NUT CONSUMPTION, NUTRIENTS AND BETTER HEALTH

A secondary analysis of the Australian Health Survey data, together with current and emerging evidence on nuts and their health benefits

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EXECUTIVE SUMMARY

AUSTRALIANS AREN'T EATING ENOUGH NUTS

- Only 2% of Australians were eating the recommended 30g of nuts a day.
- Among all Australians, the mean intake of nuts was 4.6g a day.
- Of those who were eating nuts, i.e. 'nut consumers', the mean intake was 11.75g a day.

NUT CONSUMPTION IS LOWEST AMONG CHILDREN

- Of those who were eating nuts, children had the lowest mean intake (7.7g a day) - almost half that of adults (18-64 years mean intake 12.8g a day).
- A similar proportion of males and females reported eating nuts (20.1% of females and 19.1% of males).

MOST NUTS ARE CONSUMED AS PART OF CORE FOODS

- Most nuts were consumed as whole nuts or as part of core foods, based on AUSNUT 2011-13 major and sub-major food groups.
- Just 11.75% of nuts consumed were from discretionary products, such as confectionery, cakes and muffins.

EATING NUTS IS ASSOCIATED WITH SIGNIFICANTLY HIGHER INTAKE OF KEY NUTRIENTS

- Greater nut consumption was associated with significantly higher intakes of key nutrients including fibre, vitamin E, iron, magnesium and phosphorous.
- In the diets of nut consumers, whole nuts alone contributed more than 10% of the amount of selenium, linoleic acid, polyunsaturated and monounsaturated fat consumed.

EATING NUTS WAS NOT ASSOCIATED WITH HIGHER BODY WEIGHT

- Nut consumption was not associated with higher weight, BMI or waist circumference.

MOST AUSTRALIANS ARE MISSING OUT ON THE HEALTH BENEFITS ASSOCIATED WITH EATING 30g OF TREE NUTS A DAY.

- A 30g handful of nuts most days of the week is associated with:
  - 29% reduced risk of CHD[1]
  - 21% reduced risk of CVD[1]
  - 13% reduced risk of type 2 diabetes[2]
  - Reduced all-cause mortality[1]
  - Weight management[3-5]
  - 15% reduced risk of total cancer[1]
- Most Australians need to increase their nut consumption six-fold to meet population health recommendations.

FOREWORD

Even though it has been consistently demonstrated that nuts are a key food in healthy dietary patterns, this new analysis shows a lack of translation into Australian eating habits. Instead of a reasonable amount of 30g a day, Australians are reporting an average intake of only 4.6g of nuts a day.

In the context of a healthy diet, regular nut consumption is associated with a range of cardio-metabolic benefits and, unlike other foods, is not linked with weight gain. Despite this knowledge, poor eating habits continue to contribute to the burden of lifestyle related chronic disease. There is clearly a need to find ways of enabling shifts in national dietary patterns toward healthier food choices, including nuts, in meals and snacks consumed across the day.

By Professor Linda Tapsell, PhD FDAA FNSA AM

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Enjoy a 30g handful of nuts every day for good health.

INTRODUCTION

This report presents the results of a new analysis of Australian Bureau of Statistics (ABS) data showing the extent of nut consumption among Australians aged two years and older, including the health benefits and nutrients associated with nut consumption. It also summarises evidence on the heart health benefits of nuts from a recently updated systematic literature review, together with a summary of other emerging areas of research pertaining to the health benefits of regular nut consumption.

The new analysis is the first study to report nut consumption from all sources (including those found in mixed dishes and products) in a representative Australian sample. The results of this analysis provide new insights into what we know and understand of nut consumption among Australians. It provides proof that Australians are a long way off meeting the suggested daily target for nut intake and are consequently missing out on the significant health benefits. The results showed that the mean intake of nuts was just 4.6g a day, with only 2% of Australians meeting the 30g a day target.

The analysis also investigated nutrient intake and showed that nut consumption was significantly associated with greater intakes of fibre, vitamin E, iron, magnesium and phosphorous. Consistent with the scientific literature, nut consumption was not associated with higher weight, BMI, or waist circumference.

Nuts play a significant role in delivering essential nutrients and in providing evidence-based health benefits.

For decades now, nut consumption has been associated with a reduced risk of cardiovascular disease (CVD).[1] This is consistent with our recently updated systematic literature review on nuts and heart health, which found a causal relationship between nut intake and heart health indicators, and reduced mortality from CVD.[3] Nut consumption has also been associated with reduced risk of other chronic diseases such as type 2 diabetes[2] and metabolic syndrome[6]. Research also shows that those who consume nuts tend to gain less weight over time[4] and have healthier diets overall.[7,8]

Results from this analysis clearly indicate that Australians need to increase their consumption of nuts substantially to gain the significant benefits that nuts offer – increasing their average consumption by more than six times. We recommend for everyone to enjoy a 30g handful of nuts, every day, for good health.

