

The logo for the Fishmeal Information Network (FIN) features the lowercase letters 'fin' in a dark blue, serif font. The letters are positioned in the lower-left corner of a square image showing a close-up of blue water ripples.

FISHMEAL  
INFORMATION  
NETWORK

# Fishmeal for PIGS

## Fishmeal for pigs – a feed with a very healthy future

### Benefits for the producer – productivity, health and welfare

- 1 Improves growth, feed intake and feed conversion efficiency
- 2 High protein – 100g/tonne improves the protein content of a barley-based ration from 11 to 16%
- 3 Rich in essential amino acids in a readily digestible, slow release form
- 4 Low antigenicity and high digestibility to reduce stress in young pigs and help maintain a healthy gut
- 5 The only commonly-used feed ingredient which is high in health-promoting omega-3 PUFA

### Benefits for the consumer – safety, welfare, natural, human health

- 1 RSPCA recognises the welfare benefits from fishmeal
- 2 Fishmeal helps reduce the need for routine drug treatment
- 3 Accepted by Assured British Pigs and Freedom Foods
- 4 Acceptable under the EU organic standards, but some certification bodies restrict its use
- 5 Meat from pigs fed fishmeal helps prevent heart disease and cancer

### Benefits for the environment

- 1 Feeding fishmeal reduces nitrogen and phosphorus excreted, and methane and ammonia entering the environment

Feed ingredients need to meet producers' demands for high feed conversion efficiency and growth rate. Equally, ingredients must comply with the consumers' wish for assurances that products are safe and healthy, and produced with care for animal welfare and the environment.

As this leaflet explains, independent scientific evidence suggests that fishmeal has a positive contribution to make on both counts.

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# The benefits of fishmeal

## PIG RATIONS

### The benefits of fishmeal in pig rations

## 1 Nutritional value

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Fishmeal is a natural balanced feed ingredient that is high in protein, energy, minerals (calcium and phosphorus), a natural source of vitamins (including choline, biotin and vitamin B<sub>12</sub>, A, D and E) and a range of micronutrients (including selenium and iodine).

It is the compositional quality of the nutrients in fishmeal that make it distinctive, in particular its content of essential amino acids and the very long chain polyunsaturated omega-3 fatty acids (omega-3s). Fishmeal and fish oil are the only commonly used feed ingredients that contain these omega-3s.



## 2 Health promotion

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Diets including fishmeal have been shown to reduce infection due to the content of long chain omega-3s, which improve immune status and lessen inflammatory conditions. This leads to higher productivity and reduced losses.

In addition, it has long been recognised that the antigenicity of fish protein is low. Coupled with the anti-inflammatory properties of fishmeal,

this makes it an ideal component of baby pig diets, where dietary proteins other than sows milk can cause an inflammatory response in piglets under four weeks of age.

There are a number of trials, which demonstrate increased

survivability of piglets born to sows fed fishmeal, or fish oil enriched diets. For example, in trials at SAC Aberdeen improved reproductive performance has been reported in gilts fed 5% fishmeal in their diet<sup>1</sup>. The total birth weight of gilt litters and piglet survival was significantly improved. In both gilts and second parity sows gestation length increased, which is generally considered to be beneficial for piglet survival<sup>2</sup>.

A further health benefit reported was reduced effects of sepsis (*E.coli*) in young pigs given long chain omega-3s<sup>3</sup>.

Fishmeal is also a natural source of retinol (vitamin A) and tocopherols (vitamin E). Both of these vitamins act as antioxidants, as does ubiquinone which has a similar structure to vitamin E and is also found in fish. All these substances can help to maintain and protect cell membranes and may also have a role in protecting from inflammatory diseases.

## 3 Welfare

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The natural balance of vital nutrients in fishmeal is widely believed to play a role in reducing major welfare problems, such as tail biting in pigs<sup>3</sup>.



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# The use of fishmeal in

## PIG RATIONS

### The use of fishmeal in



By helping to protect livestock against disease, feeding fishmeal can reduce the need for routine drug treatment. Dr Vernon Fowler formerly of the Rowett Research Institute argues that an inclusion of 5 to 7.5% fishmeal in the diet acts as 'nutritional insurance'.

Nearly 38,000 tonnes of fishmeal are used in UK pig rations each year. This represents around 14% of the 270,000 tonnes of fishmeal consumed annually in the UK. Recommended rates of inclusion in pig diets are shown in Table 1.

