

## FATTY ACIDS COMPOSITION OF FISH, LINSEED AND RAPESEED OILS

S. Ezhil Valavan<sup>1</sup>, B Mohan, P Selvaraj, S. C. Edwin, K. Mani,  
R. Amutha and A. Bharathidhasan

Directorate of Distance Education  
Tamil Nadu Veterinary and Animal Sciences University  
Chennai- 600 051

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### INTRODUCTION

Fatty acids, n-3 or omega-3 as well as n-6 or omega-6, are essential for normal physiological functioning and for the health of humans and all domestic species. In humans, not all fatty acids can be produced endogenously due to the absence of certain desaturases. Thus, specific fatty acids termed essential need to be taken from the diet. Dietary sources of saturated fatty acids are animal products and tropical plant oils, whereas sources of unsaturated fatty acids are vegetable oils and marine products. Addition of fats or oils rich in polyunsaturated fatty acids in poultry diets is a straightforward approach to enrich poultry products with polyunsaturated fatty acids. In recent years there has been a greater demand for foods with increased levels of functional fatty acids, such as long-chain omega-3 fatty acid, because of their biological roles in cells. Hence, there is a need to develop alternative food sources to increase consumption of n-3 polyunsaturated fatty acids. The aim of the study presented in this research paper was to investigate fatty acids composition of fish, linseed and rapeseed oils.

### MATERIALS AND METHODS

Fish, linseed and rapeseed oils used for this study as n-3 lipid or omega -3- fatty acids sources to enrich n-3 fatty acids in poultry

products (egg and meat) were purchased from M/s. Higashimaru feed International limited, Kerala, M/s.S.Rajesh Chemicals, Mumbai and Commercial outlet, Chennai respectively. n-3 lipid or omega -3- fatty acid sources (Fish, linseed and rapeseed oils) were subjected to fatty acid estimation. Each seven samples of fish, linseed and rapeseed oils were used to extract lipids and transmethylation process as described by Sukhija and Palmquist (1988). Thin layer chromatography was carried out as per the method of Du *et al.* (2000) to check completeness of the transmethylation process. The fatty acid methyl esters were separated and quantified by gas chromatography using a fused silica capillary column of 30 m x 0.25 mm i.d, 0.25  $\mu$  film thickness. Ramped oven temperature conditions (180°C for 5 min increased to 220°C and held for 5 min) were used. Temperature of both injector and detector were 250° and 260°C respectively. The data collected in this experiment were subjected to statistical analysis as per Snedecor and Cochran (1989). Angular transformation was applied to percentages before statistical analysis done.

### RESULTS AND DISCUSSION

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Corresponding author : 1. Assistant Professor, E-mail: vet\_ezhil2001@yahoo.co.in

The mean fatty acids composition of fish, linseed and rapeseed oils utilised in this study is presented in Table 1. In this study, fish oil recorded the higher myristic acid value when compared to linseed and rapeseed oils. The difference among oils was found to be highly significant ( $P < 0.01$ ). The palmitic acid content of fish oil utilized in this study was highly significant ( $P < 0.01$ ) when compared to linseed and rapeseed oils. Sargent and Henderson (1995) reported that the palmitic acid content of fish oil derived from different varieties of fish ranged from 130 to 170 g per kg total fatty acids, which is almost similar to the value obtained in the present study. However, Mehta *et al.* (2000 a and 2000 b) reported that the palmitic acid content of linseed and rapeseed oils ranged from 5.4 to 7.7 per cent and 1.1 to 3.5 per cent, respectively which are higher than the results obtained in this study.

The stearic acid content of fish oil in this study recorded the higher value when compared to linseed and rapeseed oils. The difference due to oil was found to be highly significant ( $P < 0.01$ ). Lands (1986), Sargent and Henderson (1995) and Sargent (1997) observed that stearic acid content of fish oil derived from different varieties of fish ranged from 10 to 40 g per kg total fatty acids, which is almost agreeable with the result of this study. However, Mehta *et al.* (2000 a and 2000 b) indicated that the stearic acid content of linseed and rapeseed oils ranged from 3.80 to 9.20 and 0.72 to 1.60, respectively which are higher than the results obtained in this study.

In this study, the linseed oil had the higher oleic acid content when compared to fish and rapeseed oils. The difference due to oil was found to be highly significant ( $P < 0.01$ ).

According to Mehta *et al.* (2000 a and 2000 b), the oleic acid content of linseed and rapeseed oils were 20.0 to 28.5 and 7.8 to 18.7 per cent respectively, which are similar to the results obtained in this study. However, Lands (1986), Sargent and Henderson (1995) and Sargent (1997) reported that the oleic acid content of fish oil derived from the various types of fish ranged from 100 to 190 g per kg total fatty acids which is in agreement with the result of this study.

The rapeseed oil recorded the higher value of linoleic acid when compared to fish and linseed oils utilized in this study. The statistical analysis showed highly significant ( $P < 0.01$ ) difference due to oils. Mehta *et al.* (2000 a and 2000 b) reported that the linoleic acid content of rapeseed oil ranged from 2.5 to 20.9 per cent which is in agreement with the results obtained in this study and the linoleic content of linseed oil reported (8.1 to 15.8 per cent) is not in agreement with the results of this study. However, Lands (1986), Sargent and Henderson (1995) and Sargent (1997) observed that the linoleic acid content of fish oil derived from various types of fish ranged from 10 to 38 g per kg total fatty acids which is higher than the results obtained in this study.