Belinda Neville, APD
Nutrition Program Manager
Nuts for Life

A SECONDARY ANALYSIS OF THE AUSTRALIAN HEALTH SURVEY: ABOUT THE RESEARCH

In 2018, Nuts for Life commissioned the University of Wollongong to undertake a secondary analysis of the Australian Bureau of Statistics (ABS) 2011-2013 Australian Health Survey (AHS).[9] The AHS is the largest and most comprehensive health survey conducted in Australia. The survey was designed to collect information from Australians about health-related issues, including health status, risk factors, socioeconomic circumstances, health-related actions and use of medical services. The survey collected information on nutrition, physical activity and national biomedical information collection. The 2011-12 National Nutrition and Physical Activity Survey (NNPAS) was part of the AHS and obtained detailed 24-hour recalls (including foods and beverages consumed) on two separate days. Day one included data from more than 12,000 Australians and more than 7,500 Australians on day two. Survey data was collected from May 2011 to June 2012.

Results from the NNPAS suggested on the day of the survey (i.e. day one 24-hour recall) Australians consumed a mean of 5.2g of nuts.[9] However, given the food categorisation system used in the NNPAS, this information was based on whole nuts only and did not include nut consumption from mixed dishes such as breakfast cereals, baked goods or muesli bars, which may have underestimated consumption. In addition, currently available data on nut consumption from NNPAS is based on one 24-hour recall. In order to more accurately estimate consumption, a specific nut database was developed for application to the NNPAS.[5]

RESEARCH AIMS

The overarching aim of the research was to explore the relationship of nut consumption vs. non-nut consumption on nutrient intakes and anthropometric measures - including weight, waist circumference and body mass index (BMI) - among Australians aged two years and older. Specifically to:

- Apply the nut specific database (developed previously)[5] to dietary intake data.
- Quantify nut consumption in Australia.
- Determine contributions of nuts to nutrients intakes.
- Identify associations between nut intake and anthropometric and blood pressure measurements.

METHOD

The nut specific database was applied to the 24-hour recall data to identify nuts and nut-containing products and the number of nuts (in grams) in each product. Nut consumption and energy intake were then determined for both 24-hour recalls. Usual intake of nuts and energy were then determined using the multiple source method (MSM), which determines usual intake of all participants based on the 24-hour recalls.[10] The sampling design of the survey was also taken into account to ensure data was representative of all Australians.

Mean nut consumption was determined for the total Australian population, which comprised of consumers who ate nuts ('nut consumers') and those that didn't eat nuts ('non-consumers'). Mean nut consumption was also calculated for 'nut consumers' only.

Linear regression was performed to explore the association between nut consumption and anthropometric measures (body weight, waist circumference and BMI) and systolic and diastolic blood pressure. Confounding factors (age, gender, usual energy intake, physical activity and education level) were considered in the analysis.

In both the Australian population, as well as among nut consumers, the majority were not meeting the 30g target. As a result, nut intake was further examined in 5g increments (i.e. below 5g/day; between 5-10g/day etc).

The relationship between grams of nut intake and consumption of key nutrients (dietary fibre, vitamin E, calcium, iron, magnesium and phosphorous) was explored via linear regression. The selection of nutrients was based on those nutrients found to be higher in nut consumers in a representative sample in New Zealand.[8]

Food sources of nuts were also investigated. The proportion (%) of nuts contributed by various AUSNUT 2011-13* major and sub-major food groups was determined. Additionally, the proportion of nuts consumed from discretionary and core products was determined, as well as the proportions of each type of nut consumed. The percentage contribution of all nut products (i.e. including mixed dishes which contain nuts), and products that only comprised nuts (e.g. whole nuts), to overall intakes was then determined.

**AUSNUT 2011–13 was developed to enable food, dietary supplement and nutrient intakes to be estimated from the 2011–13 Australian Health Survey (AHS). It categorises foods into major food groups (e.g. 'nuts and nut products') and then further breaks this down into 'sub-major' food groups (e.g. peanuts; peanut products; coconut and coconut products; other nuts and nut products and dishes; mixed nuts or nuts and seeds).*

Although peanuts are not a true nut, they are included in this analysis as they are categorised in the 'nut and nut products' food group used in the AHS. Other nuts included in this analysis include all tree nuts - almonds, Brazil nuts, cashews, chestnuts, hazelnuts, macadamias, pecans, pine nuts, pistachios and walnuts.

A SECONDARY ANALYSIS OF THE AUSTRALIAN HEALTH SURVEY: RESULTS

NUT CONSUMPTION IN AUSTRALIA

HOW MANY AUSTRALIANS WERE EATING NUTS?

The NNPAS collected data from 12,153 participants, who were representative of the Australian population of 21,526,456 at the time of the survey. Among the Australian population the mean intake of nuts was 4.61g a day. The proportion of Australians who were consuming the recommended 30g intake was 2.2%, with 97.8% of Australians not meeting the recommendation.

