VITAL
Issue 55
autumn
2014
mla MEAT & LIVESTOCK AUSTRALIA

Gut microbiota – what role can diet play?

Differences in gut microbiota have been reported between healthy individuals and those with diseases including IBD, asthma, arthritis, obesity and cardiovascular disease. Although it is unclear at this stage whether the effect is causative or secondary, the potential to influence health outcomes by manipulating gut microbiota is compelling.

The relevance of diet lies in the symbiotic relationship between the host and the gut microbiota – the host provides the nutrient-rich environment and the microbiota performs functions which the host cannot perform alone, including production of essential vitamins and digestion of indigestible dietary residues.

A critical starting point for understanding the role of diet is that our gut microbiota is individually distinctive and is largely determined at birth. Whilst the microbiome is mostly stable, the composition of the microbiota changes with age. Changes in response to external factors, such as diet, have also been reported.

These changes in composition can be either beneficial or harmful to the host. For instance, they can result in the production of either anti- or pro-inflammatory markers which can then travel throughout the body. Since chronic inflammation plays a crucial role in the initiation and progression of several diseases, understanding the inflammatory response to external factors could help to elucidate effective preventative or remedial strategies required to modulate inflammation.

At this stage, there is insufficient evidence to provide specific dietary recommendations based on an analysis of an individual's gut microbiota because our understanding of what constitutes a 'healthy profile' and what specific alterations from 'normal' means, is limited.

In addition, there will most likely be no silver bullet because the same diet or treatment may not always achieve the same outcome in individuals differing in microbiota composition and genetic predisposition. It will also require consideration of the impact of other external factors in addition to diet, such as physical activity, chronic stress, smoking, antibiotics, hygiene and disease. Another modifying factor can be the food structure and mix of foods consumed which has been shown to influence the site and rate of fermentation in the gut.

Aside from diet, other options for changing composition of flora are being investigated including use of antibiotics, probiotics, prebiotics, synbiotics and faecal transplants. This will require research to understand the long term consequences of these treatments and the role of diet as part of the treatment.

For now, researchers are working on identifying the functional health properties of different species and classes of microbiota within the major phyla. Once these have been established, it will be possible to understand the effect of diet and lifestyle choices and develop dietary recommendations for achieving a healthy gut.

Microbe terminology

Gut microbiota or **microflora** describes the collection of microbial communities colonising a particular ecological niche in the gut. Whilst all humans generally have similar microbiota, the relative abundance of the major phyla, Firmicutes and Bacteriodetes, is not always the same and species composition can also differ. There are more than 100 trillion micro-organisms of which lactobacilli and bifidobacteria represent only a few percent of the adult gut microbiota.

The **microbiome** describes the microbial genome which contains more than 5 million genes which encode a wide range of bioactive compounds, many of which are involved in cell differentiation, immunomodulation and metabolic regulation, thereby greatly expanding the host's own biochemical and metabolic capability.

Metagenomics is the analysis of the collective genomes that are present in a defined environment or ecosystem and provide information about the functions of non-cultivated bacteria.

Conference report available

The International Life Sciences Institute's (ILSI) symposium held a symposium on gut microbiota in December in association with the ARC Centre of Excellence in Plant Cell Walls. Presenters discussed the role of microbiota for optimal gut health and potential implications for human health and disease. The conference report is published in Food Australia (Feb/March 2014) and provides a useful overview of the current status of research, future directions and the role of the diet. Presentations from the ILSI symposium and a summary report from the meeting can be accessed at http://goo.gl/IlWWGj

Subscribe to *Vital* e-newsletter NOW and enter into the draw to WIN 1 of 30 Arcosteel Woks

Over the coming months, we will be transitioning the current hardcopy *Vital* newsletter to an e-newsletter. If you would like to continue to receive *Vital*, please email nutrition@mla.com.au with the subject 'Subscribe'. You can enter into the draw to win 1 of 30 Arcosteel woks by telling us in 10 words of less 'What would you like to see in future *Vital* e-newsletter issues?'
For terms and conditions visit www.mla.com.au/nutrition-vital. Entries close 30.05.14.

