IAFMM

international association of fish meal manufacturers

Hoval House, Orchard Parade, Mutton Lane, Potters Bar, Hertfordshire, EN6 3AR
Tel: (Potters Bar) 0707 42343/4/5

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CHOLINE CONTENT OF FISH MEALS FROM VARIOUS ORIGINS

by

S. M. BARLOW, I. H. PIKE AND F. NIXON

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SUMMARY

The choline content of 45 samples of fish meal from nine different origins (Table 1) has been determined. The overall average was 4396 with a standard error of a single sample of ± 955 mg kg^{-1} (Table 2). No significant differences were found between meals of different origins, different species of fish, or different processing conditions. Because of the quantity of choline required by young chicks, it is one of the more expensive vitamins to add to a diet. Knowledge of the choline content in fish meal may give feed formulators the opportunity of taking into account the contribution of choline to the diet which inclusion of fish meal produces, thus, reducing the quantity of additional choline required in the diet.

RESUME

La teneur en choline de 45 échantillons de farine de poisson provenant de 9 sources différentes a été déterminée (tableau 1). La moyenne générale était de 4396, avec une erreur-type par échantillon de ± 995 mg/kg (tableau 2). Aucune différence significative n'a été observée entre les farines d'origine différente, les différentes espèces de poisson, ou les différents procédés de traitement. Etant donné la quantité de choline requise pour l'alimentation des jeunes poulets, il s'agit de l'une des vitamines les plus chères rajoutées aux rations. En connaissant la teneur en choline de la farine de poisson, les spécialistes de la formulation des aliments ont la possibilité de tenir compte de la contribution de la choline au régime due à l'inclusion de farine de poisson, ce qui réduit la quantité de choline supplémentaire requise dans les rations.

ZUSAMMENFASSUNG

Der Cholin-Gehalt von 45 Fischmehlmustern aus 9 verschiedenen Quellen (Tabelle 1) wurde bestimmt. Der Gesamtgehalt war 4396 mg mit einem Standardfehler eines einzelnen Musters von ± 995 mg per kg (Tabelle 2). Es wurden keine signifikanten Unterschiede zwischen den Mehlen verschiedenere Quellen, verschiedener Fischarten oder verschiedener Verarbeitungsmethoden gefunden. Wegen der von Küken benötigten hohen Menge an Cholin ist es eines der teuersten Vitamine, die man einer Diät zufügen muss. Mit der Kenntnis des Cholin-Gehaltes wäre dem Fischmehl-Formulierer die Möglichkeit gegeben, den Beitrag an Cholin, die durch Zufügung von Fischmehl der Diät zugetragen wird, in Betracht zu ziehen. Auf diese Weise würde die Menge an zusätzlich benötigtem Cholin in der Diät herabgesetzt.

RESUMEN

Se ha determinado el contenido de coleina en 45 preparados de harina de pescado de neuve orïgenes diferentes (Cuadro 1). El promedio global fue de 4396 con error standard de una sola muestra ± 995 mg kg^{-1} (Cuadro 2). No se encontraron diferencias substanciales entre los preparados de diferentes orïgenes, distintas especies de pescado, o condiciones de elaboración diferentes. Debido a la cantidad de coleina que requieren los pollos jóvenes, ésta resulta una de las vitaminas más caras de incluir en la dieta. El conocer el contenido de coleina en la harina de pescado puede que ofrezca a los formuladores de preparados alimenticios la oportunidad de considerar adecuadamente la contribución que la harina de pescado ofrece, y de esta forma poder reducir otra forma de adición de coleina requerida en la dieta.