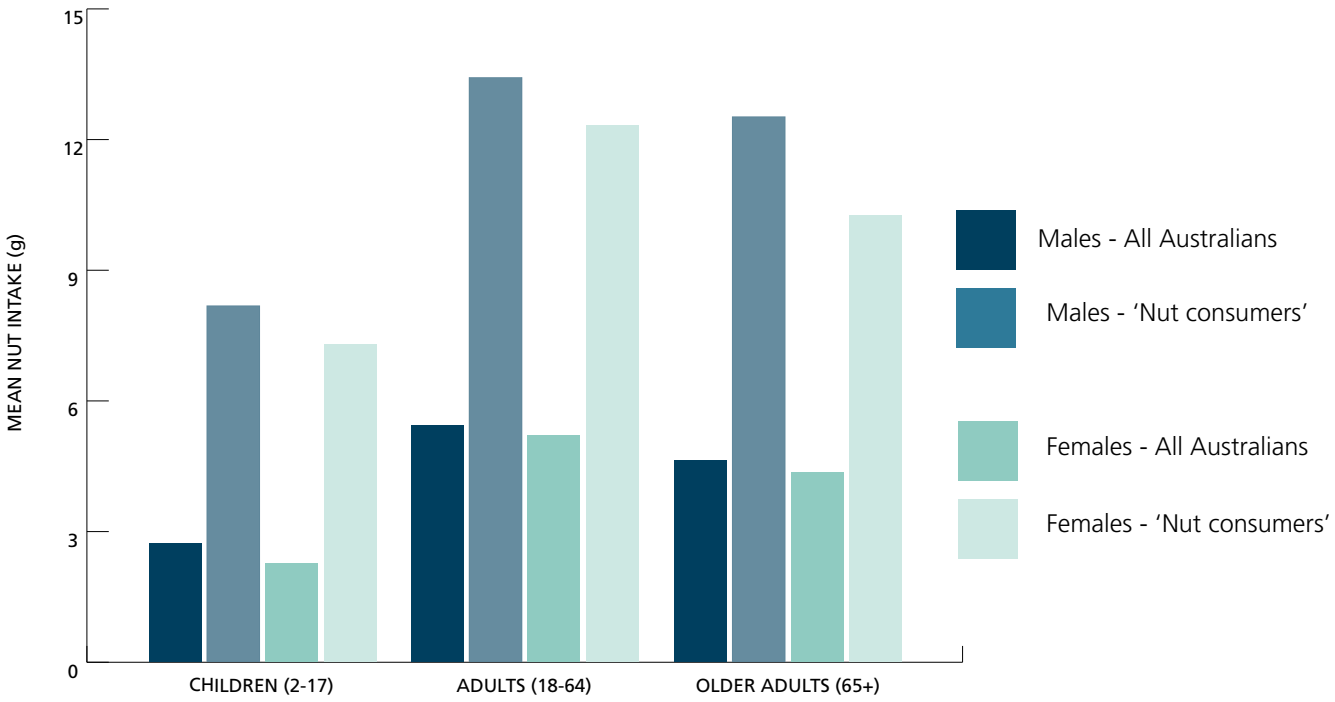
Just under 40% (39.2%) of Australians were found to be 'nut consumers'. Among nut consumers, mean intake was 11.75g a day, with 5.6% meeting the recommendation of 30g of nuts a day.

NUT INTAKES AMONG ALL AUSTRALIANS AND NUT CONSUMERS

NUTS CONSUMED	LESS THAN 5g	5-10g	10-20g	20-30g	30g OR MORE
ALL AUSTRALIANS PERCENTAGE (%)	71.20	12.38	9.73	4.50	2.19
'NUT CONSUMERS' PERCENTAGE (%)	26.57	31.56	24.82	11.46	5.59

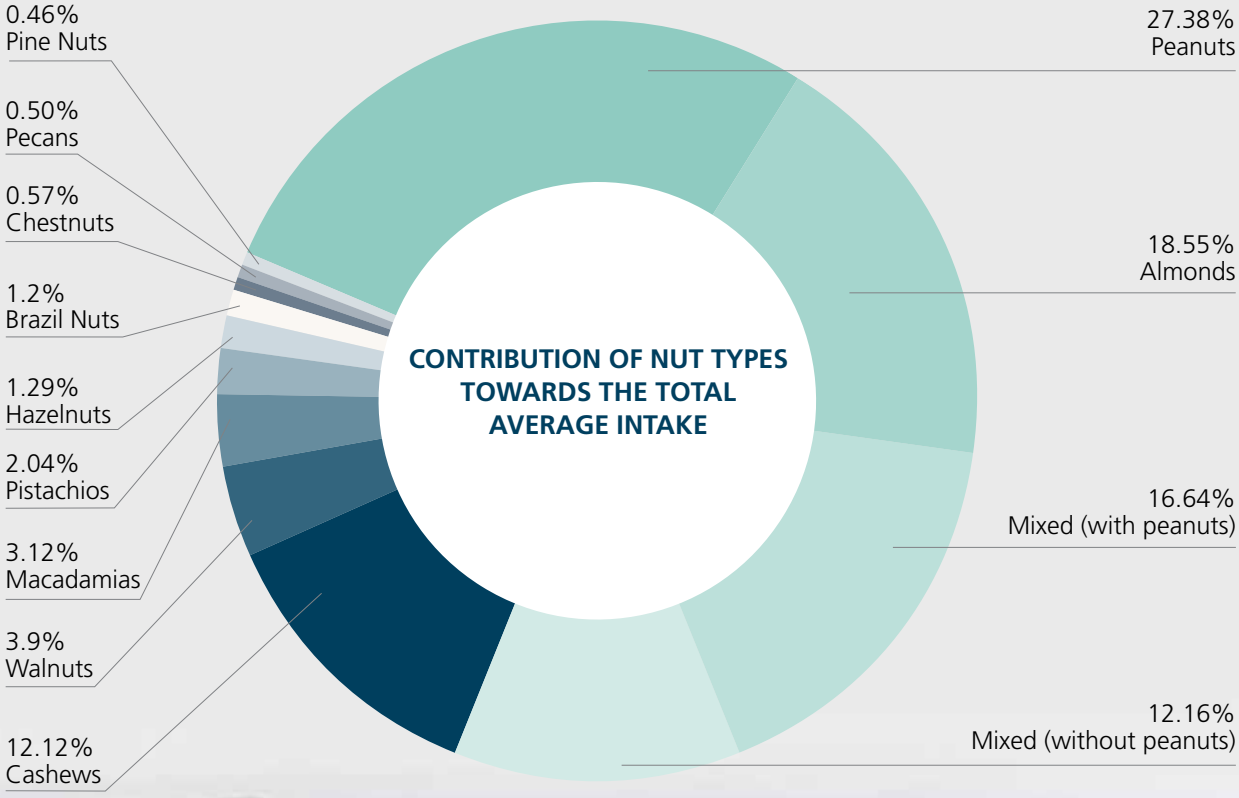
Nut consumption was examined according to age and gender groups. Age groups were split into three groups: children (2-17 years), adults (18-64 years) and older adults (65 years and older). A similar proportion of males and females reported consuming nuts. Of those who reported consuming nuts, 20.1% were female and 19.1% were male. Children were the least likely of the three age groups to consume nuts.

