TATE & LYLE

SUBMISSION

FSANZ Consultation Paper – W1109 – Consultation about beta-glucan and blood cholesterol health claims

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To whom it may concern:

Tate & Lyle is hereby respectfully submitting our comments regarding FSANZ Consultation Paper W1109 – Consultation about beta-glucan and blood cholesterol health claims.

It is clear from the systematic review performed by FSANZ that studies on oats constituted the main body of evidence examined to test the hypothesis that consumption of oats or barley as sources of beta-glucan decreases blood total and LDL cholesterol. Out of 40 data strata, 33 studies were from oats, and only 7 from barley.[1]

FSANZ has investigated the plausibility of the cholesterol-lowering effects of oats and barley and cited different mechanisms by which oats and barley may alter blood cholesterol concentration.[2] For example:

"*soluble fibres (including beta-glucan) increase viscosity within the gastrointestinal tract and can coat the mucosal layer, thereby slowing absorption of nutrients from the gut (reviewed in Othman et al. 2011);"*

"In addition to effects on viscosity, beta-glucan and other soluble fibres undergo anaerobic fermentation in the colon, generating short chain fatty acids (Kumar et al. 2012). These short chain fatty acids may inhibit cholesterol synthesis, which could lead to decreases in blood cholesterol concentration;"

In the systematic review of the food-health relationship between the dietary intake of wholegrain oats or oat bran and reduction of blood total and LDL cholesterol concentrations, FSANZ has concluded that these mechanisms are plausible to explain the observed effects. However, in weighing the evidence, FSANZ considered that there are a variety of possible components in oats and barley, including beta-glucan, which make the observed results plausible and it is likely that additional factors within oats and barley may also have cholesterol-lowering properties[2]. FSANZ compared the beta-glucan and arabinoxylan content between oats and barley:

"In a study of various cereals, the beta-glucan content of oats and barley was approximately 5% w/w, while the content in wheat was less than 1% w/w (Shewry et al. 2013)"[3]

" For example, arabinoxylan, another non-starch polysaccharide, is found at similar levels to beta-glucan in the grain endosperm of oats and barley (Izydorczyk and Dexter 2008)." [4]

We would like to submit additional information for your consideration, in support of the compositional differences between oats and barley and implications thereof to their potential cholesterol-lowering properties:

Gross chemical composition[5]
Note: Figures are mean values from the Official National Food Composition Tables in Norway, Denmark and Sweden

Table 1. Gross chemical composition of oat flakes (whole grain) and pearled barley flakes (per 100 g as eaten)

Component	Oats	Barley
Protein	12.7	9.0
Starch	62.1[b]	62.1[a]
Sugars	1.4	0.8
Fat	7.1	2.2
Ash	2.1	1.2
Total DF	10.3	10.3

[a]Data from Sweden not included
[b]Data from Sweden and Denmark not included

Dietary fiber components[5]

Table 2. Dietary Fiber content and composition in dehulled oats and naked barley (as % dry matter)

Component	Oats	Barley
Total DF	10.2	15.2
Arabinoxylan	**2.0**	**5.2**
Cellulose	1.3	1.9
B-glucan	**5.0**	**4.6**
Fructan	0.2	1.6
Klason lignin	1.4	0.7

Based on the above table, beta-glucan content in dehulled oats is almost the same as in naked barley (~5%w/w), consistent with the citation[3] given in the systematic review. However, the same cannot be observed about the arabinoxylan content which has more than twice the amount in barley compared to oats. This was confirmed in another study [6] which found that "*compared to other grains, the amount of arabinoxylans in barley is similar to that in wheat (5.8), lower than in rye (7.6–12%), but higher than in oats (2.7– 3.5%), sorghum (1.8%) or rice (2.6%).*" (Izydorczyk & Biliaderis, 2007)[6]

It can be seen from these studies that arabinoxylan and beta-glucan content is similar in barley, but not in oats. Oats contain more than twice the amount of beta-glucan compared to arabinoxylan, and as such is contrary to what one of the cited studies[4] had stated, i.e. that *"arabinoxylan, another non-starch polysaccharide, is found at similar levels to beta-glucan in the grain endosperm of oats and barley"*

In the same study[4] cited by FSANZ comparing the arabinoxylan and beta-glucan content in oats and barley, the authors observed that *"the nutritional values of other fibre components in*

barley, most notably arabinoxylans, have not been investigated to the same extent as those of beta-glucans. However, some recent studies revealed positive effects of water soluble maize, wheat and rye arabinoxylans on cecal fermentation, production of short-chain fatty acids, reduction of serum cholesterol and improved adsorption of calcium and magnesium (Hopkins et al., 2003; Lopez et al., 1999)[7,8]."

