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Higher protein diets: what's new?

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MEAT & LIVESTOCK AUSTRALIA

EDITORIAL

The symposium titled 'Higher Protein Diets: What's New?' was held in Sydney, Melbourne and Brisbane in March. Hosted by DAA and sponsored by MLA, evidence supporting the benefit of a higher protein diet for addressing health issues at key life stages was discussed. Presentations and webinars are available on DINER through the DAA website including:

- The RESIST study – dietary strategies to improve insulin sensitivity in overweight adolescents by Dr Sarah Garnett, Children's Hospital Westmead
- Strategies to improve compliance with weight management in young women by Dr Helen O'Connor, The University of Sydney
- Dietary strategies for improving muscle health in older women by Professor Caryl Nowson, Deakin University
- Health Benefits of Combining Exercise and Nutrition in Ageing – What to Recommend in Practice by Professor Robin Daly, Deakin University

The symposium highlighted several emerging health issues, including the need for evidence to inform best management of adolescents with insulin resistance; weight management in young women who are most at risk of weight gain; and dietary strategies for maximising the benefits of exercise to achieve optimal muscle health and function through aging.

Chairs Claire Hewat (DAA) and Mary Hannan-Jones (Queensland University of Technology) pointed out that emerging evidence continues to show that there is a need to consider macro-and micronutrients, as well as interactions and synergistic effects between nutrients, and other lifestyle factors such as physical activity. Claire encouraged dietitians to get involved in research and to collaborate with other disciplines, such as exercise physiologists and psychologists.

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Building muscle mas

a diet and exercise strategy

We are an ageing population. More than 1 in 4 Australians are over 65 years of age. Centenarians are the fastest growing age segment of the population. In this context healthy aging is critical for maintaining quality of life and reducing healthcare costs.

A major impact on quality of life is sarcopenia, making it an important public health issue and area of research.

Progressive resistance training (PRT) is well established as a way of increasing lean body mass. However, there is a marked heterogeneity in the anabolic response to PRT between individuals. This suggests that other factors are involved, including inflammation and nutrition.

Professors Robin Daly and Caryl Nowson have combined their expertise in nutrition and exercise physiology to investigate dietary strategies for maximising the benefit of exercise in the Women's Healthy Ageing and Muscle (WHAM) study (previously reported in *Vital* #50).

In his presentation, Professor Robin Daly explained that a combination of different exercises, together with dietary strategies, is required to achieve optimal muscle health and function in older adults and the elderly.

Defining sarcopenia

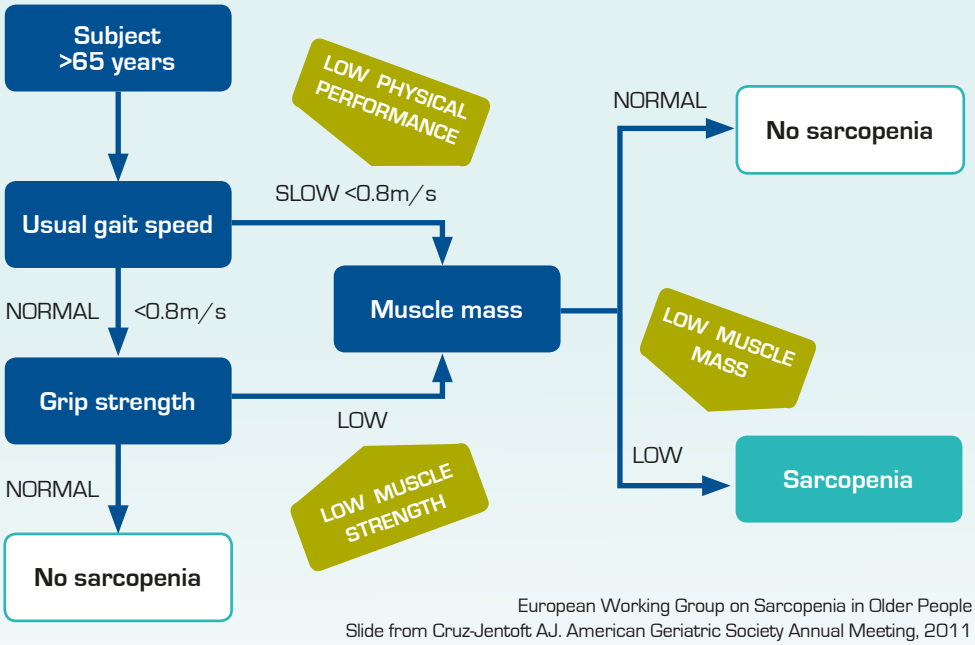
The European Working Group on Sarcopenia in Older People's Consensus Statement describes sarcopenia as 'a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death.' They recommend a two-part diagnosis which includes low muscle mass and low muscle strength or low muscle function (see Figure 1).