MEAN NUT CONSUMPTION BY GENDER AND AGE GROUPS



WHAT VARIETIES OF TREE NUTS WERE EATEN?

Of the tree nuts eaten, almonds were the most commonly reported (18.55% proportion of total nut intake), followed by mixed nuts (12.16%) and cashews (12.12%). Peanuts, whilst not a true nut, made up 27.38% of the total nut intake.



Only 2% of Australians were eating the recommended 30g intake a day, with a mean nut intake of 4.6g a day.

HOW WERE NUTS CONSUMED?

Based on the AUSNUT 2011-13 categorisation, the food groups whereby nut consumers ate the majority of nuts was from the 'seed and nut products and dishes' (e.g. whole nuts) category. This made up 76.08% of the total nut intake. The other food groups contributing the next highest levels of nut intakes were from 'confectionery and cereal/nut/fruit/seed bars' (e.g. muesli bars) which made up 7.33%, 'cereals and cereal products' (e.g. breakfast cereals) which made up 5.21% and 'cereal based products and dishes' (e.g. cakes and muffins) which made up 3.26% of the total nut intake.

These results showed that the majority of nut consumers were consuming nuts from core foods, with 11.75% coming from discretionary products such as confectionery, cakes and muffins.

CONTRIBUTION OF TOP FOOD GROUPS TOWARD THE AVERAGE NUT INTAKE OF 'NUT CONSUMERS'

MAJOR FOOD GROUPS* (BASED ON AUSNUT 2011-13)	PROPORTION (%) OF NUT INTAKE OF 'NUT CONSUMERS'
Seed and nut products and dishes	76.08
Nut and nut products	*76.08*
Confectionery and cereal/nut/fruit/seed bars	7.33
Chocolate and chocolate-based confectionery	*3.97*
Muesli or cereal style bars	*2.94*
Fruit, nut and seed bars	*0.42*
Cereals and cereal products	5.21
Breakfast cereals, ready to eat	*5.21*
Cereal based products and dishes	3.26
Cakes, muffins, scones, cake-type desserts	*1.70*
Mixed dishes where cereal is the major ingredient	*0.79*
Sweet biscuits	*0.38*
Pastries	*0.38*

*Sub-major food groups shown in italics

NUT CONSUMPTION AND NUTRIENT INTAKES

WHAT WAS THE RELATIONSHIP BETWEEN NUT INTAKE AND THE CONSUMPTION OF KEY NUTRIENTS?

Consumption of nuts was found to be associated with significantly higher intakes of fibre, vitamin E, iron, magnesium and phosphorous.

WHAT NUTRIENTS DID NUTS (AND NUT PRODUCTS) CONTRIBUTE?

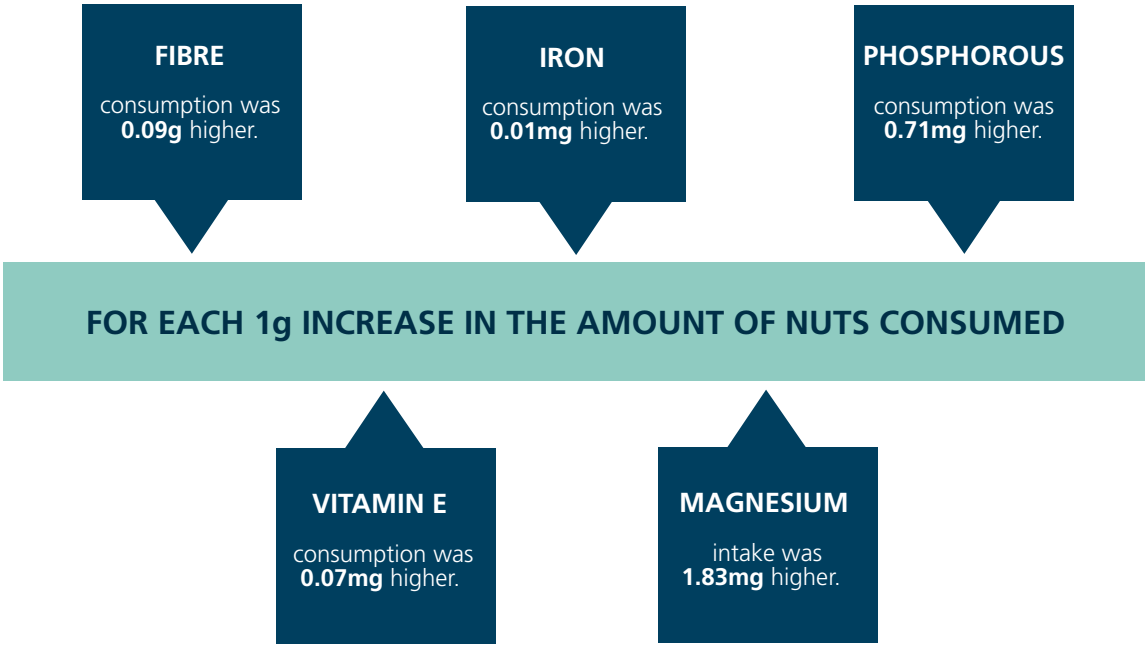
Both nut products and whole nuts contributed substantial proportions of total nutrients. Nut products contributed more than 20% of the amount of linoleic acid, polyunsaturated and monounsaturated fat, vitamin E and total fat. Whole nuts alone contributed more than 10% of the amount of linoleic acid, polyunsaturated and monounsaturated fat and selenium.

