

# “FISHY” TAIN IN BROWN EGGS

International News Letter of  
Institut de Sélection Animale

March 2010

- 1 ISA uses a DNA-test to remove the FMO3-gene, responsible for fishy eggs, out of her brown lines.
- 2 All Brown PS delivered from the operational centers in France, The Netherlands, Brazil, Venezuela and Indonesia are 100% free of the fishy taint gene.
- 3 Brown PS delivered from Canada and the USA will be free starting May 2010.
- 4 All white ISA products have always been TMA-free, so they never produce fishy eggs.
- 5 Fewer requirements for feed ingredients for brown layers are needed. The feed costs can be reduced.

**Eggs with a fishy taint have always been associated with the fishmeal in the hen’s ration. But some layers that have never been exposed to feed containing fishmeal produce eggs with the smell of rotten fish. For years raw materials such as rapeseed were not used in layer feed, as this caused some Brown hens to produce “fishy”eggs.**

## What causes egg taint?

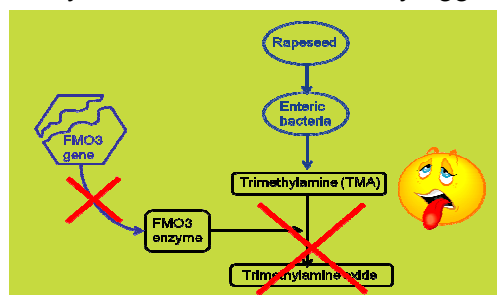
Egg taint is related to the transfer and excretions of smelling substances, resulting from increased intake or from endogenous metabolism, into the egg. Tainting eggs are a severe problem, because even taint malodours are noticed by consumers and lead to complaints.

The fishy taint is caused by the accumulation of trimethylamine (TMA) in the yolk.

Trimethylamine is produced by the bacterial fermentation of choline in the small intestine and caeca. The liver converts TMA via the enzyme trimethylamineoxidase into the nonodorous TMA N-oxide.

The problem can be caused by dietary trimethylamine or by precursors for TMA formation like thrimethylamine oxide, choline, sinapine or betaine.

Hens with the defective FMO3-gene produce not enough enzyme to oxidate TMA into the nonsmelling TMA-oxide. TMA can be deposited in the yolk which resulted in fishy eggs.



Fish taint in eggs by defective FMO3-gene.

## TMA in Brown layers

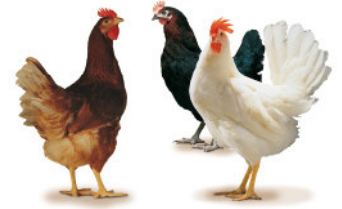
Fishy or undesired egg taint occurs in certain strains of brown layers. Biotechnology researchers found that the cause of the taint was conditional on the presence in the hen, in the heterozygous or homozygous state, of an autosomal semidominant mutant gene with variable expression, depending on environmental factors.\*

This gene has been specifically identified as the FMO3-gene. They also discovered that eggs from brown layers in general do not smell this way unless hens with the inherited genetic defect have been given feed containing an ingredient that triggers the taint.



One of these ingredients is rapeseed, which is widely used in Central Europe. Approximately 5-10 % of the brown layers that consumed such feed produce the fish tainted eggs. Those hens miss the genetic predisposition to eliminate TMA. In the past it was only possible to find the genetic deficit by smelling the eggs and breath of the individual hens and cocks. But with this method not all the carriers of the defective gene are found. So it was impossible to clean all products completely.

\* Bolton W. Carter, T.C. Jones, R. M., J. R. Morley (1976): *The hen’s egg: genetics of taints in eggs from hens fed on rapeseed meal. British Poultry Science* 17: 313-320



## DNA - Tests

The in-house developed DNA-techniques and a DNA testing license agreement with the Swedish inventors FunboGen AB, gives ISA the exclusive right to perform a DNA test against fishy odour in birds.

This procedure requires only DNA from blood to produce an unequivocal result. The test makes it possible to select brown chicken lines for cross breeding to ensure that off-spring do not have the genetic defect which causes the odorous taint. After checking the eventually negative effects from forced removal of this gene, the ISA R & D department started removing the defective FMO3-gene in their brown lines.

Now, 100% of all Grand Parents (GPS) are free of the fishy taint phenotype. Figure 2 lists the status per Operational Center. All ISA clients worldwide will benefit from the investments made in ISA R&D and their exclusive right to use this patented selection method.

## The Effects on Feed Programs

Brown layers free of this mutation are much more flexible to differences in feed ingredients and management. This allows higher levels of sinapine, choline and betaine without any negative consequences.



Rapeseed contains sinapine and is the second leading source of vegetable oil (rapeseed animal meal as a byproduct). It is a good, easily digestible protein source with many advantageous qualities including: a high level of crude fiber. The use of many different feed ingredients can lower feed costs; an important factor for commercial layer farms.

## Checklist egg odour and taste

Eggs with a different odour and taste are often described as “fishy eggs” (fresh as well as boiled eggs). Trimethylamine, a bacterial decomposition product of sinapine, can be deposited in the egg yolk, specifically for layers of brown eggs. This causes the related “fishy” taste and odour of the eggs.

Potential causes of fishy egg odour and taste:

### 1. High levels of TMA:

- a High TMA-levels are found in the raw material fishmeal and fish oil.
- b Intestine bacteria can synthesize TMA out of choline and betaïne. High levels of choline are possible when FLS-mix is used. Sinapine, an ester of sinapine acid and choline, is a negative constituent.
- c Fermentation stimulating raw materials like wheat, barley or leguminoses can cause an excessive fermentation in the caeca with more TMA production. To reduce the fermentation it is recommended to add flavomycine (not allowed in EU) to the feed.

### 2. Reduced action of trimethylamine-oxidase:

- d Some brown hens are missing the gene for synthesis of thrimethylamine- oxidase.
- e A disturbed liver action slows the synthesis of thrimethylamine-oxidase.
- f Tannins (from beans, rapeseed, peas) and glucosinolates (from linseed products and rapeseed products) deactivate trimethylamine-oxidase.

### 3. Other factors:

- g Long chain, polyunsaturated fatty acids (in linseed- and fish oil) in low concentrates can cause a bad taste and odor in the eggs.
- h Residues of chlorine-anisoles can cause eggs with fishy taste and odour.
- i Contaminated layer feed with Robenidine (Cycostat).
- j Some antibiotics like furazolidone and oxytetracycline.
- k Storage of eggs near strong smelling products like onions, leeks, manure or fishmeal.



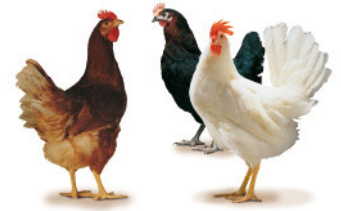


Figure 2: Status per operational center

France & The Netherlands

All GPS flocks placed after January 2008 are free of the TMA gene. As of May 2009 all PS flocks delivered from France and The Netherlands are TMA free.

Canada

The GGPS imported in January 2009 is free of the TMA gene. The first TMA-free PS flocks will become available in May 2010.

Brazil

The first TMA-free GPS flock was hatched in January 2009. All deliveries of PS in 2010 are free of TMA.

If you need more information please contact us:  
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Indonesia

The GPS flocks imported into Indonesia in June and October 2008 are free of the TMA gene. As of June 2009 all PS deliveries are free of TMA.

Venezuela

The first TMA-free GPS flock was delivered in December 2008. All deliveries of PS in 2010 are free of TMA.

**Comment:**

All Brown GPS deliveries are TMA-free.

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