Defining sarcopenia in terms of muscle mass alone is too narrow and may be of limited clinical value. Muscle mass and muscle strength have different effects on muscle function and performance. For example, for an elderly women to cross the road quickly it is particularly important that she have adequate muscle strength, power and function (speed).

Exercise recommendations for healthy aging

Exercise recommendations for healthy aging should include a combination of aerobic exercise for cardiovascular health; resistance exercise for building muscle and strength; and balance exercise for those at risk of falling (see 2007 physical activity guidelines).

Figure 1: Suggested Algorithm for Sarcopenia



European Working Group on Sarcopenia in Older People
Slide from Cruz-Jentoft AJ. American Geriatric Society Annual Meeting, 2011

ss and function in the elderly:

2007 PHYSICAL ACTIVITY GUIDELINES for adults >65 years with chronic conditions

Aerobic Exercise

- ≥ 30 minutes of moderate intensity on 5 days/week*

OR

- ≥ 20 minutes of vigorous intensity on 3 days/week

AND

Resistance Exercise

- 8–10 exercises @ 10–15 repetitions performed on 2 non-consecutive days; progressive; moderate (5–6) to vigorous (7–8) on the Borg Scale of 0 to 10.

AND IF AT RISK OF FALLING

Balance Exercise

- Progressively challenging exercises to help maintain balance and prevent falls; no current recommendations on the dose

* You can "bank" aerobic activity throughout the day. However, activities must last for at least 10 min without stopping to count toward your daily total (eg. 3 x 10 min bouts = 30 minutes).

Nelson M et al. Med Sci Sports Exer 39: 1435-45, 2007

Professor Daly explained that the type of exercise prescribed depends on the desired outcome i.e. increased muscle mass; function; or falls prevention (see best practice recommendations).

Importantly, Professor Daly explained that not all exercises are relevant for preventing sarcopenia and falls. For instance, walking, while beneficial for cardiovascular health, is not effective for improving muscle mass or preventing falls. In fact, walking may increase an individual's exposure to risk of falls while reducing the time available for more effective challenge balance activities. Similarly, cycling and swimming are great for improving fitness but since they are non-weight bearing they are unlikely to be effective for increasing muscle function or bone strength.

Older adults should be advised to undertake a progressive resistance training program under professional supervision.

Best practice recommendations for:

> **Sarcopenia prevention**

Moderate to high intensity progressive resistance training (PRT): The key is to progressively overload the muscles, increasing weights by 5–10%. A variety of exercises should target large muscles groups including legs, chest, back, arms and shoulders. Free weights, weight machines and resistance bands all offer increasing levels of difficulty to keep challenging muscles.

> **Muscle function**

High challenging balance and power training: An example of a high challenging balance activity involves heel-toes walking, standing on one leg with eyes open and then closed or transferring body weight from one leg to the other while leaning forward or minimising the use of hands for support. Power training involves performing resistance training exercises such as the leg press or squats in quick, controlled movements where the focus is on muscle force and movement speed.

- **Falls prevention**

Moderate to high challenging balance activities combined with lower extremity strengthening exercises: Adding dual task activities, such as stepping in time with music or counting backward by 3's whilst balancing, further strengthens the ability to prevent falls in daily life.

FACTORS THAT AFFECT THE RESPONSE TO EXERCISE:

Professor Daly explained that the following factors, including nutrition, may explain the varied response to PRT reported in the literature. Combining exercise with diet is therefore important to achieve optimal muscle health.

1. **Protein**

   An increase in skeletal muscle mass arises from a positive net protein balance where muscle protein synthesis exceeds muscle protein breakdown. PRT stimulates muscle protein synthesis but in the fasted state, it can also result in muscle protein breakdown. The provision of dietary protein following PRT inhibits muscle protein breakdown. In the elderly, the anabolic response to dietary protein appears to be blunted in comparison to the response in younger individuals. This suggests that higher protein intakes are required to achieve a positive net protein balance.