PERCENTAGE CONTRIBUTION TO NUTRIENT INTAKES BY ALL NUTS IN 'NUT CONSUMERS'

NUTRIENT	% FROM ALL NUT PRODUCTS (I.E. NUTS AND NUTS FROM MIXED DISHES)	% FROM NUT-ONLY PRODUCTS
Protein	9.22	2.46
Saturated fat	12.65	2.84
Polyunsaturated fat	28.09	11.78
Omega 6 linoleic acid	*30.85*	*13.29*
Omega 3 alpha-linolenic acid	*16.47*	*4.75*
Monounsaturated fat	27.02	12.29
Dietary fibre	15.27	3.16
Calcium	6.53	1.44
Iron	15.36	3.19
Magnesium	18.34	6.27
Phosphorous	11.63	3.18
Selenium	17.32	10.07
Vitamin E	23.88	8.9
Vitamin B1 (thiamin)	11.98	2.76
Vitamin B2 (riboflavin)	10.19	2.89
Niacin equivalents	10.9	2.94
Folate equivalents	7.36	0.97
Vitamin B6	9.82	2.96

Overall, Australians need to consume more than six times as many nuts as they currently eat to meet population health recommendations.

The relationship between nut intake and consumption of key nutrients was examined.
These analyses were adjusted for covariates (energy, physical activity, gender, age and education levels).



NUT CONSUMPTION AND HEALTH MEASURES

WHAT WAS THE RELATIONSHIP BETWEEN NUT CONSUMPTION AND SELECTED HEALTH MEASURES?

The association between nut consumption and anthropometric measures (body weight, BMI, waist circumference) was explored via linear regression, and confounding factors were considered in the analysis.

Nut consumption was not significantly associated with a greater body weight, BMI or waist circumference.

Consumption of nuts was not significantly associated with systolic and diastolic blood pressure, when adjusted for covariates.

A SECONDARY ANALYSIS OF THE AUSTRALIAN HEALTH SURVEY: WHAT DOES THIS MEAN?

For the first time, this analysis reports on nut consumption in a representative sample of Australians, based on the application of a novel nut database to the 2011-12 NNPAS. The research provides a more accurate insight into nut consumption in Australia, as well as associations between intakes of key nutrients and health measures, such as weight and blood pressure.

The analysis showed the mean nut intake among the Australian population was 4.6g a day. The results of this new analysis showed slightly lower figures than those reported in 2011-13 AHS, estimated to be 5.2g a day. However, this figure represented the whole of the 'nut and nut products' food group (which includes peanuts, tree nuts, nut products, coconut and coconut products, and seeds) thereby over-estimating actual nut consumption. In addition, the AHS original figure was based on only one day of 24-hour recall data, which may not reflect usual intake, since nuts are often consumed more sporadically.

Despite these small differences, the usual nut intake for the Australian population (4.6g a day and for 'nut consumers' 11.75g a day) was considerably lower than recommendations of 30g a day. This is concerning as the literature indicates that the risk of cardiovascular diseases, cancer and type 2 diabetes is lowered when nut consumption reaches 30g a day.[1, 11-13] These results suggest that substantial increases in nut consumption are required in order to reach the intake level associated with improved health outcomes.

The usual nut intake identified in the current study was considerably lower than dietary recommendations of 30g of nuts a day. This is concerning as the literature indicates higher consumption of nuts is associated with reduced risk of a number of chronic diseases, such as cardiovascular and coronary heart disease. In fact, the present study suggests most Australians and 'nut consumers' are consuming less than 10g a day. These results suggest that substantial increases in nut consumption are required in order to reach the intake level associated with improvements to health.

Dr Elizabeth Neale and Cassandra Nikodijevic, University of Wollongong.