SAVE THE DATE – Annual symposium 'Getting the balance right' – 12th June 2014, 12:30pm – 5:00pm. Sydney

Ironing out weighty issues in young women

Iron deficient and overweight young women – a common problem

Iron deficiency is common in young women; with Australian estimates suggesting around 20–25% may be low in iron.[1] At the same time, there is some evidence that young Australian women are gaining weight faster than any other age or gender groups. Dietary advice which address this 'double burden' is necessary to ensure young women enter pregnancy healthy as good nutrition during the first 1,000 days – the period from conception to the child's second birthday – is considered critical for lasting health.

Iron-rich protein for weight management

Higher protein, low GI diets have been shown to be effective for achieving both weight loss and maintaining iron levels in young women.[2] Protein foods not only have benefits for appetite regulation, they also tend to be rich in nutrients. This is particularly important for iron, where animal protein provides iron in the most bioavailable form.

Cognitive effects, including aspects of mood and fatigue, which have been associated with iron deficiency, may affect a young women's ability to adhere to a healthy diet and lifestyle. Preliminary evidence suggests iron deficiency may influence impulsivity and potentially decrease dietary compliance by reducing self-control.[2]

Strategies to improve iron and zinc bioavailability at meal times

Lim et al provide a timely review of iron and zinc and food sources and recommend that those groups at risk of iron deficiency maximise iron absorption by consuming potential absorption enhancers while avoiding inhibitors at meal times.[3]

They suggest that bioavailability of iron may be just as important as the amount of iron in the diet. Single-meal absorption studies suggest that including 50mg of vitamin C or 50g of meat, fish or poultry can improve the iron absorbed from the meal; and that the inhibitory effect of phytates (most commonly found in legumes and wholegrains) may be tempered by consuming meat, fish or poultry as part of these meals. They suggest that tea and coffee may be best consumed approximately one hour before meal times and that calcium does not appear to have a significant effect on iron absorption.

Since dietary sources of bioavailable iron tend to rich in bioavailable zinc, there is some evidence that iron deficiency is often associated with zinc deficiency. Hence dietary strategies to improve bioavailable iron intake are likely to improve zinc status as well. While less is known about zinc due to the difficulty of measuring zinc status, as with iron, it is well established that phytate inhibits zinc absorption and a molar ratio of dietary phytate to zinc of less than 15 is recommended to prevent zinc deficiency.

Higher iron and zinc status with meat consumption

Although further research is required to better understand the impact of these enhancers of iron and zinc absorption in free-living populations, iron and zinc status tends to be higher in meat eaters than vegetarians. Despite similar iron intakes, iron status tends to be lower in diets with less meat, most likely due to differences in bioavailability.

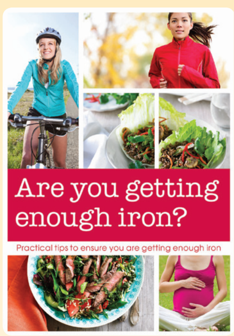
Intakes in women below recommended amounts

The latest Australian Dietary Guidelines recommend consuming 65g/day or 130g every second day of red meat to meet iron requirements. Findings from the last National Nutrition Survey in 1995 and the 2007 Australian Children's Nutrition and Physical Activity survey suggest that women and adolescent females are not eating the recommended amounts of red meat and that fortified cereals are making the greatest contribution to iron and zinc intakes. With no upper limits for iron and zinc fortification, Lim et al recommend research to assess their contribution, given the adverse consequences of excess iron and zinc consumption.[3] The availability of both dietary data and biomarkers in the Australian Health Survey, due for release later this year, will help to better understand this issue.

