SeaHealthUCD

Issue 12: August, 2014: This e-bulletin is aimed at personnel in fisheries & aquaculture, at fish packers, processors, distributors, retailers, and finally consumers.

Beneficial peptides in mussels

Mussel production is a significant part of the Irish aquaculture industry with about 15,500 tonnes produced in 2013 comprising 10,000 tonnes of rope cultured and 5,500 tonnes of bottom produced mussels (BIM, 2013). Over 50% of the overall production is certified as organic and the principal species produced in Ireland is *Mytilus edulis* (blue mussel). Mussels are prized for their unique flavour and texture by many consumers and are cooked in a variety of ways usually with sauces, cream or some other accompaniment. Many consumers are aware of the health properties of finfish such as salmon and mackerel, e.g. as sources of omega-3 polyunsaturated fatty acids, but are not nearly as aware of the health properties of shellfish including mussels. A recent review paper (Grienke et al., 2014) has highlighted the bioactive compounds from marine mussels and their likely effect on human health. Two families of bioactive compounds in mussels of particular interest are antimicrobial peptides and peptides with antioxidant and blood pressure lowering (anti-hypertensive) properties.

Antimicrobial peptides

Peptides are formed when a number of amino acids combine together or when proteins are broken down. Mussels contain a number of natural peptides which are probably part of the mussel's defence system against disease; this may be the reason that mussels tend to have a lower incidence of disease compared to other bi-valve molluscs (Gestal et al., 2008). Some of these peptides are active against microbes (bacteria, fungi, moulds, viruses) and hence the name antimicrobial peptides (AMPs). For example, mytimycin has antifungal properties. Other AMP families have a broad spectrum activity against bacteria such as *Staphylococcus aureus (S. aureus)* and *Escherichia coli (E. coli)* in laboratory tests and also exert anti-fungal activity (Mitta et al., 2000).

Antioxidant and anti-hypertensive peptides

Antioxidants are important in the human diet in order to help the immune system quench harmful free radicals. Free radicals are very unstable molecules (they contain an unpaired electron) and cause oxidative damage to human cell membranes and DNA; this can lead

to inflammatory diseases including certain forms of cancer and also to coronary artery disease. Our bodies produce millions of free radicals every day and these need 'quenching' on an ongoing basis. A number of peptides from mussels have strong antioxidant properties and quenched free radicals in laboratory tests (Jung et al., 2007); in time these may be shown to be beneficial for human health. Many people have high blood pressure in our modern society with consequent implications for health. A number of mussel peptides are anti-hypertensive and help lower blood pressure in rats with high blood pressure, i.e. they act as ACE inhibitors. Angiotensin converting enzyme (ACE) converts angiotensin 1 (dilates blood vessels and thus lowers blood pressure) to Angiotensin 11 (constricts blood vessels and thus raises blood pressure). Thus it is very important to prevent this conversion taking place in the human body.

Human health effects: food versus pharma delivery

It is important to stress that many of the outcomes above on the potential of mussel peptides as anti-microbial, antioxidant and anti-hypertensive agents are based on laboratory tests (*in-vitro*) and there is no absolute guarantee that the benefits will translate to humans (*in-vivo*). However, the likelihood is that they will but more research is needed on *in-vivo* testing. Peptides can be delivered to humans by eating mussels (including their juices) or via pharmaceutical products. The former is the more desirable as eating whole foods is usually superior to taking supplements. The peptides in the ingested mussels will be broken down in the gut by enzymes to a new range of compounds which may also be potent bioactives. Mussel peptides and their breakdown products could be the basis of new pharmaceutical products for humans and for the treatment of farmed fish diseases. For example, they may have potential to kill bacteria that have become resistant to conventional antibiotics. Similarly, the role of mussel peptides as antioxidants and anti-hypertensive agents could also lead to new pharmaceutical products for minimising oxidative changes and reducing blood pressure in humans.

References

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