Differing patterns of nut consumption were observed across age groups. Of interest is that children were the lowest proportion of nut consumers and had the lowest intake of nuts. Possible reasons for this pattern of consumption in children could be due to concerns over the risk of choking, nut allergy and schools adopting 'nut free' policies. A recent New Zealand study, published in *Public Health Nutrition*, acknowledged that nut allergy was a reason for low nut consumption.[14] However, this goes against current guidelines that recommend introducing allergenic foods, including nuts, to all infants in their first year of life, in an attempt to reduce the risk of developing allergies.[15] A recent theory of allergy development relates to the importance of the gut microbiome, with emerging evidence suggesting how products of good bacteria (such as short-chain fatty acids) are very immunologically active and could shape immune responses.[16] Nuts themselves, via their effect on increasing short chain fatty acids, may increase the growth of beneficial bacteria.[17,18]

In this analysis, it was found that almost 90% of nut consumption was from core food groups. This is reassuring given the Australian Dietary Guidelines recommend limiting the consumption of discretionary foods and given about a third of Australians' energy comes from these foods, with the proportion even higher for teenagers aged 14–18 years, at 41%.[19] Whilst only a small proportion of nuts were consumed from discretionary products, including ice-creams, chocolate coated nuts and muesli bars, it is important to be aware of this pattern of consumption, particularly given the relationship between diets high in discretionary foods and chronic disease.

Nut consumption has previously been associated with an overall favourable dietary pattern and there is an emerging body of evidence from intervention studies suggesting that nut consumption facilitates the development of a higher quality diet.[7,20] The findings of this analysis align with these findings. Consumption of nuts was associated with significantly higher intakes of key nutrients including fibre, vitamin E, iron, magnesium and phosphorous. Nuts were also found to contribute substantial amounts of fatty acids, selenium, vitamin E and magnesium. Possible reasons for this include:

- nuts themselves contribute to overall nutrient intakes,
- nuts may be consumed as a component of a healthier diet overall, and
- consuming nuts may facilitate the consumption of other core foods and may help to lower the consumption of discretionary (or treat) foods.

Nuts are energy dense foods. Both consumers and health professionals report concern regarding their impact on body weight.[14,21,22] This analysis found that

This analysis found that increased nut consumption was not associated with greater body weight, BMI or waist circumference.

increased nut consumption was not associated with greater body weight, BMI or waist circumference. These results are consistent with the body of evidence,[4,23] showing that those who include nuts in their diets tend to be a healthier weight and that nuts are not associated with weight gain. Research also suggests that those consuming nuts tended to have healthier diets and lifestyles, which may also partially explain the results of this analysis. Whilst confounding factors such as energy intake, age, sex and physical activity levels were considered in the analysis, it is possible that other confounding factors may have played a role.

In terms of other health measures, the analysis results showed no significant association between nut intake and blood pressure, which is mainly consistent with the literature.[24]

This is the first analysis to accurately explore nut consumption and associated health outcomes in a representative Australian sample. Overall, the results indicated that the Australian population were falling significantly short of reaching the recommended 30g daily intake of nuts, with an average intake of just 4.6g a day. Given the broad range of health benefits associated with a regular intake of around 30g a day, this is concerning as Australians are essentially missing out on an opportunity to both improve their health, and help reduce the risk of chronic disease. Contrary to the common perception that eating nuts causes weight gain, this analysis showed that nut consumption was not associated with higher body weight, BMI or waist circumference, which also aligns with the evidence base.

Nuts were associated with higher intakes of several nutrients, and also contributed significant nutrients to the diet, highlighting the important role of this food in the diet. Future strategies are therefore required to help educate consumers on the health benefits of nuts and to address misconceptions about the impact of nuts on weight. Strategies to encourage all Australians to consume a 30g handful of nuts every day, within a healthy diet are warranted to help ensure their positive impact towards public health is realised.

