HEALTH AND BIOSECURITY
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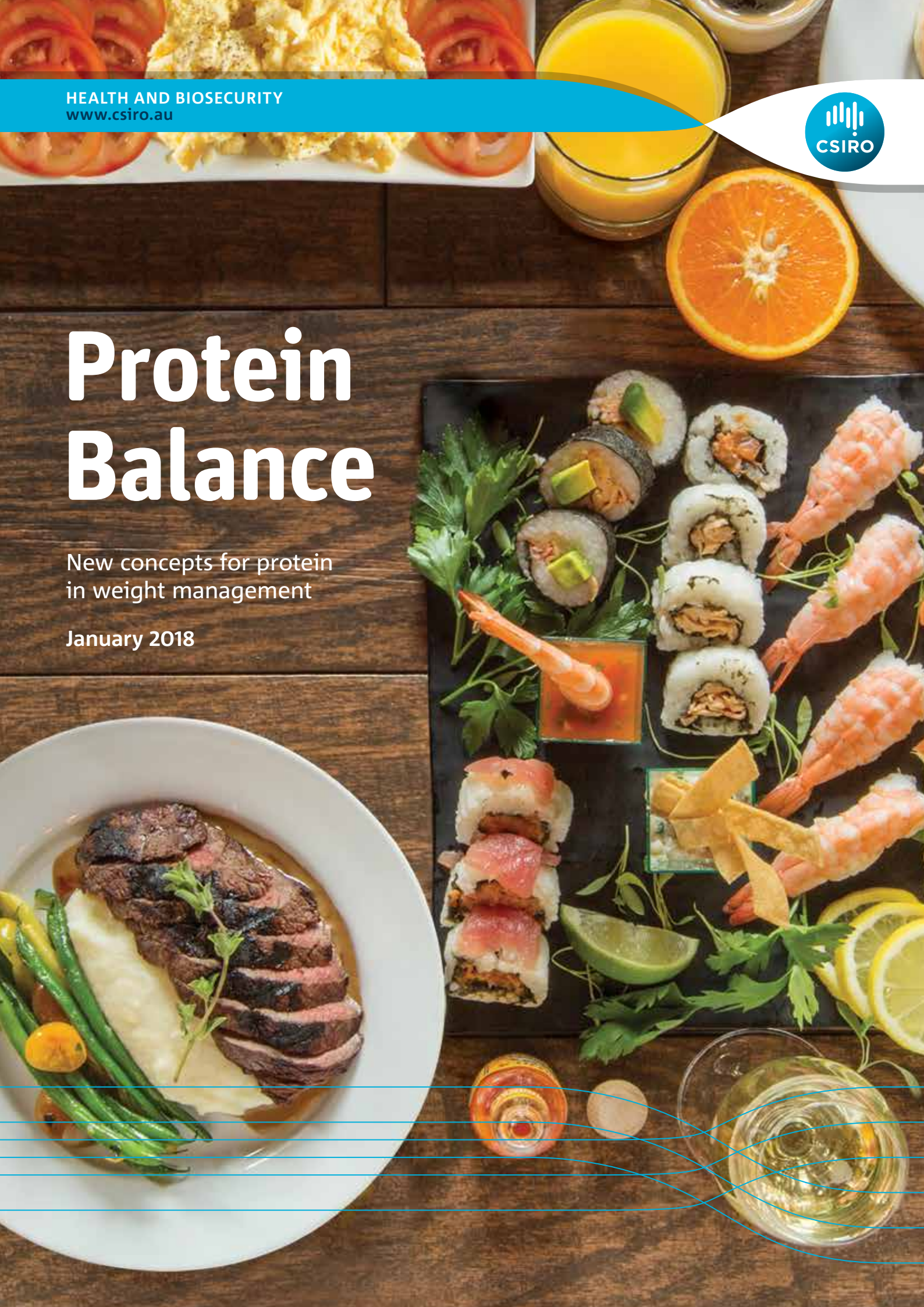
Protein Balance

New concepts for protein in weight management

January 2018



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M. Riley and D. Baird undertook the secondary analysis of protein intakes in Australia from the Australian Health Survey.

Contents

Executive summary

Protein requirements are increased for healthy weight loss

Australian dietary protein recommendations were released in 2006, but the latest science supports an increase in protein intake especially for overweight and older Australians who are seeking to lose weight.

More protein at breakfast for appetite control

While support for higher protein diets is well established to boost fat loss, new research suggests that protein at breakfast could reduce cravings later in the day, which may benefit weight management.

At least 25 g protein per meal

Australians currently get the majority of their protein at the evening meal, although the new science suggests that a more even distribution helps hunger management and muscle metabolism. It appears that 25-30 g protein per main meal is the threshold for benefits.

Protein-rich whole foods are the best choice

Australians are eating significant amounts of protein from foods not considered good sources of protein, such as junk food and cereal-based dishes, due to the large quantities in which these foods are consumed. Quality protein whole foods include lean meat, poultry, eggs, legumes and dairy products.

Protein balance helps craving control

The CSIRO Total Wellbeing Diet Online Protein Balance eating plan boosts fat loss and provides a steady distribution of protein across meals to reduce hunger and cravings.

Introduction

The Total Wellbeing Diet (TWD) Online was launched in 2015 by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and SP Health. The TWD Online platform was developed as a result of the research around weight loss conducted within the CSIRO's Health and Nutrition Program since 1999, which provided the scientific substantiation that a high protein, lower carbohydrate diet is safe and effective in weight loss and disease risk management [1].

The Total Wellbeing Diet also aimed to improve the nutrition status of Australians, as the eating plan is based on the Australian Dietary Guidelines and used recommendations for core food groups to meet nutritional recommendations as well as a higher protein composition. The distribution of protein which was clinically evaluated and shown to be effective was skewed towards the evening meal which was consistent with eating patterns on the Australian population.

The original output on the research was the book, The CSIRO Total Wellbeing Diet, which was adopted by around 10 per cent of Australian households. As of 2010, an estimated 547,200 people have lost weight through the Total Wellbeing Diet, based on a household survey of self-reported weight loss from this diet[2].

In 2014, the TWD Online platform was established to broaden the reach of the program to an online community.

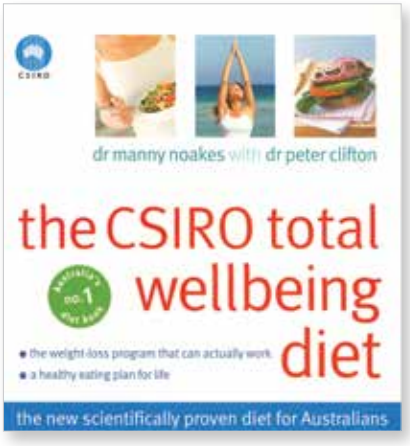
About Total Wellbeing Diet Online

Total Wellbeing Diet Online enables individuals to engage in a 12-week program of weight loss and improved health through diet modification to a higher protein and lower GI eating plan. The program has higher rates of sustained weight loss rather than necessarily superior immediate results compared to other forms of weight loss strategies.

