Improving n-3 PUFA content in poultry meat by using different dietary sources

Teresa Ribeiro[1], M. Lordelo[2], Luís M.A. Ferreira[1], Carlos M.G.A. Fontes[1] and J.A.M. Prates[1]

[1]Faculdade de Medicina Veterinária, Av. Universidade Técnica, 1300 Lisboa - Portugal
[2]Instituto Superior de Agronomia, Tapada da Ajuda, 1300 Lisboa - Portugal

Introduction

N-3 polyunsaturated fatty acids (PUFA) are known to have potential to prevent cardiovascular diseases, some autoimmune disorders, diabetes, some cancer types and to improve neuronal development. Nowadays, the human consumption of diets rich in n-3 PUFA and with a lower n-6/n-3 ratio are very desirable. In addition, there is a wider concern about problems with health and their relationship with diet. Total meat consumption is decreasing but poultry and cattle meat consumption are increasing. Poultry meat has been considered as one of the major sources of n-3 PUFA for human diets. Since diet composition is the main factor to modulate the fatty acids profile in non-ruminants, dietary supplementation can be used to promote the production of more healthy meat. Marine products are rich in n-3 PUFA. *Schizochytrium* is a algae very rich in DHA (22:6n-3). This FA is the last product of the conversion n-3 fatty acids pathway. Some vegetables are also rich in some n-3 PUFA. This is the case of linseed , which is a very important source of linolenic acid (18:3n-3, ALA). ALA is the main precursor of n-3 fatty acids.
The aim of this experiment was to test two different n-3 PUFA sources, algae and linseed, for diet supplementation of broiler chicks. The effect of the different diets on the fatty acids profile of breast meat, mainly the n-3 PUFA levels, and meat quality were evaluated.

Experimental Design

120 male broiler chicks (Ross 308 strain) distributed in 40 cages, with 3 animals per cage

0 — 21 — 35 days

Starter/ Grower period

Corn based diet (53%)

PB=23% ; EM=3100 kcal/kg

Incorporation of 2% of n-3 PUFA

Finisher period

Corn based diet (53%) → PB=21% ; EM=3200 kcal/kg

Introduction of **4 treatments:**

DHA= 7.4% DHA gold®

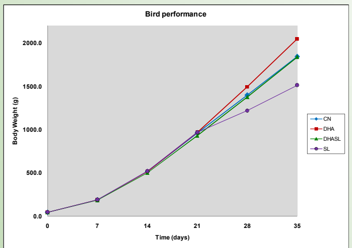
SL= 15.4% linseed

DHASL =3.7% DHA gold® + 7.7% linseed

CN= Based diet without supplementation

Results and Discussion

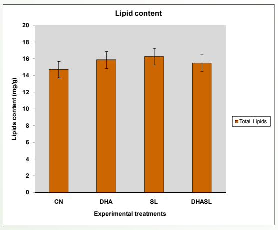
Bird performance was affected by the dietary treatment, especially the SL treatment (graphic 1). This may be explained because the SL diet had a less grainy presentation.



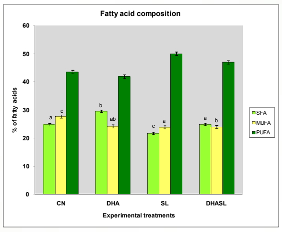
Graphic 1. Bird performances during the 5 weeks of experiment

As expected, also the carcass yield was affected by the linseed. The pH was not affected and the only **colour** parameter that has been affected was the luminosity value (L) for the skin. The L value was lower in the DHA suplemented animals and higher in the control group.

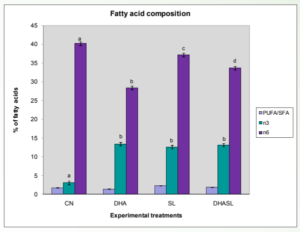
Although total **fatty acids in meat and total lipids** were not affected by the treatment (graphic 2), the content of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) (graphic 3) as the total amount of n-3 and n-6 FA's had differences between treatments (graphic 4).



Graphic 2. Total lipid content in poultry meat



Graphic 3. Percentages of SFA, MUFA and PUFA in poultry meat

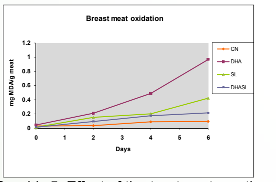


Graphic 4. Percentages of n-3 and n-6 FA

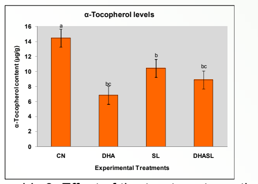
The differences in PUFA content were not proeminent but the DHA treatment had more long-chain fatty acids (22:6 n-3) than the other ones (table 1), which may contribute to the higher levels of **oxidation** measured by miligrams of malondialdeyde (MDA) per meat gram (graphic 5). DHA treatments also had higher levels of **α-tocopherol**, which also contributed for the higher levels of oxidation of breast meat for this treatment (graphic 6).

n-3 PUFA (%)	Treatments				SEM	P		
	CN	DHA	SL	DHASL		DHA	SL	DHA*SL
ALA	1,75	1,99	10,40	6,50	0,4272	<0.0001	<0.0001	<0.0001
C18:4n-3	0,05	0,09	0,09	0,10	0,0064	0,0013	<0.0001	0,0048
C20:3n-3	0,05	0,21	0,12	0,12	0,0141	<0.0001	0,4355	<0.0001
EPA	0,11	0,66	0,34	0,48	0,0206	<0.0001	0,251	<0.0001
C22:5n-3	0,34	0,59	0,75	0,53	0,0374	0,6623	<0.0001	<0.0001
DHA	0,76	9,82	0,83	5,37	0,2643	<0.0001	<0.0001	<0.0001

Table 1. Effect of the treatments on omega-3 PUFA composition



Graphic 5. Effect of the treatments on the oxidative stability of broiler breast meat



Graphic 6. Effect of the treatments on the α-tocopherol levels on the breast meat

Conclusions

Diet FA profile is determinant on the breast meat FA profile. DHA gold inclusion in the diet increased the total amount of DHA, but also the total amount of SFA and total of n-3 FA, while decreases the ratio n-6/n-3;
Total lipids and cholesterol levels in poultry meat are not affected by the dietary treatment;
α-Tocopherol content is higher in the CN treatment while DHA treatment presents the lower value of the vitamin analogue which decreases the breast oxidation stability.

References:
(1)Betti, M. et al (2009). Omega-3-enriched broiler meat:2.functional properties, oxidative stability and consumer acceptance. Poultry science, 88:1085-1095. Canada; (2)Griffin, B.A. (2008). How relevant is the ratio of dietary n-6 to n-3 PUFA to cardiovascular disease risk? Evidence from the OPTILIP study. Current opinion in Lipidology, 19:57-62. Surrey, UK; (3) Food:from farm to fork statistics. (2008). Eurostat, european comission. Luxembourg; (4) Pisulewski, P.M.. 2005. Nutritional potentuial for improving meat quality in poultry. Animal science and reports, vol23, 303-315. Poland; (5) Martek Biosciences Corporation. (2008); (6) Arterburn, L.M. et al (2006). Distribution, interconversion and dose response of n-3 fatty acids in humans. American Society for Nutrition. 83, USA

This work was supported by the SFRH/BD/32321/2006 (to T.R.) from Fundação para a Ciência e Tecnologia (Portugal).