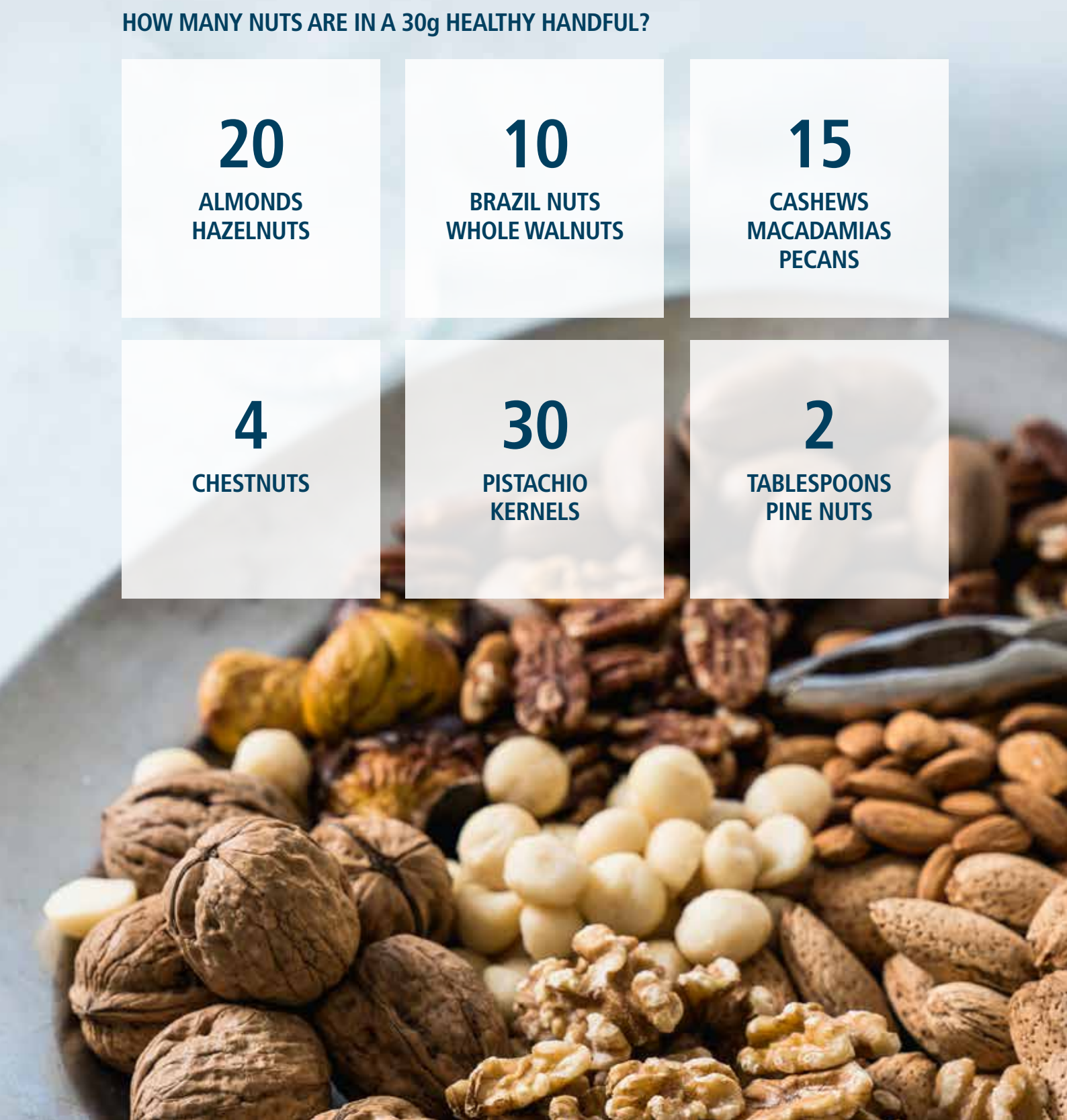
AIM FOR A 30g HANDFUL OF NUTS EVERY DAY

The Australian Dietary Guidelines define a serving of nuts as 30g and encourage regular consumption as part of the protein food group.

A healthy handful of nuts each day, in conjunction with a balanced diet, supports good health.

HOW MANY NUTS ARE IN A 30g HEALTHY HANDFUL?

20 ALMONDS HAZELNUTS	**10** BRAZIL NUTS WHOLE WALNUTS	**15** CASHEWS MACADAMIAS PECANS
4 CHESTNUTS	**30** PISTACHIO KERNELS	**2** TABLESPOONS PINE NUTS



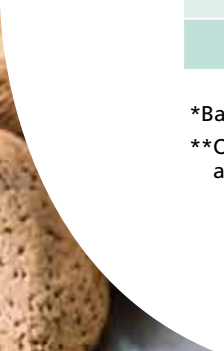
WHAT NUTRIENTS DOES A 30g HANDFUL OF NUTS PROVIDE?

Nuts contain a combination of at least 28 different essential nutrients and bioactive substances. Their health benefits can be attributed to their unique combination of healthy fats, plus a broad range of vitamins, minerals and phytochemicals.

MIXED TREE NUTS*	NUTRIENT	PER 100g	PER 30g
	Energy	**2754 kJ**	**826kJ**
Macronutrients	Protein	14.6g	4.4g
	Total fat	63.3g	19g
	Saturated fat	*6.5g*	*2g*
	Monounsaturated fat	*33.2g*	*10g*
	Polyunsaturated fat	*21.2g*	*6.4g*
	*Omega 3 ALA***	*791mg*	*237mg*
	Carbohydrate	6.2g	1.9g
	Sugars	*4.2g*	*1.3g*
	Dietary fibre	7.7g	2.3g
Minerals	Calcium	94mg	28mg
	Copper	1.3mg	0.4mg
	Iron	3.4mg	1mg
	Magnesium	193mg	58mg
	Manganese	3.2mg	1mg
	Phosphorous	430mg	129mg
	Potassium	603mg	181mg
	Selenium	218µg	65.4µg
	Sodium	4.3mg	1.3mg
	Zinc	3.4mg	1mg
Vitamins	Thiamin	0.5mg	0.2mg
	Riboflavin	0.4mg	0.1mg
	Niacin equivalents	4.9mg	1.5mg
	Folate DFE	45.6µg	13.7µg
	Vitamin B6	0.4mg	0.1mg
	Vitamin E	8.4mg	2.5mg
Other	Arginine	2g	0.6g
	Plant sterols	159mg	47.7mg
	Polyphenols	809mg	243mg

*Based on the average of all the tree nuts.

**Omega 3 ALA figure is calculated from the average of four nuts only – walnuts, pecans, hazelnuts and macadamias, as they are the only tree nuts containing ALA.



EVIDENCE SUPPORTING THE HEALTH BENEFITS OF A 30g HANDFUL OF NUTS A DAY

Nuts are an integral component of a healthy diet. Regularly eating nuts has been shown to contribute to heart health, reduce the risk of developing type 2 diabetes and overall mortality, assist with weight management, reduce the risk of cancer, improve sperm quality, reduce depression, and promote overall good health.

According to the latest Burden of Disease study by the Australian Institute of Health and Welfare,[25] the third most significant dietary impact on disease was a 'diet low in nuts and seeds'. A 'diet low in nuts and seeds' had a bigger impact on disease burden than a 'diet low in vegetables'. It also had a bigger impact than 'diets high in sugar sweetened beverages' and 'diets high in sodium'.

