RESEARCHES REGARDING THE INFLUENCE OF LINOLEIC ACID ENRICHED FOOD OF LIVER AND MUSCLE TISSUES IN LAYING HENS

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Abstract

From the old times, the relation between food and health was accepted by common consent. Hippocrates said that "we are hat we are eating", the theory which can be extrapolate also in animal feeding. At the modern consumer's request, which perception can exceed frequently the scientific arguments, we tried, in an anterior scientific paper, to obtained eggs which content lipid fractions with positive influence on human health. But, for obtain, animals products, using different scientific ways, it is obligatory to examine the condition of experimental animals health. In this research paper, we intended to study which is the effect of the linoleic acid introduced in laying hens food upon the liver and muscle tissues.

Key words: linoleic acid, linolenic acid, liver tissue, muscle tissue,

INTRODUCTION

Fats and oils included in animal feeds are composed of fatty acids bound to glycerol. Including fats and oils in livestock diets increases their energy content and the fatty acid composition of the laying hens diets can influence egg fat composition (Elena Pogurschi -2007, Stoica I.-2001). In general, feeding diets with high levels of fat or oil can result in liver and muscle tissues**.** The conjugated linoleic acid (CLA) is a collective name for a group of fatty acids that are isomers of linoleic acid. Alvarez C. et al. (2005) found that conjugated linoleic acid (CLA) suppressed the growth of human breast adenocarcinoma cells. Ip et al (1995, 1997) reported that CLA inhibited the postinitioation phase of carcinogenesis. Lee et al. (1995) showed that the content of monounsaturated fatty acids in tissues decreased after conjugated linoleic acid (CLA) feeding. Ahn et al. (1995, 1999) reported that the chemical composition of eggs could pe changed after feeding hens with diets containing CLA. In this study, diets rich in linoleic or linolenic acid were formulated using soybean oil and lindseed oil to assess the effects of dietary on conjugated linoleic acid (CLA) on polyunsaturated acids composition in vivo.

MATERIAL AND METHODS

In the our coming experiment, biological material was represented by a total of 48 chickens belonging to the ROSO SL 2000 hybrid, chickens aged 33 weeks, which were distributed in 4 experimental groups. At 30 week age chickens have started to be fed with compound feed in which different proportions of soybean oil, linseed oil, and a source of conjugated linoleic acid have been introduced. The structure of the four compound feed which have been used is to be found in table 1.

Table 1

The structure of the compound feed used

Specification	Group E1	Group E2	Group E3	Group E4
Corn	37,8	37,8	37,8	37,8
Wheat	22,0	22,0	22,0	22,0
Soy meal	18,0	18,0	18,0	18,0
Flour, hay, alfaalfa	2,0	2,0	2,0	2,0
Soybean oil	10,0	5,0	-	5,0
Linseed oil	-	-	5,0	5,0
Conjugate linoleic acid	-	5,0	5,0	-
DL-methionine	0,2	0,2	0,2	0,2
Calcium carbonate	8,0	8,0	8,0	8,0
Dicalcium phosphate	0,5	0,5	0,5	0,5
Salt	0,5	0,5	0,5	0,5
Vitamin-mineral premix	1,0	1,0	1,0	1,0
TOTAL	100	100	100	100

The compound feed given to the four experimental groups were isocaloric and isoproteic, the metabolized energy reaching the value of 2800 kcal/kg and crude protein was 16.88%. After four weeks of administration of this compound feed were sacrificed three hens from each group, and liver and muscle tissues were sampled for fatty acid composition analysis. Tissues were frozen in liquid nitrogen immediately after sampling (Belury M.A. -1995). Lipid fractions of liver and muscle tissues were separated by chromatographymethod, the results present are the average of two determinations. The compound feed was also analyzed in terms of fatty acid contents.

RESULTS AND DISCUSSION

Following the analysis of the content of fatty acids in compound feed given, the following results were obtained (table 2)

Table 2

The proportion of the main saturated and unsaturated fatty acids found in combined fodder

Specification	Lot E1	Lot E2	Lot E3	LotE4
Saturated fatty acids				
Stearic ac.	3,75	2,50	2,00	2,82
Palmitic ac.	11,85	7,50	I,01	8,56
Unsaturated fatty acids				
Oleic ac.	17,10	14,78	13,01	14,24
Linoleic ac.	40,52	23,00	8,90	25,81
Linolenic ac.	6,57	3,30	20,54	24,14
Conjugated linoleic ac.	-	25,33	25,33	-

The data analysis shows that the biggest concentration of linoleic acid (40.52%) is found in mixed fodder in which the soybean oil had the largest share (10%). High concentration of linolenic acid (24.14%) is to be found in mixed fodder in which soybean oils have been introduced in equal proportions of 5%, and so as expected, high concentrations of conjugated linoleic acid were found in mixed fodder in which a commercial source of conjugated linoleic acid (25.33%) has been introduced.

