# Biological value of the proteins of a variety of fish meals

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The nutritive values of a series of commercial fish meals and deodorized fish flours intended for human consumption have recently been examined for the Food and Agriculture Organization of the United Nations. It is well known that fish protein can be damaged during drying, although this damage does not necessarily occur, and as these meals were prepared under widely varying conditions in six different countries, it was considered that the results might be worthy of note.

#### **EXPERIMENTAL**

The net protein utilization (N.P.U.) was determined on rats by the method of Bender & Miller (1953) and Miller & Bender (1955). Digestibility of the protein was determined in the same experiments and the biological value was calculated by dividing N.P.U. by digestibility.

#### RESULTS

The results are shown in Table 1. The values are the means of the results of several replicate estimations made on different groups of rats. A brief description of each material is included in the table but details of the drying process have not been revealed. It was considered unwise to reveal the country of origin, which is, therefore, merely indicated by a number so that products from the same country can be grouped together.

### DISCUSSION

The N.P.U. of laboratory preparations of codfish meal, apparently undamaged, was found to be 84 (Bender, Miller & Tunnah, 1953) when determined by the same method as used in the present work. The results on the series examined here show N.P.U.'s of fish meals ranging from 80 for undamaged material to values as low as 18 for grossly maltreated fish meal.

Several of the meals were tested before and after defatting and deodorization. There was no consistent evidence of serious damage resulting from this treatment.

## SUMMARY

- 1. Twenty-seven fish meals and deodorized fish flours intended for human consumption were examined for net protein utilization (N.P.U.) and digestibility by the carcass-analysis method.
  - 2. N.P.U.'s ranged from 18 to 80.
- 3. There was no consistent evidence of serious damage resulting from the defatting and deodorization whereby fish meals are converted to edible fish flours.

Table 1. Analysis and net protein utilization, digestibility and biological value of various fish meals