Choline Content of Fish Meals from Various Origins

Stuart M. Barlow, Ian H. Pike, and Frederick Nixon[a]

International Association of Fish Meal Manufacturers, Hoval House Orchard Parade, Mutton Lane, Potters Bar, Hertfordshire,

1. Introduction

Choline plays a role in the correct functioning of the animal's nervous system, in the production of phospholipids and in furnishing labile methyl groups for various metabolic conversions. Although sometimes classified as a vitamin, in the strictest sense it does not have this role in nutrition since animals can synthesise sufficient choline for their needs provided enough methyl groups are supplied for this purpose. However, in most animals the rate of choline synthesis is insufficient to meet the their needs and it must be included in the diet. This is particularly true for the young chick and turkey poult.[1]

It is estimated that the young chick requires 1300 mg of choline per kg of diet under normal conditions, and the young turkey poult requires up to 2000 mg choline per kg diet.[2-4] It is usual practice to add synthetic choline to a diet to meet these requirements, although it is known that some of the natural feed ingredients are rich in choline. Fish meals are regarded as one of the best sources of choline, and yet feed formulators rarely take account of fish meal's contribution of choline to the chick or turkey diet because of the absence of reliable data giving a measure of the average figure for choline and its variability.

Thus the present study was undertaken to determine the choline content of several samples of fish meal taken from nine different origins.

2. Experimental

2.1. Fish meals

Samples of fish meal were supplied by members of the International Association of Fish Meal Manufacturers, which also provided analytical data. Details of the samples are given in Table 1.

2.2. Chemical analysis

Choline was determined by hydrolysing the fish meal with hot sulphuric acid, neutralising with a saturated solution of barium hydroxide, precipitating the choline with ammonium reineckate solution, redissolving in acetone, and measuring the extinction at 520 mμ.[5]

3. Results and discussion

The contents of choline in the 45 samples of fish meal are given in Table 2. There were no significant differences between fish meals of different origin in terms of choline content. The overall average

[a] Aynsome Laboratories Limited, Kentsford Road, Grangeover Sands, Cumbria.

Table 1. Details of fish meal samples received for choline analysis

Sample number	Origin of fish meal	Type of fish used and fishing area	Type of dryer	Analysis: Moisture (%)	Protein (%)	Fat (%)	Ash (%)
1	Chile	Anchovy/Mackerel/Sardine	S	10.3	64.7	6.6	14.7
2		Anchovy/Mackerel/Sardine	S	10.2	65.4	6.7	15.4
3		Anchovy/Mackerel/Sardine	S	10.7	64.9	5.1	14.4
4		Anchovy/Mackerel/Sardine	S	12.2	64.2	5.8	14.7
5		Anchovy/Mackerel/Sardine	S	11.2	64.3	5.8	15.3
6	USA	Menhaden—Chesapeake Bay	HA	7.8	62.0	7.4	20.9
7		Menhaden—W. Gulf Mexico	S	7.5	63.0	8.8	20.3
8		Menhaden—E. Gulf Mexico[a]	HA	7.9	64.4	7.4	19.5
9		Menhaden—E. Gulf Mexico	S	10.3	59.8	11.9	—
10		Menhaden—W. Gulf Mexico	S	5.3	64.7	10.7	—
11		Menhaden—Mid Atlantic Coast	S	8.6	65.0	9.4	—
12	South Africa	Pilchard—Sandy Point	HA	10.2	68.1	5.8	13.2
13		Anchovy—Sandy Point	HA	7.9	69.8	10.0	10.8
14		Lantern—Sandy Point	HA	10.3	61.4	11.3	13.9
15		Mackerel—Sandy Point	HA	8.3	73.5	7.3	11.9
16		Anchovy—Da Gamma	HA	12.2	63.1	8.8	13.5
17	UK	W. Fish Offal	S	2.4	75.0	7.0	16.8
18		Mackerel	S	6.6	71.7	12.1	11.3
19		Norway Pout	S	3.4	72.8	6.5	16.3
20		W. Fish Offal	S	12.0	59.4	4.6	24.1
21		Sprat	S	10.0	65.9	13.9	9.9
22	Germany	Red Fish Offal—Iceland	HA	12.6	61.4	7.5[b]	22.4
23		Red & Lean Fish Offal—Faroes	S	10.0	60.7	6.9[b]	23.0
24		Red & Coal Fish Offal—Iceland	S	11.3	60.2	8.3[b]	22.0
25		Lean Fish—Norway	S	11.1	68.6	7.2[b]	11.4
26		Herring—Harbour Breton		4.2	72.0	4.0	19.2
27	Canada	Mixed—Lunenburg	S	4.8	64.3	8.2	23.6
28		Herring—Vancouver	HA	7.3	65.4	8.3	17.5
29		Herring—S.W. Nova Scotia	HA	6.6	76.4	7.7	11.6
30		Herring—Newfoundland	HA	4.2	72.0	4.0	19.2
31	Norway	Sprat	S	8.9	77.3	7.0	9.0
32		Capelin	S	8.1	72.2	9.7	10.9
33		Mackerel	S	7.9	74.6	7.2	11.7
34		Capelin	HA	7.8	71.2	5.4	10.5
35	Denmark	Norway Pout	S	5.9	57.7	8.6	—
36		Sand Eel	S	8.4	73.3	7.8	—
37		Sprat	S	6.0	74.0	6.1	—
38		Norway Pout & other round fish	S	5.9	74.1	6.4	—
39		Sprat	S	5.0	73.8	8.6	—
40	Peru	Anchovy	HA	8.0	68.6	8.5	14.0
41		Anchovy	HA	These results were obtained as a compound sample of the six samples			
42		Anchovy	HA				
43		Anchovy	HA				
44		Anchovy	HA				
45		Anchovy	HA				

