Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: http://www.tandfonline.com/loi/tjas20

The dietary inclusion of Portulaca oleracea to the diet of laying hens increases the n-3 fatty acids content and reduces the cholesterol content in the egg yolk

Antonella Dalle Zotte, Francesco Tomasello & Igino Andrighetto

To cite this article: Antonella Dalle Zotte, Francesco Tomasello & Igino Andrighetto (2005) The dietary inclusion of Portulaca oleracea to the diet of laying hens increases the n-3 fatty acids content and reduces the cholesterol content in the egg yolk, Italian Journal of Animal Science, 4:sup3, 157-159, DOI: 10.4081/ijas.2005.3s.157

To link to this article: http://dx.doi.org/10.4081/ijas.2005.3s.157

COMMUNICATION

The dietary inclusion of *Portulaca oleracea* to the diet of laying hens increases the n-3 fatty acids content and reduces the cholesterol content in the egg yolk

Antonella Dalle Zotte[1], Francesco Tomasello[2], Igino Andrighetto[1]

[1]Dipartimento di Scienze Animali. Università di Padova, Italy
[2]Settore Agricoltura. Aziende Sperimentali e Dimostrative, Pordenone, Italy

Corresponding author: Dr. Antonella Dalle Zotte, Dipartimento di Scienze Animali, Università degli Studi di Padova, Agripolis, Viale dell'Università, 16, 35020 Legnaro (PD), Italy – Tel. +39 049 8272640 – Fax: +39 049 8272669 – E-mail: antonella.dallezotte@unipd.it

ABSTRACT

The effect of n-3 polyunsaturated fatty acids (PUFA)-enriched diet on yolk fatty acid profile and cholesterol content was evaluated. Dried *Poutulaca oleracea* (purslane: PO diet) was added to a commercial diet (C diet) at 20% of inclusion level. The effect of the supplemented diet was compared to that of C diet. Twenty-six laying hens were fed *ad libitum* for 21 days with the 2 diets, supplemented also with 300 mg α-tocopherol acetate/kg. Eggs were collected and then the fatty acids (FA) profile and the cholesterol content were analysed. The PO diet significantly reduced the saturated FA content ($P<0.05$) and increased that of the polyunsaturated FA (PUFA): 18:2 n-6 ($P<0.001$), 18:3 n-3 ($P<0.001$) and 22:6 n-3 (DHA; $P<0.01$). Both n-6 and n-3 PUFA significantly increased with the PO diet and the n-6/n-3 ratio was improved (10.4 *vs* 11.3; $P<0.05$).

Key words: Laying hens, *Portulaca oleracea*, N-3 fatty acids, Yolk

Introduction

Portulaca oleracea (PO) is an herbaceous weed that contains many biologically active compounds and is a source of many nutrients. PO is one of the richest green plant sources of omega-3 fatty acids, such as alpha-linolenic acid (18:3 n-3), but contains also high levels of linoleic acid (18:2 n-6), both essential for normal human growth, health promotion, and disease prevention. PO leaves have also high contents of antioxidants, such as alpha-tocopherol, ascorbic acid and glutathione (Simopoulos *et al.*, 1992). The high levels of protein in PO compete with those of other commercially important vegetable crops and it has been measured from 20 to 27% according to the planting date (Ezekwe *et al.*, 1999). Fed to hens, PO could be able to increase the omega-3 fatty acids and to reduce the cholesterol content of the eggs yolk. To date, any study involved the effect of the PO supplement fed to hens on their egg composition.

Material and methods

With the aim to increase the levels of n-3 FA and to reduce the cholesterol content in eggs, 2 diets containing different levels of polyunsaturated fatty acids n-3 (PUFA n-3) were tested. The control diet was a commercial diet (C) while the other diet was the C diet supplemented with 20% of dried *Portulaca oleracea* (purslane: PO). Twenty-six laying hens from Warren strain of 24 weeks of age were fed *ad libitum* for 21 days the 2 diets, enriched also with 300 mg a-tocopherol acetate/kg.

Table 1. Chemical composition of the experimental diets (as fed).

		Diets	
		C	PO
Inclusion level	%	--	20.0
Moisture	"	9.0	8.3
Crude Protein (calculated)	"	17.5	18.8
Ether Extract	"	5.6	3.4
Ash	"	12.8	16.6
Crude fibre	"	2.9	5.2
N-free Extracts	"	51.2	46.8
NDF	"	14.0	16.2
ADF	"	3.5	6.5
ADL	"	0.34	1.89
Calculated ME [(1)]	MJ/kg	12.87	11.04

[(1)]*Sibbald,1980*

Fifty-four eggs from C and 24 from PO dietary groups were collected and then analysed.

Diets were analysed (Table 1) to determine moisture, ether extract, ash, crude fibre, N-free extracts and fibre fractions, while protein was calculated by difference according to the standards of the A.O.A.C. (1984). The metabolizable energy (ME) was calculated with the equation of Sibbald (1984). The fatty acids (FA) profile of diets and egg yolks were determined using a gas-chromatography, after Folch extraction, according to A.O.A.C. methods (1984). The cholesterol content of yolks was also determined (Casiraghi *et al.*, 1994). The data were submitted to ANOVA (SAS, 1990) adopting a linear model which considered the diet effect.