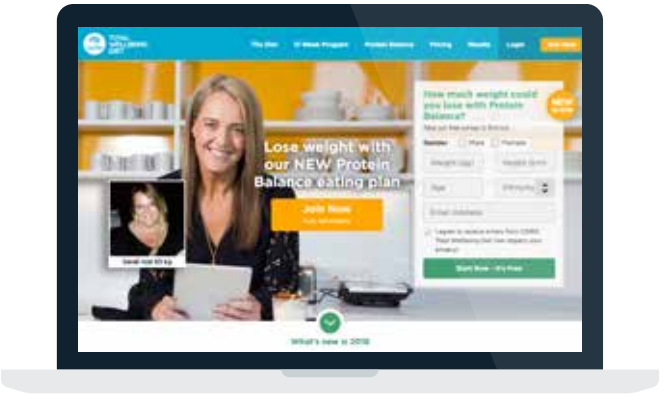
A recent report by the Centre for International Economics has estimated that CSIRO and SP Health's investment in the Total Wellbeing Diet Online has provided a stream of benefits that exceed costs by approximately 2.5:1.

Objectives of this report

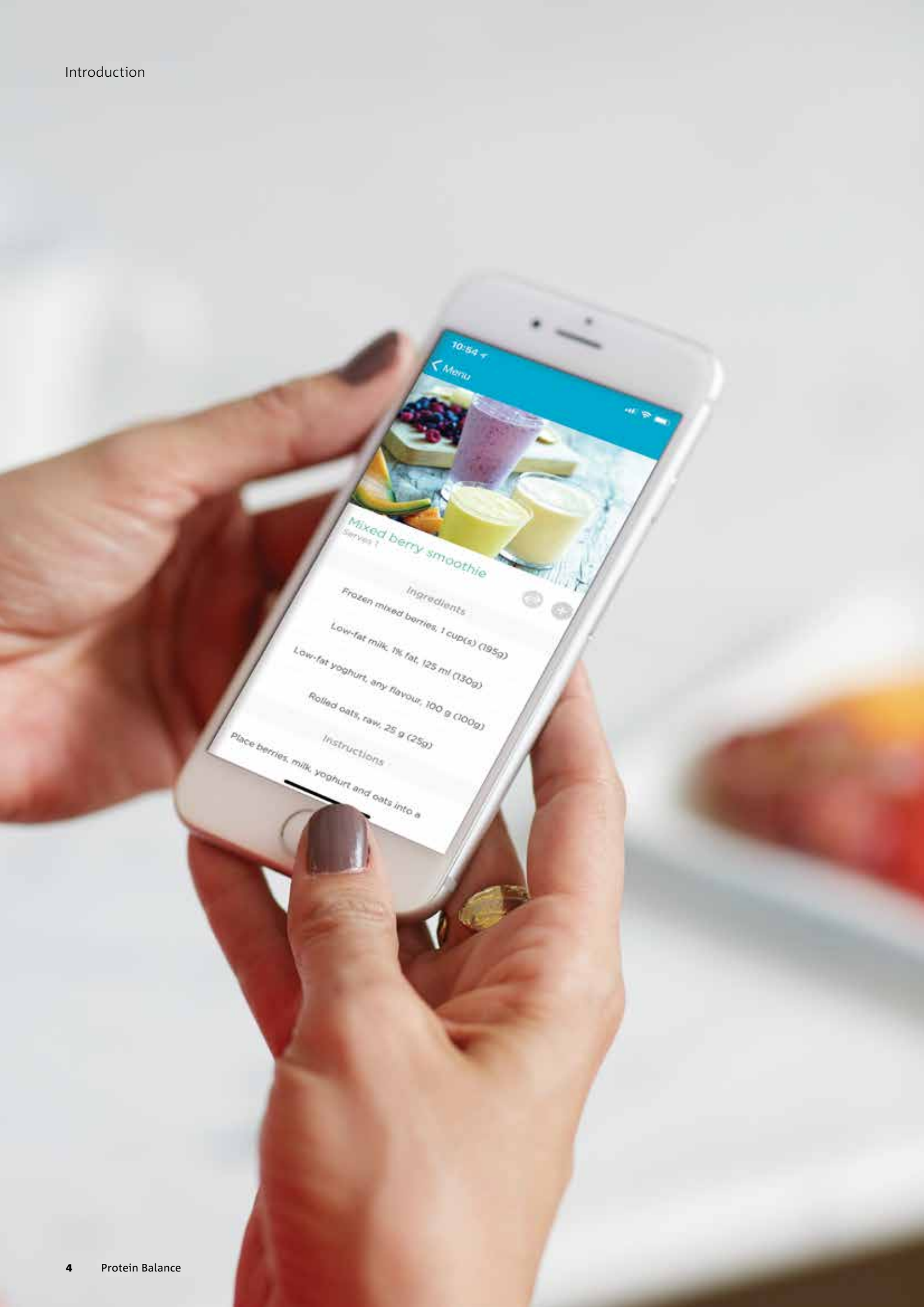
In order to maintain the scientific relevance of the Total Wellbeing Diet, continual review of the science which underpins the program is required. This report reviews the science which relates to dietary protein and its implications for evolving TWD Online to achieve optimal improvements in its members. In particular, this review focusses on new research relating to daily protein distribution and its associated meal pattern.



The CSIRO Total Wellbeing Diet book first published in 2005



Total Wellbeing Diet Online launched in 2015


10:54
Menu
Mixed berry smoothie
Serves 1
Ingredients
Frozen mixed berries, 1 cup(s) (195g)
Low-fat milk, 1% fat, 125 ml (130g)
Low-fat yoghurt, any flavour, 100 g (100g)
Rolled oats, raw, 25 g (25g)
Instructions
Place berries, milk, yoghurt and oats into a

The power of protein

Its role in weight loss and good health

FAST FACTS

Higher protein diets boost fat loss

Protein reduces cravings and helps control appetite

Protein requirements increase during weight loss

A personalised approach to protein intake is required

Protein and weight management

The beneficial role of protein in weight management has been established for some time[3,4] but continues to be topical with 3 more recent meta-analyses examining the effects of higher protein diets on body weight management and heart health.

Wycherley et al.[5] performed a meta-analysis with 24 tightly controlled feeding trials that compared higher protein with lower protein energy-restricted diets of 12 ± 9 weeks in duration. It included 1063 overweight and obese individuals between 18 and 80 years of age. The higher protein diets contained between 27% and 35% of daily energy intake as protein (1.07–1.60 g protein · kg^{-1} · d^{-1}), whereas the lower protein diets contained 16–21% protein (0.55–0.88 g protein · kg^{-1} · d^{-1}). Despite studies matching for energy intake, the higher protein diets led to an additional average weight loss of 0.79 kg; $P < 0.03$ and an additional fat loss of 0.87 kg; $P < 0.001$) compared with the lower protein higher carbohydrate diets. The higher protein diets also preserved more lean mass during weight loss by 0.43 kg; $P < 0.01$). Although both diets were equally effective in lowering fasting glucose, fasting insulin, blood pressure, and total LDL cholesterol, fasting triglycerides were lower in the higher protein diets by 0.23 mmol/L; $P < 0.0001$).