After the analyses effectuated on two fresh samples liver draw from the hens of each group were obtained the follow results (table 3 and table 4). The results reported are the average of two determinations.

Following analysis of data from tables from 3 and 4, we can notice that the concentration of arachidonic acid was much higher in the muscle tissues by chicken fed with fodder without conjugated linoleic acid additions (E1 and E4- 7,97% acid arachidonic from total fatty acids and 7,32% acid arachidonic from total fatty acids). This result could be caused by the high amount of linoleic acid in the feed with added soybean oil.

Table3

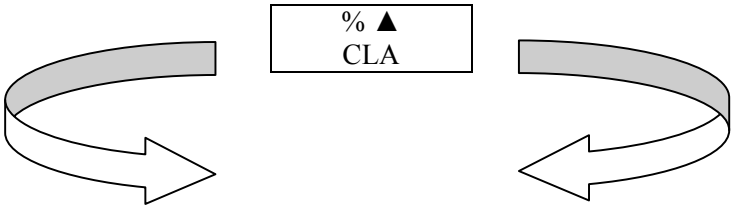
The saturated fatty acids composition of liver tissues
(% from total fatty acids)

Saturated fatty acids	Lot E1	Lot E2	Lot E3	LotE4	SEM
Ac. Stearic	18,02	19,78	16,67	14,91	0,051
Ac. Palmitic	21,11	23,10	22,12	19,88	0,389
Total saturated fatty acids	39,13	42,88	38,79	34,79	

Table4

The unsaturated fatty acids composition of muscle tissues
(% from total fatty acids)

Unsaturated fatty acids	**Lot E1**	**Lot E2**	**Lot E3**	**LotE4**	**SEM**
Ac. Oleic	29,99	27,01	26,98	28,32	0,560
Ac. Palmitoleic	0,70	0,31	0,59	0,78	0,178
Ac. Linoleic	19,52	15,44	12,89	18,03	0,518
Ac. linolenic	1,04	0,69	2,55	3,49	0,102
Ac. linoleic conjugat	-	1,80	1,89	-	0,041
Ac. Arahidonic	7,97	6,10	5,20	7,32	0,301
Ac. Eicosapentanoic	0,16	0,21	0,55	0,48	0,029
Ac.docosahexanoic	2,28	1,99	5,68	5,08	0,095
Monounsaturated fatty acids	30,69	27,32	27,57	29,10	
Polyunsaturated fatty acids	30,97	26,23	28,76	34,40	



Decrease the concentration of arachidonic acid	Decrease the concentration of linoleic acid

In 1998, Sugano and al. reported a decrease in arahidonic acid concentration in rats in whose food conjugated linoleic acid was introduced.

The concentration of eicosapentaenoic acid and docosapentaenoic acid in the muscle of hens of the lots E3 and E4, indicate that conjugated linoleic acid promoted the synthesis or deposition of docosapentaenoic acid and eicosapentaenoic acid. This finding illustrates that conjugated linoleic acid increases the level of n-3 long chain polyunsaturated fatty acids. Michael Dugan and al. (2002) showed that arachidonic acid and docosapentaenoic acid could affect each other's levels.

This study indicated that the conjugated linoleic acid reduced monounsaturated fatty acid and nonconjugated linoleic acid polyunsaturated fatty acids content in tissue lipids. The concentration of docosapentaenoic acid

in lipid was increased by dietary with conjugated linoleic acid, which could be related to the decreased arachidonic acid content.

A disadvantage of placing in a conjugated linoleic acid into food is that it increases the concentration of saturated acids (palmitic and stearic) in expense of unsaturated fatty acids, the latter having beneficial effects on human health**.**

Placing conjugate linoleic acid into the food in laying hens led to the reduction of concentration of mono fatty acids (27,32% of total fatty acids - E2 and 27,57% of total fatty acids-E3), compared to lots that who's food wasn't introduced this acid, the differences being significant. Polyunsaturated fatty acids had the same decreasing tendency.

CONCLUSION

► Introducing conjugated linoleic acid into the food of laying hens leads to low arachidonic acid and linoleic acid quantities in muscle tissues;
► A direct relationship between the concentration of linoleic acid in food and the tissues has been noticed;
► The introduction of linseed oil in the food laying hens lead to an increase of linolenic acid in the liver and muscle tissues;
► The introduction of conjugated linoleic acid into the food leads to increased saturated fatty acids in the tissues to the detriment of unsaturated fatty acids, lipid fractions with beneficial effects on human health;
►Linoleic acid influences the biosynthesis of arachidonic acid;
►There is a direct relationship between the concentration of oleic acid and docosahexaenoic acid given by the fact that linolenic acid intensifies docosahexaenoic acid's biosynthesis;
► Conjugated linoleic acid leads to a decrease of the concentration of oleic acid, by its ability to inhibit the synthesis of n9 acids.

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