The differences in the amount of dietary fiber components in oats and barley (including beta-glucan and arabinoxylan) may have implications on the different physiological effects as well.[5] Frolich et al (2013)[5] noted the following in their study:

" Insoluble and less fermentable dietary fiber components (lignified cell walls with arabinoxylan and cellulose as main components) in the outer parts of the caryopsis will influence passage rate and give high bulking effects in the large intestine.

"Arabinoxylan and especially b-glucan in the starchy endosperm are partly extractable viscous dietary fiber components and may influence the rate of absorption of nutrients in the small intestine and reabsorption of bile acids."

" Fructan, which has lower molecular weight than the other dietary fiber components in cereals, is highly extractable and fermentable and will thus generally not influence the absorption of other nutrients in the small intestine to any notable extent."

Given the limited studies available on the physiological effects of other components in oats and barley other than beta-glucan (most notably arabinoxylan), it would be difficult to conclude with certainty that these components have cholesterol-lowering properties and therefore, contribute to the food-health relationship of oats and reduction of blood cholesterol. Beta-glucan still remains to be the most investigated component in oats and barley in relation to cholesterol reduction.

Conclusion

There are other components in wholegrain oats or oat bran such as protein, starch, insoluble fibers, soluble fibers including beta-glucan, arabinoxylan and fructan, vitamins and minerals and bioactive components.[5]

Of these components, mainly beta-glucan and to a much lesser extent arabinoxylan, have been shown to provide physiological effects related to cholesterol-reduction.

We like to point out that:

- beta-glucan is the most extensively studied soluble fiber with respect to its cholesterol-lowering effects, while arabinoxylan has limited studies on reduction of serum cholesterol.
- As mentioned in the FSANZ Supporting Document 1, out of 40 data strata, 33 are coming from studies on oats, and only 7 from barley.
- Specifically in oats, the beta-glucan levels are about 2.5 times higher than arabinoxylan. Only in barley they have about equal levels.
- According to the different EFSA positive opinions, oat (and barley) BGL have been sufficiently characterised, and were recognised as the active ingredient to which the health claim on cholesterol could be attributed.

In conclusion, we believe that sufficient evidence is available to link the cholesterol lowering effect to beta-glucans.

References:

1) FSANZ Consultation paper W1109 Attachment, Supporting Document SD1, page 7, Figure 1. PRISMA diagram of the studies identification process.

2) FSANZ Consultation paper W1109 Attachment, Supporting Document SD1, page 26, Section 3.1.3 Plausibility.

3) Shewry PR, Hawkesford MJ, Piironen V, Lampi AM, Gebruers K, Boros D, Andersson AA, Aman P, Rakszegi M, Bedo Z, Ward JL (2013) Natural variation in grain composition of wheat and related cereals. J Agric Food Chem 61(35):8295–8303

4) Izydorczyk MS, Dexter JE (2008) Barley ß-glucans and arabinoxylans: Molecular structure, physicochemical properties, and uses in food products-a Review. Food Res Int 41(9):850–868

5) Frolich Wenche, Per Aman, Inge Tetens (2013). Whole grain foods and health – a Scandinavian perspective. Food & Nutrition Research 2013. 57: 18503

6) Izydorczyk, M. S., & Biliaderis, C. G. (2007). Arabinoxylans: Technologically and nutritionally functional plant polysaccharides. In C. G. Biliaderis & M. S. Izydorczyk (Eds.), Functional food carbohydrates (pp. 249–290). Boca Raton: CRC Press, Taylor & Francis Group.

7) Hopkins, M. J., Englyst, H. N., Macfarlane, S., Furrie, E., Macfarlane, G. T., & McBain, A. J. (2003). Degradation of cross-linked arabinoxylans by the intestinal microbiota in children. Applied Environmental Microbiology, 69, 6354–6360.

8) Lopez, H. W., Levrat, M.-A., Guy, C., Messager, A., Demigne, C., & Remesy, C. (1999). Effects of soluble corn bran arabinoxylans on cecal digestion, lipid metabolism, and mineral balance (Ca, Mg) in rats. Journal of Nutritional Biochemistry, 10, 500–509.