Similar findings were reported in a meta-analysis in individuals with type 2 diabetes[6]. Compared with the lower protein high carbohydrate diets, the higher protein diets led to additional greater average weight loss of 2.08 kg; $P < 0.05$), greater reductions in glycated hemoglobin concentrations of 0.52%; $P < 0.05$, and greater additional reductions in systolic and diastolic blood pressure of 3.13 mm Hg ($P < 0.05$) and –1.86 mm Hg ($P < 0.05$).

Santesso et al.[7] performed a meta-analysis of 74 randomized controlled trials again finding that the higher protein diets led to small to moderate advantages in greater weight loss, waist circumference, blood pressure, fasting insulin and triglycerides.

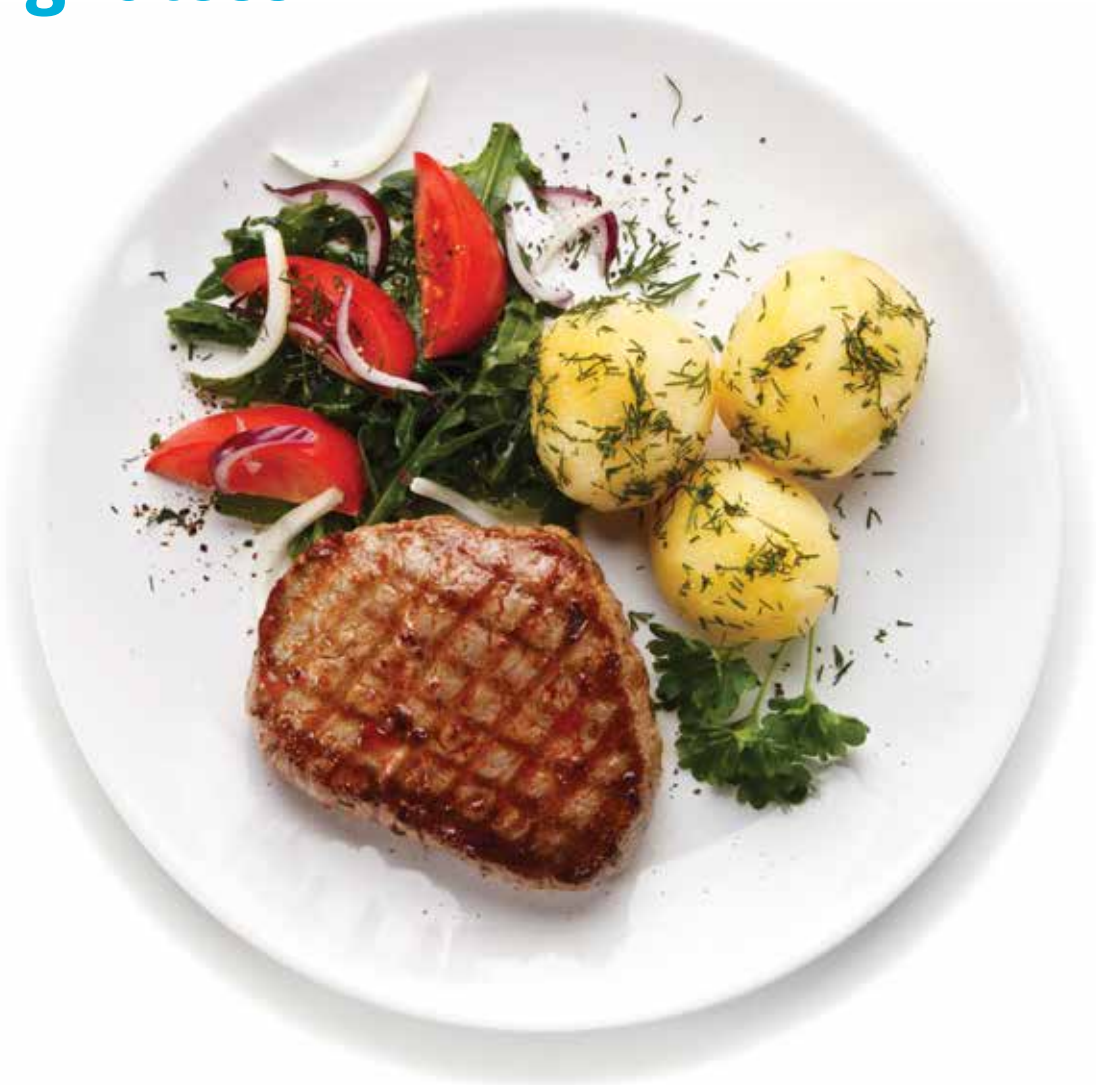
The single largest study examining higher protein and lower glycaemic index (GI) diets is the Diet, Obesity and Genes (Diogenes) Study [8]. This European multicenter trial included 938 adults as well as their children. In this study, a higher protein diet led to less weight regain than a lower protein high carbohydrate diet.

Benefits of protein for weight loss

Higher protein diets may have a positive effect on weight management for these reasons:

- **Better appetite control**: Protein-induced satiety from increases in concentrations of 'satiety' hormones as well as the increases in concentrations of branched chain amino acids after meals[9,10].
- **Metabolic enhancement**: Increases in the thermic effects of protein after meals which may either increase energy expenditure or help mitigate the reduction in metabolic rate following energy restriction and weight loss[11].
- **Reduced food cravings**: Recent studies have shown reductions in neural activation in brain regions controlling food motivation, reward, and cravings after high-protein vs. high carbohydrate breakfast meals[12,13].
- **Biological drive for protein**: According to the protein leverage hypothesis developed by Simpson and Raubenheimer, even small increases in the dietary percentage of protein at meals may have substantial effects on energy intake[14] with an essential biological drive to achieve an adequate protein intake compared to carbohydrate and fat.
- **Improved body composition**: Greater fat loss and less muscle loss is attributable to higher protein dietary patterns[5,7].

Benefits of protein for healthy weight loss



BETTER APPETITE CONTROL

PROTEIN HELPS YOU FEEL SATISFIED AND PREVENTS HUNGER

METABOLIC BOOST

PROTEIN HELPS BURN MORE KILOJOULES AND PREVENTS THE SLOWING OF METABOLISM THAT OCCURS WHEN YOU LOSE WEIGHT

REDUCED FOOD CRAVINGS

HIGH PROTEIN BREAKFASTS CAN HELP REDUCE NIGHT-TIME CRAVINGS

IMPROVED BODY COMPOSITION

HIGHER PROTEIN DIETS RESULT IN GREATER FAT LOSS AND LESS MUSCLE LOSS

REDUCED ENERGY INTAKE

INCREASES IN PROTEIN AT MEALS CAN HAVE SUBSTANTIAL EFFECTS ON ENERGY INTAKE, WHICH IS ESSENTIAL FOR WEIGHT LOSS

Australian protein recommendations – time for a review?