Women and adolescent's red meat consumption are influenced by a range of belief systems, including ethical and environmental concerns. Some studies suggest restrained eaters tend to restrict meat intake. It may be important to address these issues as part of dietary advice to ensure their viewpoints are adequately informed and do not compromise their health.

Updated brochure – *Are you getting enough iron?*

This popular brochure which MLA has been producing since the launch of the successful Iron Campaign in the 1990s has been updated to reflect new knowledge in nutrition science. Several focus groups were conducted to understand how best to communicate to women of child-bearing age, a key target audience for this brochure. Surprisingly, we found many young women believed that green leafy vegetables were the best source of iron and were unaware of the importance of iron bioavailability. To better explain this important concept, the amount of absorbable iron was calculated based on the advice of key experts in nutrition iron research.



Iron absorption calculations

Calculations of absorbed iron are based on 25% absorption of haem iron and 15% of non-haem (if meat, fish or poultry present in meal), 10% (if 25mg vitamin C present in meal) and 5% (if no enhancers present in meal). Approximately 60% of iron in meat, fish and poultry is haem iron.

Consultation with representative practitioners was conducted to ensure the content was consistent with recommended guidelines and our consumer insights expert provided advice on the most effective images, words and layout.

We would appreciate your feedback on its usefulness in your practice to guide future revisions.

References

1. Ahmed F, Coyne T, Dobson A, McClintock C. Iron status among Australian adults: findings of a population based study in Queensland, Australia. *Asia Pacific Journal Clinical Nutrition.* 2008; 17(1):40-47.
2. HL Cheng, H Griffin, C Bryant, K Rooney, K Steinbeck, H O'Connor. Impact of diet and weight loss on iron and zinc status in overweight and obese young women. *Asia Pacific Journal of Clinical Nutrition* 2013, 22(4): 574–582.
3. Lim K, Riddell L, Nowson C, Booth A, Szymlek-Gay E. Iron and zinc nutrition in the economically-developed world: A review. *Nutrients* 2013, 5: 3184–3211.

More protein with ageing
for active body and mind

Findings from Deakin's Centre for Physical Activity and Nutrition Research study in older women which was funded by Meat & Livestock Australia are now available online in the *American Journal of Clinical Nutrition*.[1]

Intervention study in 100 women aged 60–90 years

The four month trial was led by Professor of Exercise and Ageing, Robin Daly, in collaboration with Professor Caryl Nowson, combining physical activity with nutrition expertise. This community-based intervention in 100 women aged 60—90 years residing independently in 15 retirement villages in metropolitan Melbourne assessed the effects of progressive resistance training (a form of strength training) combined with a protein-rich diet on muscle size, strength and function as well as markers of inflammation, kidney function, blood pressure and lipids.

Protein (1.3g/kg/d) + resistance training + vitamin D

All women undertook resistance training twice a week and received 1000IU/day vitamin D3. The intervention diet was designed to provide at least 1.3g/kg/day of protein by including 160g of cooked, trimmed red meat as beef, veal and lamb in 80g serves twice a day for 6 days per week. Women in the control group were provided with and advised to consume 1 serve of pasta/rice per day. Throughout the study, their protein intake averaged ~1.1g/kg/day. There were no significant differences in total energy, fat, saturated fat, or iron intakes between groups at any time throughout the study, except for dietary zinc which was higher in the intervention group.

Greater muscle strength and mass

When compared to women in the control resistance training group, those on the trimmed red meat diet had an 18% greater increase in muscle strength and gained an additional 0.5kg of muscle mass. Given that the average loss in muscle mass and strength is about 0.4-0.8kg and 12–15% per decade, respectively, these findings represent clinically important changes. They were also found to have a 10% greater increase in serum IGF-1, an important muscle growth factor, and a 16% reduction in a pro-inflammatory marker that has been linked to muscle loss and other chronic diseases.

New study testing benefit for cognition

As this study clearly demonstrated that this diet and exercise regime has benefits for muscle function, probably through the increased production of IGF-1, it is conceivable that it may improve cognitive performance and neural health as IGF-1 is also necessary for the growth and function of brain cells.