## High in protein

### Contribution to protein nutrition

Fishmeal's major advantage relative to other protein sources is that it contains weight for weight such a high proportion of protein – typically 64 to 72%. The high protein concentration of fishmeal has particular advantages for formulating protein-rich concentrates to balance farm-produced cereals. For example, in formulating one tonne of pig diet, 100kg of fishmeal substituting for wheat or barley will raise the protein concentration by at least 5% typically from 11 to 16%.

Fishmeal is a rich natural source of the essential amino acids required for animal growth and maintenance, especially lysine, methionine, threonine and tryptophan. These are present in a readily digested peptide form. Utilisation is enhanced by their slow release whereas synthetic forms may be assimilated too quickly. Lysine is usually the first limiting amino acid when pig diets are formulated from cereals and vegetable proteins. Fishmeal is not only a good source of lysine but also highly digestible (see Table 2).

Most least cost feed programmes formulate the lysine content, but fewer nutritionists formulate to the available lysine content in the diet. Formulating to available lysine changes the relative value of protein sources and can improve efficiency and reduce costs.

Numerous studies have shown that growth, feed intake and feed conversion efficiency in pigs are improved when fishmeal is included in the diet.

## 4 Environmental

As protein is an expensive component in the diet, choosing sources that are efficiently used makes good sense, not only from a financial aspect, but also because of the reduced environmental impact. The benefits that result from the inclusion of fishmeal in the diet are:

- ▶ less feed required as there are less unabsorbed nutrients
- ▶ reduction in the levels of nitrogen and phosphorus excreted
- ▶ less methane and ammonia (and their associated odours) entering the environment
- ▶ less water consumption
- ▶ reduction in manure production
- ▶ reduced requirement for fossil fuels for the transportation of feed and manure
- ▶ less land required for animal production

# fishmeal in NS in pig rations

recommendations for humans – the guidelines are an omega-6 intake of 1% of dietary energy and omega-3 of 0.2% of energy intake, with an optimum ratio of 5:1. To achieve this ratio in most pig diets it would necessitate a substantial reduction in omega-6 intake and an increase in omega-3.

In pregnant and new born mammals the omega-3 fatty acids are particularly valuable, as they are required for development of the brain and retina. Research carried out by John Rooke and colleagues<sup>2</sup> at SAC Aberdeen has demonstrated that sows supplemented with omega-3s during pregnancy produce piglets with significantly larger brains.

More important than the amount of omega-3 is its ratio to omega-6 fatty acids. A desirable ratio would be about 4:1 of omega-6 to omega-3. However, within commonly used feed there is an oversupply of omega-6 and an undersupply of omega-3, causing an imbalance in the diet.

The ratio of omega-6: omega-3 in the above-mentioned fishmeals is 1:8, 1:11 and 1:10 respectively (i.e. they contain about 10 times as much omega-3 as omega-6). This means the inclusion of fishmeal into the diet can produce the overall desired ratio of 4:1.

For example in young pigs (up to 15kg) the response is typically an increase in liveweight gain of up to 20% when compared with vegetable protein sources; and in the growing pig (up to 25kg). It is typically an increase in liveweight gain of 40g/day (an improvement of 11%).

## Essential fatty acid intake Contribution to essential fatty acid intake

Fishmeal, and fish oil, are unique and are now virtually the sole sources of the very long chain omega-3s in the diet of animals. Formerly meat and bone meal and other animal products could have provided a dietary source of omega-3s. The content of omega-3s in anchovy, herring, and white fishmeal respectively is 34, 26, and 35g/100g fatty acids.

There are, as yet, no official guidelines on essential fatty acid intakes for pigs, although it is recognised that they can reduce infection, improve immune status and reduce inflammation. However, the EU Scientific Committee for Food made the following

Table 1.  
**Recommended rates of inclusion of fishmeal in pig diets for optimum benefit**

Pigs	% inclusion
Creep	5–10
Weaner	5–10
Grower	3–5
Finisher	3
Sow	3

Bulk density: 550–650kg/m<sup>3</sup>

Table 2.  
**A comparison of fishmeal with other protein sources**

Feed ingredient <i>As received %</i>	Fishmeal			Soyabean meal – Hipro	Milk powder – skimmed
	Chilean	Herring	White		
Crude protein	66	71	66	48	34
Digestible CP	63	66	63	46	31
Essential amino acids	—	5.6	4.4	—	—
Total lysine	5.0	—	—	2.7	2.3
Available lysine	4.8	5.4	4.2	2.5	2.2
Methionine + cysteine	2.5	2.6	2.4	1.3	1.2
Tryptophan	0.8	0.8	0.6	0.8	0.4

Source: The Feeds Directory

# Beyond the FARM GATE

## Beyond the farm gate

### **FISHMEAL – for healthier pork**

Human diets are low in the omega-3s and raising the omega-3 content of livestock products, pork for example, can make a significant contribution to reducing this deficit<sup>4</sup>.