The Nutrient Reference Values for Australia and New Zealand developed in 2006[15] list the protein recommended dietary intakes (RDI) for men 19-70 years as 64 g per day and for women as 46 g per day with 25% increases in individuals >70 years. However more recent research shows protein intakes should be personalised to an individual's body weight.

Currrent protein recommendations per kilogram are 0.84 g per day for men (19-70 years) and 0.75 g per day for women (19-70 years) for healthy normal weight individuals. There are several limitations to these recommendations when developing diets for Australians.

1. **Not representative of the population**:
   The recommendations apply only to individuals with reference body weights 76 kg and 57 kg for men and women respectively. These weights are not reflective of the Australian population where >60% of adults are overweight or obese with average body weights of 86 kg and 71 kg for men and women respectively.

2. **Assumes protein and energy balance**:
   The RDI for protein assume individuals are in protein and energy balance and not applicable to those in energy restriction, i.e. those losing weight, where negative protein balance results.

3. **Assumes adequate muscle mass**:
   The RDI for protein assumes individuals have adequate muscle mass – again an unlikely scenario given the low levels of physical activity in the population. Older individuals also have suboptimal muscle mass and have higher protein requirements[16,17].

4. **Does not consider optimal muscle mass**:
   There is an assumption that the need for protein is to achieve zero protein accretion which does not consider the need for optimal muscle mass for muscle strength and other metabolic functions.

5. **Assumes high quality protein intake**:
   The recommendations assume that protein quality is high and in a mixed diet which is not the case for all protein sources.

AT LEAST
85 g
PER DAY
VS RDI
OF 45 G

HER PROTEIN NEEDS FOR WEIGHT LOSS

THE AVERAGE AUSTRALIAN WOMAN NOW WEIGHS 71 KG AND REQUIRES 85-114 G OF PROTEIN PER DAY FOR WEIGHT LOSS, HOWEVER, THE RDIS RECOMMEND ONLY 45 G OF PROTEIN PER DAY.

AT LEAST
100 g
PER DAY
VS RDI
OF 64 G

HIS PROTEIN NEEDS FOR WEIGHT LOSS

THE AVERAGE AUSTRALIAN MAN NOW WEIGHS 86 KG AND REQUIRES 103-138 G OF PROTEIN PER DAY FOR WEIGHT LOSS, HOWEVER, THE RDIS RECOMMEND ONLY 64 G OF PROTEIN PER DAY.

Personalised approach to protein

A more personalised approach is required for estimating protein needs in individuals based on age, gender, whether energy balance and particularly energy restriction is needed, and whether maintaining or increasing muscle mass is the goal.

Hence when estimating protein needs for individuals who have a vastly different body mass and who are embarking on a weight loss program, the absolute protein figures per kg need upwards adjustment.

Increased protein for weight management

A recent FAO report[18] published in 2013 recommended a population estimate of 0.99 g protein/kg/day, suggesting that prior protein requirements were too low. The report also affirmed that protein intakes greater than the minimum requirements might be required to optimise certain health outcomes in people of different ages and physiological states. These examples included weight loss, resistance physical activity and chronic inflammation. Research in this field is encouraged by the Expert Consultation and, recently, the PROT-AGE Study Group (formed by the European Union Geriatric Medicine Society, the International Association of Gerontology and Geriatrics, and other scientific organisations) developed and updated the evidence-based recommendations for optimal dietary protein intake that come with ageing, and recommended that older people should consume an average daily intake of 1.0 to 1.2 g protein/kg/day, providing 25 to 30 g protein per meal[16].

Substantial evidence further supports the consumption of increased dietary protein (ranging from 1.2 to 1.6 g protein • kg–1 • d–1) as a successful strategy to both prevent or treat obesity through reductions in fat mass and preservation of lean mass, as well as address protein needs of older individuals[19,20].

Further to this, substantial evidence supports the synergistic effects of dietary protein in combination with resistance exercise in increasing muscle mass and strength in healthy adults[21]. There are additional advantages of protein that are elaborated on further in this report.

TABLE 1. PERSONALISED DAILY PROTEIN REQUIREMENTS FOR WEIGHT LOSS

BODY WEIGHT	DAILY PROTEIN TARGET
50 kg	60-80 g
55 kg	66-88 g
60 kg	72-96 g
65 kg	78-104 g
70 kg	84-112 g
75 kg	90-120 g
80 kg	96-128 g
85 kg	102-136 g
90 kg	108-144 g
95 kg	114-152 g
100 kg	120-160 g
105 kg	126-168 g
110 kg	132-176 g
115 kg	138-184 g
120 kg	144-192 g
125 kg	150-200 g

Protein choices

How Australians get their protein

FAST FACTS

Australians get significant amounts of protein from foods not considered good sources of protein

Animal source foods (meat, dairy, eggs) are the most nutritious protein sources

Whole food proteins are nutritionally superior to processed proteins

Protein foods in the Australian diet

The major sources of protein in the Australian diet are derived from data from the Australian Health Survey (AHS) which is the most comprehensive cross-sectional nutrition and health survey ever conducted in Australia. The AHS was conducted by the Australian Bureau of Statistics (ABS) in 2011-2013, reaching 32,000 people (25,000 households). The AHS is comprised of three components; the National Health Survey (NHS), the National Nutrition and Physical Activity Survey (NNPAS), and the National Health Measures Survey (NHMS). The secondary analysis conducted for this report utilised data collected from 12,153 respondents completing the NNPAS. A detailed description of the sampling framework and data collection methods is available in the comprehensive 'Users Guide' accessible on the ABS website: **http://www.abs.gov.au/ausstats/abs@.nsf/mf/4363.0.55.001**.

Broad range of protein sources

The NNPAS data on sources of protein in the Australian diet is summarised below, showing a wide distribution of protein sources and not exclusively from animal source foods. As the graph shows, the protein intake in Australians is distributed widely over many food sources, many of which are not high in protein per se but because they are eaten in significant quantities, their protein contribution is significant. These are foods of cereal origin such as bread as well as discretionary foods such as cakes, biscuits and pastries.