2. **Vitamin D**

   Low levels of vitamin D are associated with greater losses of muscle strength, muscle mass and function in older persons. There is increasing evidence of vitamin D deficiency and insufficiency in older Australians. Professor Daly commented on the prevalence of vitamin D insufficiency in older Australians, with 70% of men and 89% of women over the age of 65 recording vitamin D levels of less than 75nmol/L. Vitamin D supplementation has been shown to reduce the risk of falling.

3. **Low grade, systemic inflammation**

   An increase in systemic inflammation caused by the release of cytokines is associated with aging and has been linked to disability, muscle weakness and atrophy in the elderly. Chronic diseases commonly seen in older people, including cardiovascular disease, diabetes, cancer and dementia are also characterised by increased levels of inflammation.

   Muscle protein synthesis may be inhibited by inflammatory cytokines, such as tumour necrosis factor-alpha (TNF-) and interleukin-6 (IL-6) and low grade systemic inflammation has been shown to attenuate the impact of exercise-induced muscle gain.

   Reducing inflammatory markers is therefore important not only for improving muscle health and reducing risk of sarcopenia, but also for reducing risk of chronic diseases.

   In the WHAM study in which all women undertook progressive resistance training for 4 months, the decrease in circulating IL-6 in the higher protein group was significantly greater than the control carbohydrate group. This suggests that combining PRT with increased protein may represent an effective strategy to reduce inflammation in the elderly. The mechanism for this response is not clear and further research is required.

INCREASING PROTEIN INTAKE WITH EXERCISE IN THE ELDERLY

Professor Caryl Nowson argues that protein intake should be modestly increased for the elderly, especially in those undertaking regular PRT.

Physiological end-points, she says, rather than nitrogen balance, should be used to determine protein requirements. She points out that no physiological variable of consequence to human health has been associated with being in nitrogen balance, yet there is emerging evidence that higher protein intakes can improve muscle mass, strength and function; immune status; wound healing and bone health.

Energy-adjusted protein intake was associated with 3-year changes in lean mass in a longitudinal study of 70–79 year olds (n=2066). Subjects in the highest quintile of protein intake (91g/day; 1.2g/kg) had a 40% lower loss in lean body mass compared to those in the lowest quintile (57g/day; 0.8g/kg).[1] Professor Nowson noted that, "interestingly in this study, animal, but not vegetable protein was significantly associated with preservation of lean body mass."

The current Australian RDI for protein for men aged 70-plus is 1.07g/kg/day, and for women it is 0.94g/kg/day. Although this is 25 per cent higher than that recommended for younger adults, protein intake tends to decline with age. Meat is a major source of protein in the Australian diet and in the 1995 National Nutrition Survey, adults aged over 60 years consumed 34% less meat than those aged 25–44, contributing to lower protein intakes.

A review of optimal protein intake in the elderly suggests 1.5g protein/kg/day, or about 15–20% of energy, is a reasonable target, but this may be difficult for many older people to achieve.[2] In the WHAM study, subjects in the higher protein group increased their protein intake to 1.3g/kg/day compared to the higher carbohydrate control group (1.1g/kg/d).This was achieved by boosting their consumption of red meat to 160g (cooked weight)/day six days a week where intake was spread over lunch and dinner.

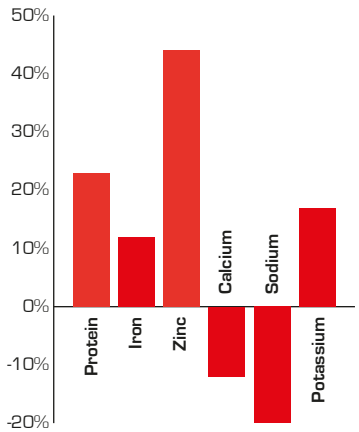
The higher protein diet in practice

Both diets in the WHAM study were popular with subjects. Compliance in the control group was 100%, and 80% in the meat group. It is interesting to consider how increased meat intake in the higher protein diet affected the nutritional profile of the diet.

As illustrated in Figure 2, on the higher protein diet, intake of protein, iron, zinc and potassium increased from baseline, while intake of sodium and calcium decreased. Professor Nowson suggested the decrease in calcium intake may possibly be due to substitution of meat for cheese at lunch.

Whilst this study used meat as a primary method of increasing protein intake, in practice, a combination of protein sources, including dairy and legumes, would ensure requirements for nutrients, such as calcium as well as dietary fibre, are met.