In addition, the omega-6 fatty acid composition of pig meat has increased from 10mg/100g fatty acid in the 1970s to its current value of 15mg/100g. This reflects higher oil content in the pig's diet and leaner carcasses. The net result of these changes is an adverse effect on the omega-6:omega-3 ratio in the meat<sup>5</sup>.

Fatty acid content is relatively simple to manipulate in pork, because fatty acids from the diet are incorporated directly into the tissues. Pigs fed a fish oil supplemented diet had significantly higher levels of omega-3s in their ham muscles. The intake of fishmeal did not affect the taste or appearance of the meat<sup>5</sup>.

However, too much PUFA – over 14% (this level would rarely be achieved in commercial diets) can cause soft carcass fat, and oxidation of PUFA, which can lead to off-odours or flavours.

Diets containing fishmeal and fish oil must be stabilised with antioxidant and supplemented with vitamin E. The use of this vitamin at high levels has been effective in some studies in reducing the off-flavours resulting from lipid oxidation<sup>6</sup>. Most commercially available products will already be stabilised but it is worth home mixers checking with their feed supplier that this is the case.

### **FISHMEAL – accepted by farm assurance schemes**

Fishmeal is recognised as a safe and natural ingredient, which is an effective feed ingredient for pigs. The RSPCA Freedom Foods standards accept fishmeal, in fact the RSPCA specifically recognises the welfare benefits from fishmeal.

Several aspects of the Assured British Pigs scheme are under review but, as at winter 2000/2001, fishmeal is permitted in diets provided that it is excluded for the 14 days prior to slaughter. This is to avoid the (remote) possibility of taint.

### **FISHMEAL – from sustainable sources**

Fishmeal is a renewable feed source, produced almost exclusively from types of fish for which there is no demand for human food use. According to independent scientific evidence, the majority of the fish stocks currently being used to produce fishmeal are within safe biological limits. All are subject to science-based monitoring and management regimes to ensure that fishing is conducted in a responsible and sustainable manner.

### **FISHMEAL – suitable for GM-free rations**

Where formulations call for GM free or low GM products, fishmeal is able to meet this requirement.

### **FISHMEAL – a natural product**

Fishmeal is the brown flour obtained after cooking, pressing, drying and milling fresh raw fish. It is produced almost exclusively from fish for which there is limited or no human food demand – the so-called industrial species. It is a primary product, not a by-product, and is manufactured in purpose-built plants that meet stringent safety and quality criteria. There are extensive controls and checks throughout the supply chain to ensure the quality, safety and integrity of fishmeal.



# Reasons to use FISHMEAL

## Six reasons to use fishmeal

- 1** High protein content and good protein quality – used efficiently by pigs, particularly baby pigs, where inflammatory response is minimal
- 2** Rich source of the essential fatty acids – to help reduce disease, improve immune status and provide an alternative approach to health promotion
- 3** Natural source of health promoting compounds – dietary alternative to antibiotics
- 4** Natural source of anti-oxidant vitamins and selenium – to promote good health, protect cell membranes and improve immune status making it ideal in a young piglet diet
- 5** Rich source of calcium, phosphorus and other minerals – contributes readily available minerals that are efficiently used reducing the environmental burden and reducing the cost of supplementary minerals
- 6** Fish stocks are monitored and catches are controlled – to meet the requirements of supermarkets and assurance schemes

### References

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- FIN (to be published early 2001).** *In depth fact sheet – Health benefits of omega-3 in fishmeal.*
- Wood JD, M Enser, AV Fisher, GR Nute, RI Richardson and PR Shear (1999).** *Improving meat production for future needs. Proc. Nutr. Soc. 58, 363–370.*

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Also available from FIN:

*Fishmeal for poultry*

*Fishmeal for sheep*

*Fishmeal for dairy cows*

For a full list of FIN publications, for further information about any aspect of fishmeal or to be added to the FIN database contact them at:

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