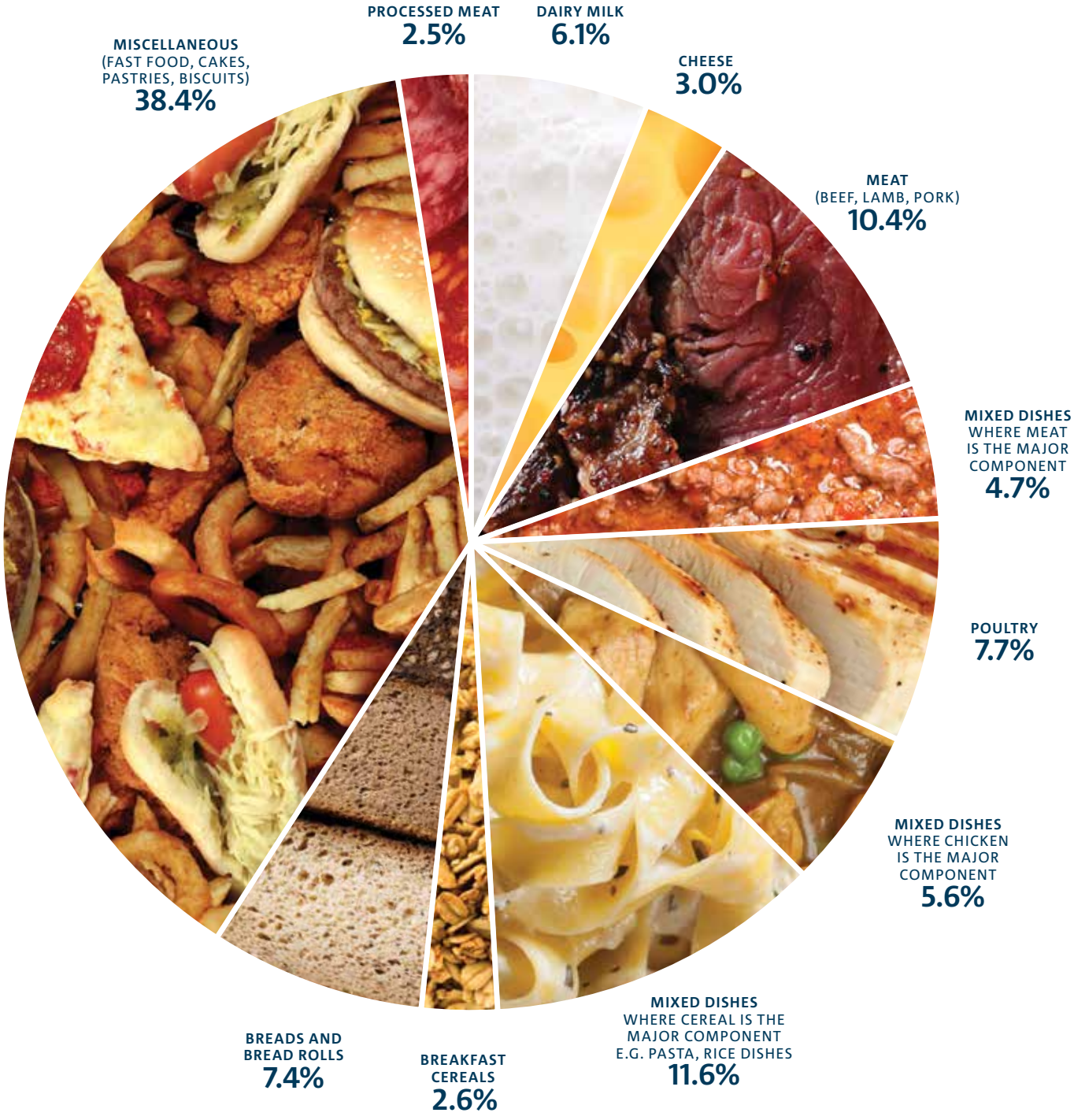
Whole foods vs processed protein

Whole food sources of protein are also sources of several micronutrients. In western diets, obtaining the recommended daily intake (RDI) for calcium, iron and zinc from whole foods necessitates protein intakes in excess of current RDIs. Some processed foods are designed to increase protein, often with purified protein ingredients. The result may be a convenient source of protein but lacking the other micronutrients that are in whole protein foods such as meat, legumes, dairy and eggs.

Best protein choices

The graph on page 22 outlines foods which provide significant amounts of protein per 100g. In general, animal source foods contain higher concentrations of protein than plant derived foods. Nuts and cheese contain moderately high amounts of protein per 100g but are also higher in kilojoules than meat, poultry and fish. The amino acid profile of protein sources differ with animal source foods containing all the essential amino acids. However, proteins from non animal sources, particularly legumes and grains, can be combined to achieve the right balance.

How Australians get their protein



High protein foods

LEAN BEEF
150 G RAW
33 G PROTEIN | 915 KJ

CHICKEN
150 G RAW
33 G PROTEIN | 660 KJ

WHITE FISH
150 G RAW
30 G PROTEIN | 720 KJ

TUNA
95 G CAN
19 G PROTEIN | 710 KJ

MILK
1 CUP
10 G PROTEIN | 550 KJ

HIGH PROTEIN MILK
1 CUP
15 G PROTEIN | 535 KJ

HIGH PROTEIN YOGHURT
170 G TUB
15 G PROTEIN | 575 KJ

CHEESE
35 G
9 G PROTEIN | 600 KJ

EGGS
2 (50 G EACH)
12 G PROTEIN | 600 KJ

TOFU
100 G
12 G PROTEIN | 530 KJ

NUTS
30 G
7 G PROTEIN | 745 KJ

LEGUMES
½ CUP
7 G PROTEIN | 450 KJ

Protein distribution

Why protein at every meal is important for weight control

FAST FACTS

Australians eat most of their protein in the evenings

A moderate amount of protein at every meal helps muscle metabolism

Higher protein breakfasts benefit appetite control and reduce cravings

A more even distribution of protein may make weight loss easier

Protein: how much, when and why

The consumption of a moderate amount of protein evenly distributed at each meal has been shown to stimulate 24-hour muscle protein synthesis more effectively than skewing protein intake toward the evening meal[22], which is typical among Australians. This suggests that such an approach may assist muscle mass, although measures of muscle protein synthesis may not conclusively translate to increased muscle mass. Kim et al argue that the net effect of both muscle protein synthesis and breakdown need to be considered when determining effects of diet on muscle mass and argue for an overall increase in dietary protein, particularly at breakfast and lunch where typically low protein intakes are common[23].

Benefits of protein at breakfast

Although the beneficial impact of protein distribution on body composition and muscle mass is promising, there is also accumulating evidence supporting higher morning protein intakes on appetite control[24].

Leidy et al showed that breakfast led to beneficial alterations in the appetite, hormonal, and neural signals that control food intake regulation. A high protein breakfast led to further alterations in these signals and reduced evening snacking compared with skipping breakfast in teenage girls[25]. A further study demonstrated that the daily addition of a high protein breakfast improved indices of weight management through voluntary reductions in daily food intake, particularly from high-fat/high-sugar evening snacks, and reductions in daily hunger and cravings in breakfast-skipping young adults with overweight/obesity[26].

A further study in men has shown that both 3 or 6 high protein meals a day led to greater evening and late-night fullness than consuming smaller amounts of protein[27]. However, consuming the same meal as a single eating event compared to multiple small meals or snacks is associated with a significantly higher increase in metabolic rate[28].

Impact of different protein meals

Sayer et al[29] found that protein and fibre at breakfast did not have separate, additive or interactive effects on food intake and appetite in overweight adults. However the high protein test meals were also higher in sugar content and not lower in carbohydrate, suggesting that other meal characteristics may negate the positive effects of higher protein meals on appetite control.

