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Metagenomics/Metabolomics vs traditional cultural techniques

In previous bulletins we have looked into the advances made in the field of metagenomics, which is the study of genetic material recovered directly from food or environmental samples. By referencing the results of the analysis to a database containing the whole genetic sequences of different microorganisms, it is possible to get an accurate assessment of the total number of bacteria in a food or environmental sample.

The advantage of this methodology over traditional cultural techniques is that it is able to identify the presence of organisms which may not be recoverable by cultural analysis alone.

In non-selective tests such as the Total Viable Count, we attempt to recover all of the organisms present in a sample. However, we incubate the plates at a defined temperature, under specific atmospheric conditions, for a set time period using agar plates which have a limited supply of available nutrients. It is little wonder therefore that we only successfully demonstrate the presence of a relatively low percentage of the total number of the organisms present in any particular sample.

In addition to metagenomics, we now have another method which we may hear more of in the future, which is Metabolomics.

Metabolomics is the study of chemical processes involving metabolites which are present in cells, and new research has used this technique to differentiate Shiga Toxin *E coli* (STEC) strains by analysing their unique and individualistic metabolic profiles.

The analysis is carried out using Nuclear Magnetic Resonance methods, which is a technique used by our ALS colleagues in Food chemistry.

It found that the pathogenic STEC strains differed from each other, and from their non-pathogenic counterparts by their amino acid metabolisms, prompting speculation that this may be another non-culturable diagnostic tool of the future.

Whilst these new methodologies have undisputed advantages over the traditional techniques, the cultural methods do demonstrate the presence of viable cells, which may not always be the case when detecting either genetic or metabolic markers in microbiological cells.

Listeria outbreak caused by Korean Enoki mushrooms

Six people in Australia are part of an international Listeria outbreak traced to imported mushrooms that has also killed four people in the United States.

The *Listeria monocytogenes* patients in Australia have been identified by whole genome sequencing as being related to the U.S. outbreak strain. Their illnesses were reported between October 2017 and March this year.

Food Standards Australia New Zealand (FSANZ) said the investigation was ongoing but no deaths have been attributed to Listeriosis amongst the current cases.

Of the six infections in Australia related to the U.S. outbreak strain, four are thought to have contracted the illness in Australia. Of these, three are residents of Queensland, and one is from New South Wales. The other two are thought to have been exposed while travelling overseas. The median age of cases is 75 years old, four are female and two are males, and all of them had underlying health conditions.

Listeria monocytogenes was detected in enoki mushrooms imported from South Korea that were recalled in the country earlier this month.

Choi's Mushrooms recalled Green Co. Enoki Mushrooms in 200-gram and 300-gram packages. The products were sold at Asian supermarkets and grocers in New South Wales, the Australian Capital Territory, Victoria, Queensland and South Australia.

Enoki mushrooms are a long thin white mushroom, usually sold in clusters. They are popular in East Asian cuisine and also known as enokitake, golden needle, futu or lily mushrooms.

Korean authorities and enoki mushroom suppliers are trying to ensure sanitary controls are being met and cooking instructions are put on packaging. In Korea, enoki mushrooms are cooked and not eaten raw in salads.

There have been multiple recalls of enoki mushrooms in both the US and Canada in the last month.

Could the levels of Campylobacter in poultry be reduced by manipulation of the chicken intestine microbiome?

It had previously been thought that one control option for *Campylobacter* in poultry may be to alter the composition of microbial communities in chicken intestines by introducing beneficial bacteria and excluding the potential for colonisation by *Campylobacter* by competitive inhibition.

In mouse models, differences in resistance to bacterial infections can be partially transferred between lines by transplantation of gut microbiota. Recent studies have also indicated a protective role of the microbiota against colonisation by *Campylobacter* in chickens.

However, recently published work in the Journal of Applied and Environmental Microbiology, carried out by researchers at the Roslin Institute in Edinburgh showed that transplanted gut bacteria only survived in the susceptible chickens for a limited time and the chickens actually became even more susceptible to *Campylobacter*.

Dr. Cosmin Chintoan-Uta, of the Roslin Institute, said: "Given the results of previous studies in mice, we thought that inherited differences in resistance to gut pathogens might be transferable by transplanting gut microbiota from chickens that are resistant to chickens that are susceptible."

However, resistance or susceptibility to colonisation was not conferred by transferring gut bacteria between lines suggesting gut microbiota did not play a role in resistance to *Campylobacter* colonisation in poultry.

EFSA publishes recommendations on the processing and use of frozen vegetables

Following the *Listeria* outbreak which affected 53 people and caused 10 deaths between 2015 and 2018, due to the consumption of frozen sweetcorn produced by Greenyard's frozen vegetable factory in Hungary, the European Food Safety Authority (EFSA) has produced a report in which they identify ways to reduce the risk from *Listeria* in these products.

The assessment focused on vegetables that are blanched (scalded in hot water or steam for a short time) before they are frozen. Vegetables are blanched before freezing because it stops enzyme actions which can cause loss of flavour, colour and texture.

The report identified several mitigation measures which would reduce the risk of *Listeria* contamination such as disinfection of the food processing environment, controls of process water, time and temperature control at different processing steps, and accurate labelling. The latter was deemed to be important as the *Listeria* outbreak was due in part to people not realising that the sweetcorn was being sold as ready to cook and not ready to eat and most of the affected individuals had consumed the product directly with a salad.

The report also stressed the importance of monitoring the production environment for *Listeria monocytogenes* as it is widely acknowledged that it can persist in the manufacturing environment, colonising harborage points and then subsequently contaminating processed food.

How healthy gut bacteria can lift your mood in these troubling times

We have discussed before how our gut bacteria can have a direct influence on our mood and even cause behavioural changes, but there is welcome evidence in these times of enforced lock down that a healthy microbiome can promote our mental wellbeing through enhanced production of the chemical dopamine.

Dopamine is a major neurotransmitter that's a key factor in motivation, productivity, and focus. In fact it is often said that dopamine provides your zest for life.

There are about 86 billion neurons in the human brain which communicate with each other via brain chemicals called neurotransmitters. Dopamine is one of the most extensively studied neurotransmitters because it is linked to so many aspects of human behaviour. It plays important roles in attention, memory, mood, learning, sleep, movement, and anticipatory pleasure. Dopamine is widespread in the animal kingdom, but our high levels may be responsible for what makes humans unique.

So how can we ensure that our bodies' levels of Dopamine are kept high? Foods such as fresh meats, fruits and vegetables contain high levels of 1-tyrosine which is one of the building blocks required for Dopamine synthesis. Broad beans (also known as Flava beans), are one of the few foods that contain l-dopa, an amino acid that's a direct precursor to dopamine.

Fermented foods which are high in probiotic bacteria such as yogurt, kefir, and raw sauerkraut may increase natural dopamine production, as 50% of your dopamine is found in your intestines where it is synthesised by gut microbes such as *E coli, Lactobacillus spp, Serratia spp and Bacillus spp.*

It may be true to say therefore that the health of your intestinal flora impacts your production of dopamine, and consequently your mood, happiness and wellbeing.