Figure 2: Percent change in nutrient intake (baseline vs. higher protein intervention)



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The RESIST study:
the first trial to provide evidence

Dr Sarah Garnett, Senior Research Fellow, Institute of Endocrinology and Diabetes, the Children's Hospital Westmead, is investigating dietary strategies for effectively managing insulin resistance in overweight adolescents.

Recognising the problem

Type 2 diabetes used to be a disease that only affected adults. However, with 1 in 4 Australian children now overweight or obese, insulin resistance and pre-diabetes are fast becoming a significant health problem in children and adolescents. Management is critical as insulin sensitivity progresses to type 2 diabetes more rapidly in children than in adults. Further, the complications associated with type 2 diabetes are common and appear early in the disease when it is diagnosed in adolescence. In a Canadian study, 69 adolescents diagnosed with type 2 diabetes were followed into adulthood. By age 23, 9% had died, 35% had microalbuminuria, 6% required dialysis, 45% had hypertension and 67% had poor glucose control.[1]

Evidence on management

Despite the serious consequences, there is little evidence on the management of insulin resistance and pre-diabetes in children and adolescents. In adults, management strategies which combine the use of metformin with diet and physical activity are effective. There is increasing evidence that in adults a higher protein, moderate-carbohydrate diet may be more effective than the traditional low-fat, high carbohydrate diet for achieving weight loss and improving markers of metabolic health, such as glycaemia, lipidaemia and blood pressure. In clinical practice, dietitians have also had success using a higher protein diet to treat adolescents with insulin resistance.

Establishing an evidence base in adolescents

Dr Garnett and her team at the Children's Hospital Westmead are keen to establish an evidence-based management plan for adolescents at risk of type 2 diabetes. They set up the RESIST study; a multi-centred, randomised, controlled trial Researching Effective Strategies to improve Insulin Sensitivity in children and Teenagers (RESIST)[2]. The primary aim of the study was to determine the effectiveness of two different structured dietary interventions on insulin sensitivity in adolescents with clinical insulin resistance and/or pre-diabetes treated with metformin.

The study diets differed in macronutrient content: one a high carbohydrate, low fat diet; and the other an increased protein, moderate carbohydrate diet. The first three months included intensive dietary intervention with regular contact with a dietitian, followed by an intensive three month exercise program with a personal trainer and a six month maintenance phase, with 24 months of follow up in total.

Study findings are due in August 2012 for results following the first six months of the trial.

THE RESIST STUDY DESIGN

Participants:

- 111 overweight adolescents, aged 10–17 years
- Pre-diabetic and/or clinical features of insulin resistance including a fasting insulin/glucose > 20
- With one or more of the following: Acanthosis nigricans, polycystic ovarian syndrome, hypertension, dyslipidaemia

Outcome measures:

- Insulin sensitivity index: 2 hour OGTT measured at 3, 12 and 24 months.
- Fasting insulin/glucose ratio at 6 months
- Weight, BMI, waist circumference and % fat change (DXA)
- Cardio-metabolic and clinical indicators

Intervention:

- All prescribed metformin
- Diet 1 high carbohydrate structured meal plan: 55–60% carbohydrate, 30% fat and 15% protein
- Diet 2 increased protein structured meal plan: 40–45% carbohydrate, 30% fat, 25–30% protein
- Intensive exercise program with a personal trainer from 3–6 months

SAMPLE MEAL PLAN FROM THE TWO DIETS IN THE STUDY

	Diet 1 – High carbohydrate, low fat	Diet 2 – Increased protein, moderate carbohydrate
Breakfast	2 breakfast (Weet-Bix) biscuits 200mL low-fat milk 1 tsp honey 1 piece fruit	1 slice of wholemeal toast 1 tsp margarine 1 egg 1 piece fruit
Morning tea	200mL low-fat flavoured milk 30g muesli bar	200g low-fat yoghurt 1 piece fruit
Lunch	2 slices wholemeal bread 1 tsp margarine Unlimited salad vegetables 1 piece of fruit	2 slices wholemeal bread 1 tsp margarine 50g lean meat Unlimited salad vegetables
Afternoon tea	2 slices wholemeal bread toasted 4 tsp peanut butter	4 wholegrain cracker biscuits 1 slice reduced fat cheese
Dinner	1 cup cooked pasta 100g meat & tomato based sauce 1 cup (or more) mixed vegetables/ salad	150g beef steak 1 potato mashed 1 cup (or more) mixed vegetables/ salad
Supper	2 scoops low-fat ice cream 1 cup strawberries	200mL reduced-fat milk 1 tbs Milo

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1. Dean HJ, Flett B. Diabetes 2002; 51.
2. Garnett SP, Baur LA et al. BMC Public Health 2010, 10.