The form of the protein in the meal may also impact on appetite control with liquid meals having earlier satiating effects and solid meals having later satiety effects, meaning that liquid protein meals can make you feel fuller sooner, however, solid protein meals can make you feel fuller longer. However, the “fast” protein whey seems to be more satiating than the “slow” protein casein in the short term and vice versa in the long term.

Animal vs plant proteins

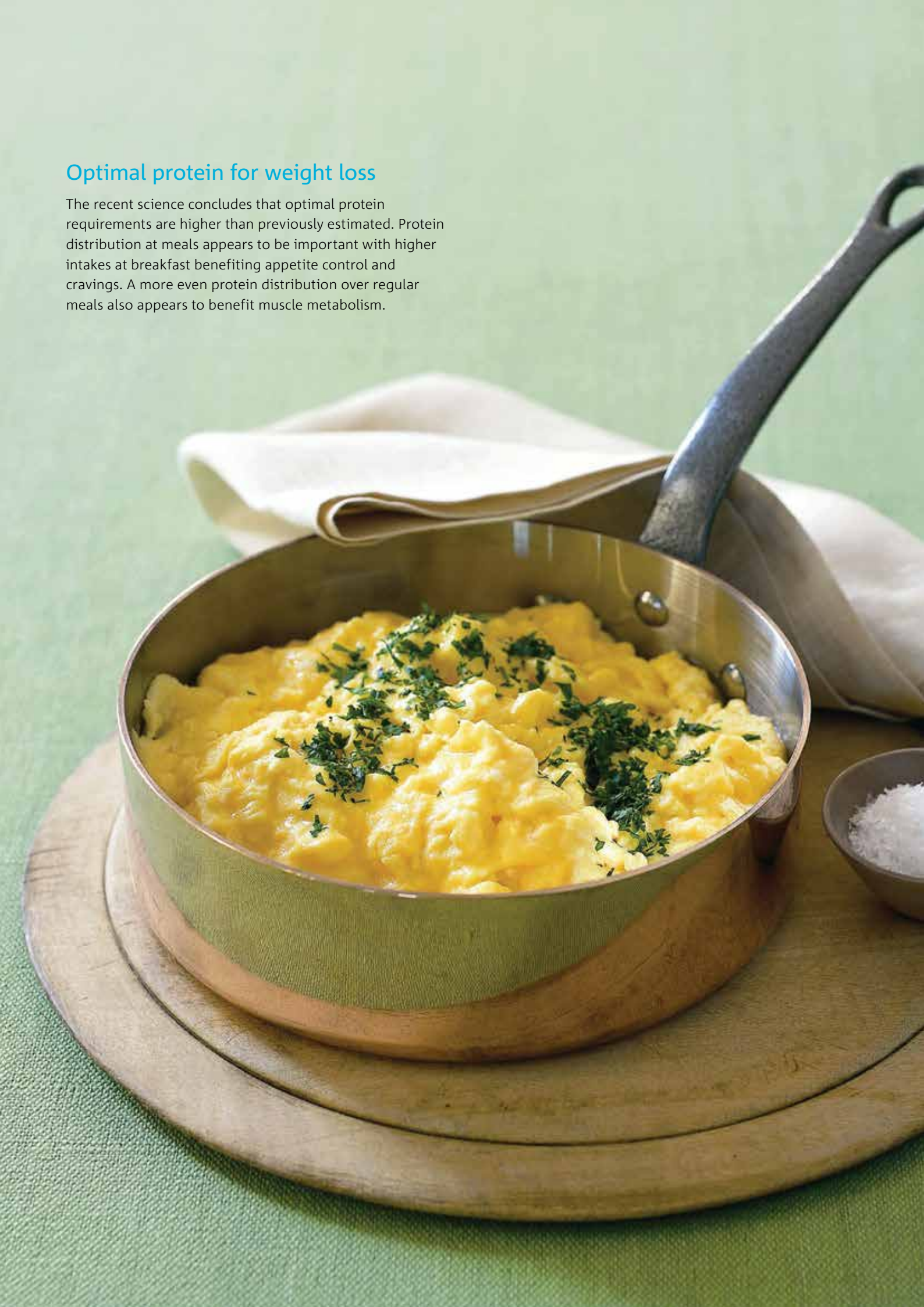
A recent review examined the theory that different protein sources affect body weight and composition to different extents[30]. They concluded that animal protein was better at promoting muscle protein synthesis than plant proteins. In contrast to this, studies have shown that incomplete proteins are slightly more effective in appetite control than complete or animal source proteins[31]. The most efficient way to maximise both muscle building response over a 24-hour period as well as appetite control is to ensure higher protein intakes particularly at breakfast and lunch, irrespective of the source.

The role of resistance exercise

There may be a diminished protein synthetic response to the ingestion of protein-dense food in overweight and obese adults compared with healthy-weight controls[32]. This impaired response to protein is offset through resistance exercise with a balanced protein distribution[33].

Optimal protein for weight loss

The recent science concludes that optimal protein requirements are higher than previously estimated. Protein distribution at meals appears to be important with higher intakes at breakfast benefiting appetite control and cravings. A more even protein distribution over regular meals also appears to benefit muscle metabolism.



Protein intake and distribution in Australia

In Australia, average protein intakes vary amongst men and women, age category and meal time. Table 2 below summarises the total protein intakes by gender in the Australian Health Survey.

Whilst on average, Australians appear to consume sufficient protein to meet minimal estimated protein needs, this assessment would need to be moderated, for example, if they are overweight or obese, whether they have insufficient muscle mass, if they are older and if they have metabolic diseases.

TABLE 2. AVERAGE DAILY PROTEIN INTAKE OF AUSTRALIANS

	MEAN PROTEIN INTAKE PER DAY	
AGE	FEMALES	MALES
14-18 years	77 g	101 g
19-70 years	79 g	107 g
71+ years	72 g	83 g

Typical protein distribution

The table below summarises the distribution of protein over main meals and all other occasions in Australian young and older adults by gender.

Overall, Australians have a skewed protein distribution which favours the evening meal with a relatively lower intake at breakfast. Protein intakes outside of main meal times are also significant and differ by age and gender. These represent total snack consumption over the day.

Although most Australian adults consume ≥25 g protein at dinner, the average consumption of protein at breakfast is consistently under 25 g for both men and women.

