ross Gordon Cooper, Artur Jóźwik, Józef Klewiec, Józef Krzyżewski, Wojciech Chyliński, Wiesław Kubasik, Magdalena Kawka

Zawartość cholesterolu i skład kwasów tłuszczowych w żółtku jaja nandu (*Rhea americana*)

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

W dziewięciu jajach nandu pozyskanych na fermie w Dąbkach koło Zielonej Góry średnia zawartość cholesterolu ogólnego wyniosła 16,41 mg/g żółtka. Suma 21 oznaczonych kwasów tłuszczowych zawierała 32,51% kwasów nasyconych i 33,55% wielonienasyconych. Kwas linolenowy (C18:3) stanowił 4,95%, a arachidonowy (C20:4) 7,59% sumy wszystkich kwasów. Wnioskuje się o wysokiej wartości dietetycznej jaj nandu.