Higher protein diets,
satiety and weight management

Evidence continues to build supporting the effectiveness of a higher protein diet for weight management.

In her presentation, Dr Helen O'Connor outlined evidence on the effectiveness of higher protein, low GI diets from her study in 18–24 year old women and the recent Diogenes study in families (previously reported in *Vital* issue 49). In her presentation, Dr O'Connor considered why this approach may help to improve compliance in weight management in young women.

The Protein Leverage Hypothesis

The Protein Leverage Hypothesis proposes a mechanism for the link between protein and satiety. This hypothesis predicts that when regulating food intake, humans will prioritise protein over other macronutrients. "This is an interesting concept that suggests excess carbohydrate and fat will be consumed to meet a certain protein target when there is not enough protein in the diet," explains Dr O'Connor.

Research on the Protein Leverage Hypothesis began in animal and insect studies and a small study in humans has recently been published. The short-term study in 22 subjects measured energy intakes and hunger over three 4-day periods, where diets provided 10%, 15% and 25% of energy from protein. Lowering the protein intake from 15% to 10% resulted in a 12% increase in energy intake, mainly from snacking in between meals. The authors concluded that a 1kJ decrease in protein intake below the 15% level, resulted in a 4.5kJ increase in non-protein intake.[1]

Whilst more research is required to test this hypothesis further in humans, Dr O'Connor noted that in her study, although the young women tended to report less hunger and desire to eat on the higher protein diet compared to the higher carbohydrate diet, the results were not statistically significant. It is possible that the differences may be too subtle to be subjectively perceived and measured. It is also possible that since appetite and hunger are complex, other factors, such as nutrient adequacy, behavioural and lifestyle barriers, may play a role.

The influence of nutrient adequacy

Dietary modelling of different diets highlights how difficult it is to meet nutrient requirements, particularly iron, when energy intake is restricted.[2] Modelling demonstrated that it was easier to meet requirements for nutrients like iron and zinc on a higher, animal protein based diet because of greater nutrient density and bioavailability. Dr O'Connor found iron deficiency (<15µg/L ferritin) in 16.9% of young women seeking weight management in her study. Tiredness and fatigue are common symptoms of iron deficiency and this may compromise compliance with both healthy diet and activity plans necessary for successful weight management.

Behavioural and lifestyle barriers

Behaviour modification is an integral part of best practice for weight management and 'lack of control' or 'emotional eating' may compromise weight loss success. "The young women in our study often reported difficulty with eating control and emotional eating. Another major issue was balancing weight management with socializing" said Dr O'Connor. She explained that socializing which often involved eating out and alcohol and the need for a flexible, less restrictive approach, makes weight management more difficult for young women.

"Young women on the higher protein diet in our study, whilst not all significant, tended to score better than those on the higher carbohydrate diet for measures of restraint, disinhibition and binge eating" said Dr O'Connor. Self worth also tended to improve to a greater extent in the higher protein diet group. It is possible that the reported higher satiety of the higher protein diet combined with its nutrient density and potentially less restrictive approach assisted the young women with the control of eating and dietary compliance.

Reference

1. Gosby AK et al. PLoS One, 2011 Oct:6(10)
2. O'Connor H et al. Asia Pac J Clin Nutr. 2011;20 (2):206–211.

COMPLETE FOOD AND NUTRITION COMPANION: THE ULTIMATE A–Z GUIDE

Catherine Saxelby's latest book is another in her career-long effort to make good health easy. It's an accessible reference with more than 500 entries covering everything from whole foods, processed foods, basic staples, slow and seasonal foods to nutrients, supplements and additives. It has taken more than two years – and 400 pages – to compile. The book will become an invaluable reference for anyone interested in nutrition, and answers all those frequently asked questions with Catherine's customary good sense and accessible tone. A glossary and reference list for the book can be found on the Foodwatch website, www.foodwatch.com.au. The book is another example of Catherine's commitment to nutrition communication through her easy-to-read publications, magazine articles and her website, www.foodwatch.com.au

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