	biological value of various fish meals									
AC	Sample		Type of meal or flour				Net protein	bility	Bio- logical value	
AC	Α	I	Sardine: commercial	63.8	14.0	7.4	67	87	77	
P	AC	I	Sardine; defatted and				•	<u> </u>	<del>-</del>	
Q   II   Lean fish; commercial   72.5   15.6   9.5   70   97   73   73   75   11   Lean fish; commercial   68.5   17.0   5.9   80	В	II	Lean fish; commercial	59.0	26.5	9·1	69	88	78	
Q	P	II	Lean fish; commercial	68.7	17.6	5.2	72	96	75	
Z	Q	II	Lean fish; commercial	72.5	15.6		70	97	73	
C         III         Cod; commercial         68·6         16·6         3·1         62         94         66           D         III         Lean fish; commercial         63·2         26·4         6·5         57         93         61           E         III         D defatted and deodorized         70·2         24·8         0·3         49         93         53           F         III         Cod; extracted         77·5         13·5         0·3         71         92         77           G         III         F deodorized         76·9         13·1         0·3         70         92         76           H         III         Cod; defatted and deodorized         89·1         4·4         0·2         64         95         67           deodorized         J         III         Herring; defatted and 87·0         3·1         0·3         74         93         79           deodorized         V         II         Lean fish; Z defatted 75·2         13·5         0·3         73         93         78           W         III         Lean fish; Commercial         61·3         23·0         3·6         71         95         76           X	$\mathbf{z}$	II	Lean fish; commercial	68.5	17.0		80	_		
E III D defatted and deodorized F III Cod; extracted 77.5 13.5 0.3 71 92 77 G III F deodorized 76.9 13.1 0.3 70 92 76 H III Cod; defatted and 74.0 22.6 0.1 65 95 69	C	III	Cod; commercial	68.6	16.6		62	94	66	
E III D defatted and deodorized F III Cod; extracted 77.5 13.5 0.3 71 92 77 G III F deodorized 76.9 13.1 0.3 70 92 76 H III Cod; defatted and 74.0 22.6 0.1 65 95 69	D	III	Lean fish; commercial	63.2	26.4	6.5	57	93	61	
G   III   F deodorized   76.9   13.1   0.3   70   92   76   F   111   Cod; defatted and   74.0   22.6   0.1   65   95   69   deodorized	E	III	D defatted and deodo-	-	•	_			53	
H	$\mathbf{F}$	III	Cod; extracted	77:5	13.5	0.3	71	92	77	
I   III   Cod fillets; defatted   89·I   4·4   0·2   64   95   67   and deodorized       J   III   Herring; defatted and   87·0   3·I   0·3   74   93   79   deodorized     V   II   Lean fish; Z defatted   75·2   I3·5   0·3   73   93   78   and deodorized     W   III   Lean fish; commercial   61·3   23·0   3·6   71   95   76     X   III   W defatted and deodo-   64·7   24·8   I·2   77   94   82   rized     Y   III   Lean fish; defatted and   71·3   24·8   I·2   77   96   80   deodorized     K   IV   Fatty fish; defatted and   72·7   21·2   0·1   29   81   36   deodorized     L   IV   Fatty fish; defatted and   73·4   20·5   0·1   31   68   46   deodorized     M   IV   Fatty fish; defatted and   66·6   20·0   0·1   42   71   59   deodorized     N   V   Semi-lean fish; defatted   74·8   17·5   0·3   18   47   39   and deodorized     O   V   Semi-lean fish; defatted   79·4   19·4   0·1   67   94   71   and deodorized     R   V   Semi-lean fish; defatted   79·4   19·4   0·1   67   94   71   and deodorized     S   VI   Herring; commercial   70·0   9·9   6·7   64   94   68   75   75   75   75   75   75   75   7	G	III	F deodorized	76.9	13.1	0.3	70	92	76	
And deodorized   And deodorized   And deodorized   J   III   Herring; defatted and   87.0   3.1   0.3   74   93   79	H	III	•	74.0	22.6	0.1	65	95	69	
deodorized   V	Ι	III	•	89.1	4.4	0.3	64	95	67	
and deodorized   W   III   Lean fish; commercial   61·3   23·0   3·6   71   95   76   X   III   W   defatted and deodo-   64·7   24·8   1·2   77   94   82   rized   Y   III   Lean fish; defatted and   71·3   24·8   1·2   77   96   80   deodorized   X   IV   Fatty fish; defatted and   72·7   21·2   0·1   29   81   36   deodorized   X   IV   Fatty fish; defatted and   73·4   20·5   0·1   31   68   46   deodorized   X   IV   Fatty fish; defatted and   66·6   20·0   0·1   42   71   59   deodorized   X   Semi-lean fish; defatted   74·8   17·5   0·3   18   47   39   and deodorized   X   Semi-lean fish; defatted   79·4   19·4   0·1   67   94   71   and deodorized   X   Semi-lean fish; defatted   74·7   19·4   0·2   55   96   58   and deodorized   X   IV   IV   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·2   0·5   57   96   59   W   VI   S   Mefatted   84·2   I0·4   0·6   56   94   Mercial   M	J	III		87.0	3.1	0.3	74	93	79	
X       III       W defatted and deodo-rized       64.7       24.8       1.2       77       94       82         Y       III       Lean fish; defatted and deodorized       71.3       24.8       1.2       77       96       80         K       IV       Fatty fish; defatted and deodorized       72.7       21.2       0.1       29       81       36         L       IV       Fatty fish; defatted and deodorized       73.4       20.5       0.1       31       68       46         M       IV       Fatty fish; defatted and deodorized       66.6       20.0       0.1       42       71       59         deodorized       N       V       Semi-lean fish; defatted 74.8       17.5       0.3       18       47       39         and deodorized       A       19.4       0.1       67       94       71         and deodorized       A       19.4       0.1       67       94       71         and deodorized       A       74.7       19.4       0.2       55       96       58         S       VI       Herring; commercial       70.0       9.9       6.7       64       94       68         T       V	V	II	•	75.2	13.2	0.3	73	93	78	
rized Y III Lean fish; defatted and 71·3 24·8 1·2 77 96 80 deodorized K IV Fatty fish; defatted and 72·7 21·2 0·1 29 81 36 deodorized L IV Fatty fish; defatted and 73·4 20·5 0·1 31 68 46 deodorized M IV Fatty fish; defatted and 66·6 20·0 0·1 42 71 59 deodorized N V Semi-lean fish; defatted 74·8 17·5 0·3 18 47 39 and deodorized O V Semi-lean fish; defatted 79·4 19·4 0·1 67 94 71 and deodorized R V Semi-lean fish; defatted 74·7 19·4 0·2 55 96 58 and deodorized S VI Herring; commercial 70·0 9·9 6·7 64 94 68 T VI S defatted 84·2 10·2 0·5 57 96 59 U VI S defatted and deodo- 83·0 10·4 0·6 56 94	W	III	Lean fish; commercial	61.3	23.0	3.6	71	95	76	
deodorized   K   IV   Fatty fish; defatted and   72·7   21·2   0·1   29   81   36   deodorized	X	III		64.7	24.8	1.5	77	94	82	
deodorized   L   IV   Fatty fish; defatted and   73·4   20·5   0·1   31   68   46   deodorized	Y	III	•	71.3	24.8	1.3	77	96	80	
deodorized   M   IV   Fatty fish; defatted and   66·6   20·0   0·1   42   71   59   deodorized	K	IV		72.7	21.2	0.1	29	81	36	
Decided   Color   Co	L	IV	,	73.4	20.2	0.1	31	68	46	
and deodorized O V Semi-lean fish; defatted 79.4 19.4 0.1 67 94 71 and deodorized R V Semi-lean fish; defatted 74.7 19.4 0.2 55 96 58 and deodorized S VI Herring; commercial 70.0 9.9 6.7 64 94 68 T VI S defatted 84.2 10.2 0.5 57 96 59 U VI S defatted and deodo- 83.0 10.4 0.6 56 94 60	M	IV		66-6	20.0	0.1	42	71	59	
and deodorized  R V Semi-lean fish; defatted 74.7 19.4 0.2 55 96 58 and deodorized  S VI Herring; commercial 70.0 9.9 6.7 64 94 68 T VI S defatted 84.2 10.2 0.5 57 96 59 U VI S defatted and deodo- 83.0 10.4 0.6 56 94 60	N	V		74.8	17.5	0.3	18	47	39	
and deodorized  S VI Herring; commercial 70.0 9.9 6.7 64 94 68  T VI S defatted 84.2 10.2 0.5 57 96 59  U VI S defatted and deodo- 83.0 10.4 0.6 56 94 60	О	V	,	79.4	19.4	0.1	67	94	71	
S VI Herring; commercial 70.0 9.9 6.7 64 94 68 T VI S defatted 84.2 10.2 0.5 57 96 59 U VI S defatted and deodo- 83.0 10.4 0.6 56 94 60	R	V		74.7	19.4	0.5	55	96	58	
T VI S defatted 84:2 10:2 0:5 57 96 59 U VI S defatted and deodo- 83:0 10:4 0:6 56 94 60	S	VI		70.0	9.9	6.7	64	94	68	
U VI S defatted and deodo- 83.0 10.4 0.6 56 94 60			Ο,	•		•	-		59	
			S defatted and deodo-					-		

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