To test this hypothesis and build on this evidence, the researchers are now recruiting for another new MLA-funded study to investigate the effects of progressive resistance training combined with a protein enriched diet consumed on training days three days per week on brain and nervous system function as well as muscle health in older adults.

3–4 serves red meat as per Australian Dietary Guidelines

Whilst there was no difference between groups in the previous study in blood lipids or blood pressure, consumption of 160g of red meat on most days is unrealistic and inconsistent with a balanced diet.

The new MLA funded study will therefore investigate whether similar benefits in muscle health are achieved with 3 to 4 serves of red meat per week as recommended in the Australian Dietary Guidelines. Meat intake will be recommended following exercise to optimise protein synthesis.

Reference

1. Daly RM, O'Connell, SL, Mundell NL, Grimes CA, Dunstan DW, Nowson CA. Protein-enriched diet, with the use of lean red meat, combined with progressive resistance training enhances lean tissue mass and muscle strength and reduces circulating IL-6 concentrations in elderly women: a cluster randomized controlled trial. *American Journal of Clinical Nutrition* 2014; doi: 10.3945/ajcn.113.064154

Meals providing 25–30g make it easier to meet the 1.3g/kg/day target and optimise protein synthesis by spreading protein intake over the day

Ploughman's lunch with leftover roast beef – great way of using leftover roast meat with common fridge and pantry staples.

- 1 slice leftover roast beef (65g) – 17g protein
- Cheddar cheese, reduced fat (20g) – 6g protein
- Bread, mixed grain (1 slice)– 3g protein

Total protein – 26g

Beef, barley and vegetable soup – soups are a great mid-meal snack that is popular among older people and can also double as hearty winter meal. Make in bulk and freeze in ready-to-eat single portions.

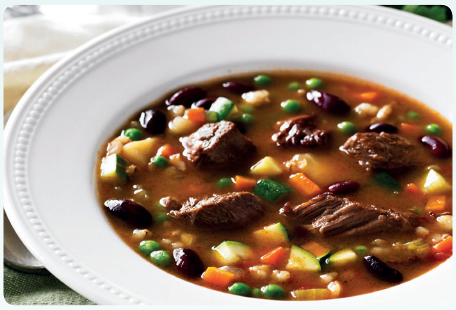
- Beef, steak, rump, raw, fat trimmed (100g) – 21.5g
- Pearl barley, raw (15g) – 1.5g

Total protein – 25g

Shepherd's pie – use mince and legumes to dial up the fibre and top with mash made from leftover roast potatoes.

- Lamb, mince, raw, premium (100g) – 20.5g
- Potato, raw, peeled (150g) – 3.5g
- Cheddar cheese, reduced fat (10g) – 3g
- Milk, reduced fat (30mL) – 1g

Total protein – 29g



Grass vs grain

– what is the difference?

When it comes to nutrient composition, the difference is not clear-cut because there is wide variability in the nutritional quality of 'grass' and 'grain' feeding regimes.

Findings from a large study[1] conducted by the Cooperative Research Centre (CRC) for Sheep Industry Innovation provides a wealth of data on the impact of different production systems on the nutrient composition of Australian lamb. The study, involving data from around 2,000 lambs per year across eight different sites is representative of different prime lamb production systems in Australia and provided an opportunity to explore the impact of different production factors on iron, zinc and fatty acid content.

Iron content reflects age, not feeding regime

The study shows that the iron content of lamb is mostly affected by animal age; however the zinc content of lamb was less variable. Older animals have higher iron content than younger animals. For instance, in NUTTAB, mutton leg has 4.3mg/100g of iron compared to 2.1mg/100g in lamb. To be labelled as lamb, the animal must have no erupted permanent incisors, after which it must be labelled as mutton.