[a] Samples did not contain solubles—all other samples were full meal.
[b] After hydrolysis with HCl.
Drying: S = steam; HA = hot air.

Table 2. Choline content in fish meal samples

Sample number	Origin	Choline content (mg kg^{-1})	Average (± s. e. of a single sample)
1	Chile	2800	
2		3800	
3		3925	
4		4800	
5		3175	3700 ± 768
6	USA	5175	
7		4800	
8		3175	
9		4000	
10		3625	
11		5050	4304 ± 824
12	S. Africa	4425	
13		5050	
14		3800	
15		5350	
16		5175	4762 ± 640
17	UK	6300	
18		4050	
19		3175	
20		3800	
21		3125	4092 ± 1296
22	Germany	4250	
23		3625	
24		5350	
25		3800	
26		4425	4292 ± 675
27	Canada	5250	
28		3550	
29		5350	
30		4425	4644 ± 839
31	Norway	3875	
32		7600	
33		3800	
34		5175	5115 ± 1773
35	Denmark	3250	
36		5425	
37		6450	
38		5050	
39		2800	4596 ± 1531
40	Peru	4255	
41		4075	
42		3830	
43		4500	
44		4550	
45		4610	4303 ± 307
	Overall average		4396 ± 995

for fish meals was 4396 with a standard error of a single sample of $\pm$ 995 mg kg^{-1}. Thus the coefficient of variation was 22.6%. The average choline figure is lower than the figure of 5800 mg kg^{-1} for whole Canadian herring meal determined by March *et al.*[6] in 1960/61. On the other hand it is higher than the figure of 3308 parts 10^{-6} stated by Nilson[7] in 1950.

There were no obvious differences in choline content between fish meals prepared from different species of fish, although there was a suggestion that capelin meal might have a higher content of choline. This is in agreement with Sparre[8] who reported 7150 mg kg^{-1} of choline in capelin meals, but would have to be confirmed by more extensive analysis.

Drying the meal by means of hot air or steam appeared to make little difference to the choline content.

Only one of the samples did not contain added fish solubles. Its content of choline was not significantly different from the samples of whole fish meal.

Because of the quantity of choline required by young chicks, it is one of the more expensive vitamins to add to a diet. Knowledge of the choline content in fish meal may give feed formulators the opportunity of taking into account the contribution of choline to the diet which inclusion of fish meal produces, thus, reducing the quantity of additional choline required in the diet.

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Dr. S. M. Barlow
International Association of Fish Meal Manufacturers.