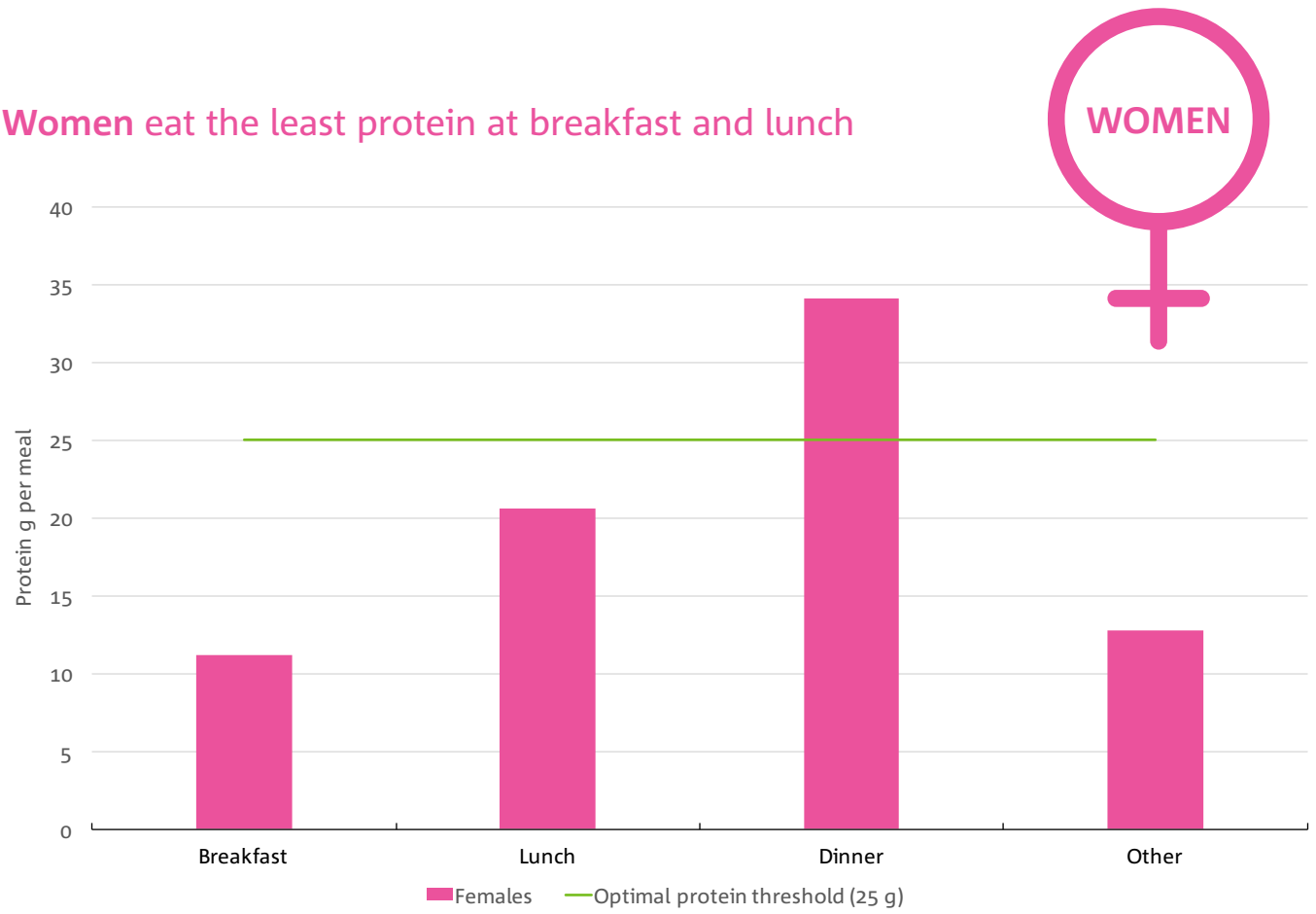
Differences in distribution by gender

Women generally have lower protein intakes than men at all meal occasions with both breakfast and lunch protein potentially below ideal quantities of 25-30 g for both satiety and muscle health. Men only have apparent deficits at the breakfast meal.

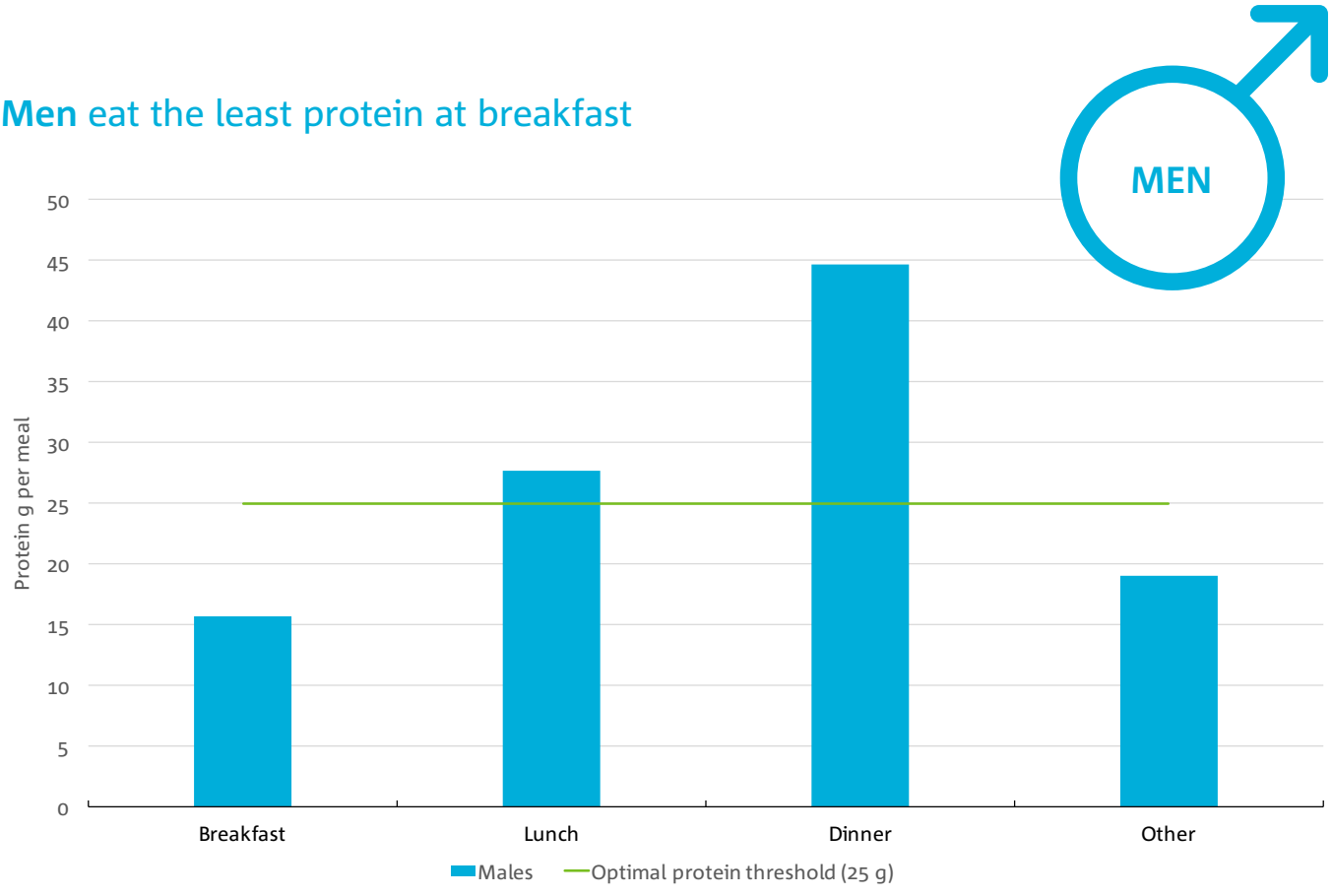
TABLE 3. AVERAGE MEAL TIME PROTEIN DISTRIBUTION OF AUSTRALIAN MEN AND WOMEN

GENDER	AGE	BREAKFAST	LUNCH	DINNER	OTHER	TOTAL
Females	14-18	11.5	18.3	32.1	14.6	76.5
	19-70	11.2	20.6	34.1	12.8	78.7
	71 +	11.2	20.7	30.5	9.2	71.5
Males	14-18	13.1	23.7	43.1	21.3	101.2
	19-70	15.7	27.7	44.6	19.0	107.0
	71 +	15.4	23.6	34.4	9.2	82.6