Omega-3 content is reflective of feeding regime

The omega-3 content was predominantly determined by the nutritional quality of the feed. There was wide variability in content ranging from a minimum of 11mg/100g to a maximum of 112mg/100g (EPA, DHA and DPA). This reflects the wide range of feeds used in different production systems in Australia.

Wide variability in omega-3 content in grass-fed animals

There was a wide variability in the omega-3 content of 'grass-fed' animals due to the wide variety of pasture bases used to feed animals, as well as the impact of seasonal variation on the nutritional quantity and quality of the grass. These include lucerne, native grass, improved perennial pasture, ryegrass, clover, fescues, cocksfoots and brassicas. In general, actively growing pastures with strong leaf development, such as lucerne, tends to have higher omega-3 content because they contain higher levels of chloroplasts (which are rich in precursors of alpha-linolenic acid (ALA). There is a strong correlation between the alpha-linolenic acid (ALA) and long chain omega-3 fatty acid (EPA, DHA and DPA) content of the meat. This most likely reflects the ALA content of the grass which is converted into the long chain omega-3 fatty acids in the animal's rumen.

Omega-3 content is determined by the overall diet of the animal

Grain-feeding in Australia involves supplementing the grass-based diet with grains, hay, legumes, oil-seed by-products or crop residues. Contrary to common misconceptions, these are second-grade crops and are not suitable for human consumption. Consequently, grain-feeding does not divert resources from production of crops for human consumption. Undoubtedly, the omega-3 levels decline when an animal transitions from a grass-based to a grain-based diet. However, it is important to note that the decline will depend on the nutritional quality of the background diet. Hence, the omega-3 content of retail meat is determined by the sum of the overall diet, which in Australia, always includes grass-feeding. In this study, the average omega-3 content was 23.5mg/100g (EPA and DHA)/100g. Similar findings have been reported from our retail survey in Australian beef, with on average, 32mg/100g (EPA and DHA) and 35mg/100g in lamb.[2]

Trimming has greatest impact

Despite differences in production systems, the nutrient content of meat has remained fairly consistent over the last 20 years. Changes in butchering and meal preparation practices have had the greatest impact on nutrient levels, in particular, fat and saturated fat content.

Since the level of fat trim of meat available for purchase contributes the greatest level of variability, recommendations to prepare meals using meat trimmed of all visible fat using a sharp knife remains the best advice for enjoying Australian beef and lamb as part of a healthy, balanced diet.

What is grass and grain feeding?

Grass-feeding

Similar to an 'ad libitum' style of diet, animals forage for their food. Depending on season, location, climate and geography, these diets might include native grasses and shrubs, irrigated and fertilised pastures, legume-based pastures, grain stubble left after harvesting, or conserved hay or silage (fermented grass).

Grain-feeding

Similar to a special diet designed to meet the nutritional needs of the animal. The feed is made from different ingredients that are combined to deliver the necessary protein, carbohydrate, fat and roughage required to keep the rumen healthy and meet the nutrient requirements of livestock. Ingredients commonly include feed-grade wheat, barley, sorghum or triticale; protein from lupins and field peas; by-products of cottonseed and canola; and silage or hay.

Grain-finished

Animals spend most of their days eating grass before being sent to feedlots where they are fed grain-based rations for a certain number of days. The number of days spent on grain is largely determined by market requirements in relation to eating quality and supply and also seasonal conditions. Whilst lamb are predominantly pasture-fed, 'partial' grain supplements may be provided for a relatively short period of time to assist with finishing when feed dry out in southern and western Australia.

References

1. Pannier L et al. Prime lamb supplies key nutrients for human health. *Animal Production Science* 2010; 50: 1115–22.
2. Williams P, Droulez V. Australian red meat consumption – implications of changes over 20 years on nutrient composition *Food Australia* 2010; 62(3):87–94.

Contact details: MLA Nutrition, Locked bag 991, North Sydney NSW 2059 Tel: 02 9463 9361 Fax: 02 9463 9173