Results and conclusions

Poutulaca oleracea at 20% of inclusion level modified the FA profile of the PO diet, if compared to the control diet (Table 2). In particular, the dietary PUFA content increased from 32.2 to 46.5% total FA, due to the enhancement of C18:2 n-6 (41.7 *vs* 30.4% total FA) and C18:3 n-3 (4.77 *vs* 1.87% total FA). Consequently, the saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA) decreased. This PO inclusion level lead to an important dietary improvement of the n-3 FA

Table 2. Fatty acid profile of experimental diets (% total FA).

	Diets	
	C	PO
Saturated Fatty Acids (SFA)	33.4	28.2
C12:0	0.00	0.13
C14:0	1.57	1.26
C16:0	21.8	21.1
C18:0	10.1	5.7
Monounsaturated Fatty Acids (MUFA)	34.4	25.2
C16:1	1.74	0.91
C18:1 n-9	32.6	24.3
Polyunsaturated Fatty Acids (PUFA)	32.2	46.5
C18:2 n-6	30.4	41.7
C18:3 n-3	1.87	4.77
Total UFA	66.6	71.7
UFA/SFA	1.99	2.54
n-6	30.4	41.7
n-3	1.87	4.77
n-6/n-3	16.2	8.8

Table 3. Fatty acid composition and cholesterol content of yolk.

Diet	C	PO	P-value[a]	RMSE
Eggs, n	54	24		
SFA	44.1	43.0	*	2.0
C14:0	0.28	0.25	**	0.04
C16:0	29.3	29.8	ns	1.3
C18:0	14.5	14.4	ns	1.0
MUFA	38.1	37.6	ns	2.2
C16:1	2.09	2.00	ns	0.37
C18:1	36.0	35.0	*	1.5
PUFA	17.8	19.4	***	1.3
C18:2 n-6	12.0	13.2	***	0.9
C18:3 n-3	0.18	0.30	***	0.11
C20:4 n-6	4.34	4.40	ns	0.53
C22:6 n-3	1.28	1.48	**	0.25
UFA	55.9	57.0	*	2.0
UFA/SFA	1.27	1.34	*	0.12
n-6	16.4	17.6	***	1.2
n-3	1.46	1.80	***	0.24
n-6/n-3	11.3	10.4	*	1.8
PCL/PCE[1]	1.25	1.28	ns	0.08
Cholesterol[2], mg/egg	301	266	†	33

*[a] †: P<0.10; *: P<0.05; **: P<0.01; ***: P<0.001;*

[1] Plasma Cholesterol Lowering FA/ Plasma Cholesterol Elevating FA = (PUFA + ½ MUFA) / (C12:0 + C14:0 + C16:0);

[2] analysed on 8 C and 6 PO yolks

and to a quite halved n-6 to n-3 ratio.

The differences in the FA profile of the C and PO diets were maintained in the FA profile of the eggs of hens fed the 2 experimental diets. In particular, the yolks of hens receiving the PO diet showed a significant reduction in the saturated FA content (43.0 *vs* 44.1% total FA; P<0.05) and an increase in the PUFA content (19.4 *vs* 17.8% total FA; P<0.001). Within the PUFA, the increase involved the C18:2 n-6 (13.2 *vs* 12.0% total FA; P<0.001), the C18:3 n-3 (0.30 *vs* 0.18% total FA; P<0.001) and the C22:6 n-3 (DHA: 1.48 *vs* 1.28% total FA; P<0.01). Both n-6 and n-3 PUFA significantly increased with the PO diet, but the ratio n-6/n-3 was healthily improved (10.4 *vs* 11.3; P<0.05).

As epidemiological studies indicates that n-3 FA exert protective effects against some common cancers, especially cancers of the breast, colon and prostate, these findings should serve as a strong incentive for the use of PO in the hens feeding. Portulaca oleracea should be considered as an item of agriculture and commerce and, on the basis of the results emerged in this study, it could be used for the poultry feeding.

REFERENCES

A.O.A.C., 1984. Official Methods of Analyses, 14th Edition. Association of Official Analytical Chemists, Washington, DC, USA.

CASIRAGHI, E., LUCISANO, M., POMPEI, C., DELLEA, C., 1994. Cholesterol determination in butter by high performance chromatography. Milchwissenschaft. 49(4):194-196.

EZEKWE, M.O., OMARA-ALWALA, T.R., MEMBRAHTU, T., 1999. Nutritive characterization of purslane accessions as influenced by planting date. Plant Foods Hum. Nutr. 54(3):183-191.

SIBBALD, I.R., 1984. L'alimentation des animaux monogastriques: porc, lapin, volailles, in: INRA (eds.), 2nd ed., Paris, pp 9-15.

SAS, 1990. User's Guide: Statistics, Version 6, SAS Institute Inc., Cary, NC, USA.

SIMOPOULOS, A.P., NORMAN, H.A., GILLASPY, J.E., DUKE, J.A., 1992. Common purslane: a source of omega-3 fatty acids and antioxidants. J. of the American College of Nutrition. 11(4):374-382