Women eat the least protein at breakfast and lunch



Men eat the least protein at breakfast



Optimal protein intake for healthy weight loss

Whilst both men and women appear to exceed their protein requirements based on the Nutrient Reference Values, more contemporary views on protein science suggests that optimal dietary intakes should be higher than recommended – particularly for older persons, people who are overweight or obese and those who are undertaking a weight loss program.

Higher protein diets that contain between 1.2 and 1.6 g protein per kg of body weight per day and potentially include meal-specific protein quantities of at least ~ 25 g protein per meal may provide optimal improvements in appetite, body weight management, and/or cardiometabolic risk factors compared with lower protein high carbohydrate diets.

Protein distribution for easier and healthy weight loss

As mentioned previously, although the current dietary guidelines state the recommendations in terms of daily protein food intake, the mechanistic data, particularly with regard to energy metabolism, protein synthesis, and appetite control, examine meal-specific quantities, not daily intake. In these studies, ~25–30 g protein per eating occasion was required to elicit protein-related benefits. Theoretically, if regular meal patterns contain at least 25–30 g protein per meal consumed throughout the day, the impact on both body weight/body composition as well as appetite control are enhanced.

The Total Wellbeing Diet Online Protein Balance eating plan includes 25 g protein at breakfast, 25 g at lunch, 40 g at dinner and 10 g at other occasions such as snacks.

Example of the protein distribution on the Total Wellbeing Diet's new Protein Balance eating plan

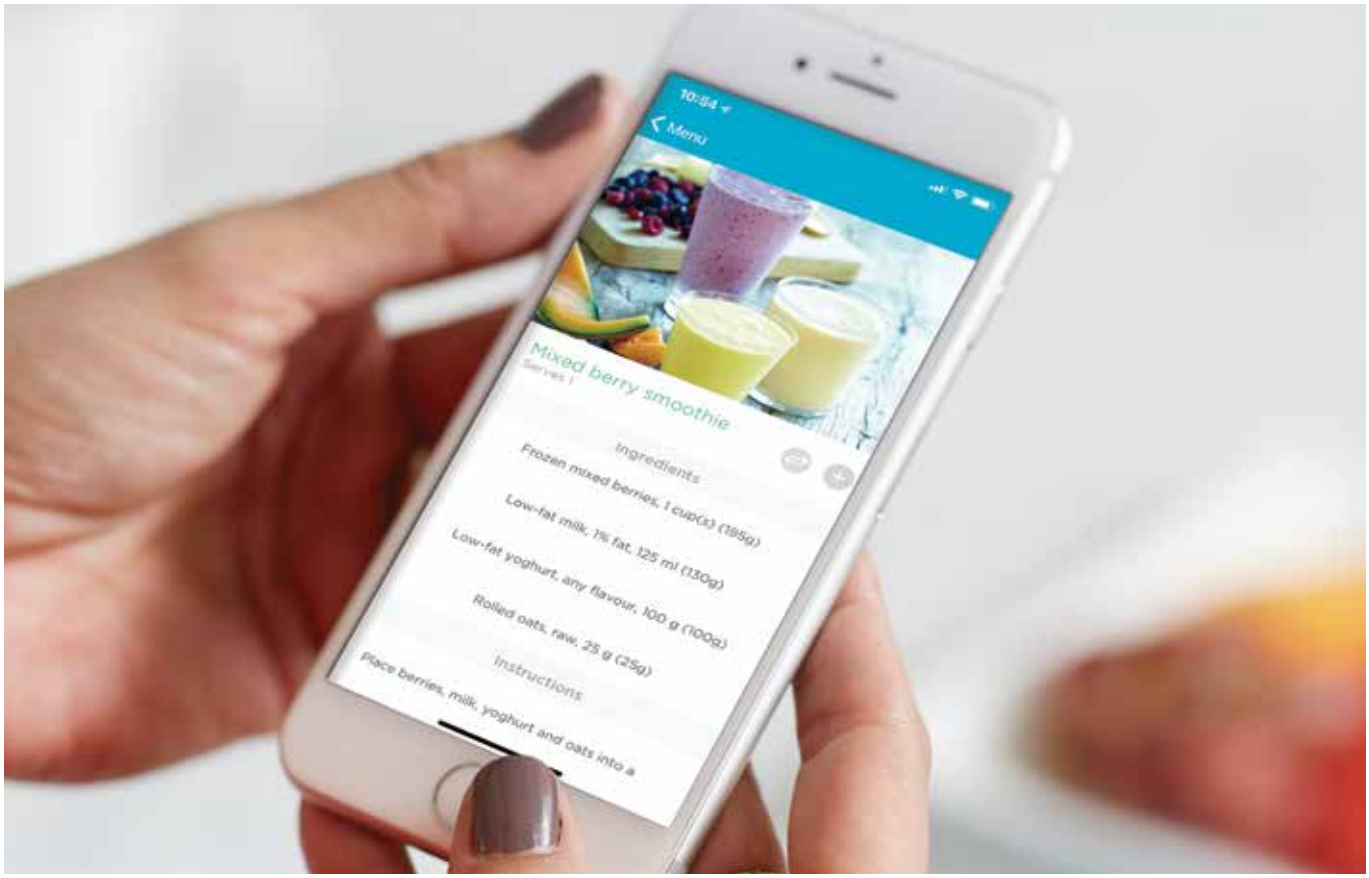
- 25 g BREAKFAST
- 25 g LUNCH
- 40 g DINNER
- 10 g SNACKS

The CSIRO Total Wellbeing Diet Protein Balance eating plan

This report highlights the need for a more personalised approach to protein recommendations, especially for those who need to lose weight. It also supports the importance of higher protein eating plans such as the Total Wellbeing Diet.

In 2018, the CSIRO Total Wellbeing Diet Online has added a new Protein Balance eating plan, consistent with the latest science, which includes at least 25 g of protein at every meal and increases protein at breakfast.

With its higher protein composition, the diet can help boost fat loss and its steady balance of protein throughout the day supports hunger management and reduced cravings.



totalwellbeingdiet.com

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