The linolenic acid content of fish oil utilized in the study was lower when compared to linseed and rapeseed oils. The difference due to oil was found to be highly significant ( $P < 0.01$ ). Lands (1986), Sargent and Henderson (1995) and Sargent (1997) reported that the linolenic acid content of fish oil derived from different varieties of fish ranged from 6.02 to 20.0 g per kg total fatty acids which is higher than the value obtained in this study. However, Mehta *et al.* (2000 a and 2000 b) reported that

the linolenic acid content of linseed oil ranged from 47.0 to 57.0 per cent which is lower than the value obtained in this study while the linolenic acid content of rapeseed oil ranged from eight to 17.5 per cent which is not in agreement with the present study.

The fish oil utilized in this study contained the maximum amount of Eicosapentaenoic acid (EPA) while linseed and rapeseed oils contained minimum amount. The statistical analysis revealed highly significant ( $P < 0.01$ ) difference due to oils. Lands (1986), Sargent and Henderson (1995) and Sargent (1997) reported that the EPA content of fish oil derived from different varieties of fish ranged from 60 to 170 g per kg total fatty acids. The EPA content of fish oil utilized in this study is well within the range as reported by the above authors.

Higher amount of Docosahexaenoic acid (DHA) was recorded in fish oil followed by linseed and rapeseed oils in this study. The statistical analysis indicated highly significant ( $P < 0.01$ ) difference due to oils. Lands (1986), Sargent and Henderson (1995) and Sargent (1997) observed that the DHA content of fish oil derived from various types of fish ranged from 40 to 151 g per kg total fatty acids which is not in agreement with the results obtained in this study.

The total n-3 fatty acids content of linseed oil utilized in the study was higher than that of fish and rapeseed oils, which was highly significant ( $P < 0.01$ ) due to oils. Lands (1986), Sargent and Henderson (1995) and Sargent (1997) observed that the n-3 fatty acids in fish

oil obtained from the various types of fish ranged from 148.0 to 284.0 g per kg total fatty acids. The total n-3 fatty acids obtained in fish oil utilized in this study is within the range as reported by the above authors.

The total n-6 fatty acids content of rapeseed oil was higher when compared to fish and linseed oils utilized in this study. The statistical analysis revealed a highly significant ( $P < 0.01$ ) difference due to oils.

The n-3 / n-6 fatty acids ratio of linseed oil was higher when compared to fish and rapeseed oils utilized in the study. The difference due to oil was found to be highly significant ( $P < 0.01$ ). The results obtained in this study in respect of n-3 / n-6 fatty acids ratio is not agreeable with the reports published by Lands (1986), Sargent and Henderson (1995) and Sargent (1997).

## CONCLUSION

The present study was carried out to estimate fatty acids composition of fish, linseed and rapeseed oils. Fish oil recorded the highest value of myristic, palmitic and stearic acids, EPA, DHA and total n-3 fatty acids while linseed oil recorded the highest amount of oleic, linolenic acids and highest n-3 / n-6 ratio. However, linoleic and total n-6 acids were more in rapeseed oil utilised in this study. These omega-3- rich oils can be incorporated in poultry feed to enrich the omega -3- fatty acids in chicken egg and meat.

**Table 1. Mean ( $\pm$  S.E.) fatty acids composition (%) of fish, linseed and rapeseed oils**

n-3 lipid sources	Myristic acid	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid	Linolenic acid	EPA	DHA	Total n-3	Total n-6	Ratio of n-3 / n-6
Fish oil	01.30 <sup>b</sup> $\pm 0.36$	13.90 <sup>c</sup> $\pm 1.29$	01.60 <sup>c</sup> $\pm 0.40$	9.90 <sup>a</sup> $\pm 0.91$	6.20 <sup>b</sup> $\pm$ 0.76	00.28 <sup>a</sup> $\pm 0.22$	11.00 <sup>b</sup> $\pm 1.12$	02.50 <sup>b</sup> $\pm 0.87$	27.20 <sup>b</sup> $\pm 1.46$	6.20 <sup>b</sup> $\pm 0.76$	0.15 <sup>a</sup> $\pm 0.04$
Linseed oil	0.01 <sup>a</sup> $\pm 0.02$	01.50 <sup>b</sup> $\pm 0.32$	0.71 <sup>b</sup> $\pm 0.30$	20.40 <sup>b</sup> $\pm 1.19$	01.20 <sup>a</sup> $\pm 0.88$	64.70 <sup>c</sup> $\pm 0.37$	01.00 <sup>a</sup> $\pm 0.03$	00.02 <sup>a</sup> $\pm 0.036$	6.20 <sup>c</sup> $\pm 0.36$	01.20 <sup>a</sup> $\pm 0.88$	2.50 <sup>b</sup> $\pm 0.84$
Rapeseed oil	0.01 <sup>a</sup> $\pm 0.02$	00.12 <sup>a</sup> $\pm 0.11$	00.02 <sup>a</sup> $\pm 0.11$	9.40 <sup>a</sup> $\pm 0.36$	16.40 <sup>c</sup> $\pm 0.70$	03.80 <sup>b</sup> $\pm 1.10$	0.01 <sup>a</sup> $\pm 0.02$	00.01 <sup>a</sup> $\pm 0.02$	04.10 <sup>a</sup> $\pm 0.107$	16.40 <sup>c</sup> $\pm 0.70$	0.02 <sup>a</sup> $\pm 0.07$

Mean values not sharing a common superscript columnwise differ significantly. (P< 0.01)

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