In terms of specific disease burden, the study showed that a 'diet low in nuts and seeds' accounted for:

- 16% of coronary heart disease burden - higher than 'diets low in whole grains and high fibre cereals' (14.1%), 'diets low in fruit' (8.2%) and 'diets low in vegetables' (13.8%), and
- 8.5% of type 2 diabetes burden (up from 7.4% in 2011) - compared with 'diets low in whole grains and high fibre cereals' (14%) and 'diet low in fruit' (7.4%).

A 30g HANDFUL OF NUTS MOST DAYS OF THE WEEK IS ASSOCIATED WITH:

- **29% REDUCED RISK OF CHD[1]**
- **21% REDUCED RISK OF CVD[1]**
- **13% REDUCED RISK OF TYPE 2 DIABETES[2]**
- **REDUCED ALL-CAUSE MORTALITY[1]**
- **WEIGHT MANAGEMENT[3,4 & 5]**
- **15% REDUCED RISK OF TOTAL CANCER[1]**

HEART HEALTH

The body of evidence regarding nuts and heart health has been established by decades of research. Four large population studies – the Adventist Health Study, Iowa Women's Health Study, Nurse's Health Study and the Physicians' Health Study[26-29] - found inverse associations between nut consumption and the risk of coronary heart disease. Since then, the evidence has continued to grow. Recent evidence from a systematic literature review (SLR) and meta-analysis, published in *BMC Medicine*, showed that nuts were associated with a reduced risk of coronary heart disease (CHD) and cardiovascular disease (CVD).[1] The researchers concluded that a one ounce serving of nuts a day (28g) was associated with a 29% reduction in the relative risk of CHD and a 21% reduction in the relative risk of CVD.[1]

Results from our own systematic literature reviews support these findings.[3,30] In late 2014, Nuts for Life commissioned the University of Wollongong to conduct an SLR to explore the evidence base on the effects of nut consumption on heart health.[30] This SLR was updated in 2018, and when combined with the original literature review, included almost 150 studies.[3]

The body of evidence suggests a regular intake of nuts is associated with improvements in several indicators of heart health including total cholesterol, LDL cholesterol and LDL: HDL cholesterol ratio. The consistency of this evidence was the same or greater than previously found in the 2014 review. Nut consumption continues to be associated with reduced risk of heart disease (CVD and CHD). Bearing in mind that being overweight is also a risk factor for CVD, it is important to note the intake of nuts is not associated with weight gain or unfavourable changes in weight measures including BMI, fat mass and waist circumference. The findings support a general level health claim that nuts contribute to heart health, when eaten as part of a healthy diet, without weight gain.

From a public health perspective, these effects are substantial and carry population level clinical significance.

EVIDENCE SUPPORTING THE HEALTH BENEFITS OF A 30g HANDFUL OF NUTS A DAY

MORTALITY

An SLR and meta-analysis, published in *BMC Medicine*, showed that total nut consumption was inversely associated with the risk of all-cause mortality.[1] The researchers stated that most of the reduction in risk was observed at intakes of about 15-20g of total nuts a day.[1] They also calculated that a total of 4.4 million deaths might be attributable to a nut intake of less than 20g a day.

The *EAT-Lancet Commission* on healthy diets from sustainable food systems, published in early 2019, reported that approximately 11 million deaths worldwide could be prevented if our current diet moved toward a more plant-based diet, including increasing nut consumption and decreasing less healthy foods.[31]

DIABETES

Diet plays an important role in the prevention of type 2 diabetes, managing existing diabetes, and preventing or reducing the progression of diabetes-related complications. One of the first studies to show an association with developing type 2 diabetes found that a 30g handful of nuts, five or more times a week, resulted in a 27% reduced risk.[32] A recent SLR and meta-analysis, published in the *American Journal of Clinical Nutrition*, showed that consuming a 30g handful of nuts, four times a week, was associated with a 13% reduction in the risk of type 2 diabetes.[2]

The mechanisms by which nuts help reduce the risk of type 2 diabetes have been explored. While nuts themselves are not low glycaemic index (GI), they can help lower the GI of a meal and improve insulin sensitivity.[32] In addition, nuts contain many nutrients that may benefit metabolic health, including unsaturated fatty acids, protein, fibre, minerals, antioxidants and phytochemicals. The low carbohydrate and high unsaturated fat content of nuts produces lower postprandial glucose and insulin responses, which is thought to be important for reducing diabetes risk over time.[2]

WEIGHT MANAGEMENT

Consumption of nuts, when incorporated into a healthy diet, does not result in weight gain. The results of the AHS analysis – that increased nut consumption was not associated with greater body weight or BMI - align with the broader body of evidence. Results from an SLR and meta-analysis of cohort studies and 62 randomised trials, showed that nuts were associated with reduced risk of overweight and obesity,[4] and that nut consumption reduced body weight, BMI and waist circumference.[3,4] However, there is a need to better understand the factors that may influence this relationship, such as the amount and type of nuts, time period, and the comparator diet.

The mechanisms by which nuts help manage body weight and may help reduce adiposity have been examined in scientific research conducted over more than 20 years. Firstly, nuts are high in protein and fibre which act to satisfy hunger and reduce appetite.[33,34] Secondly, as the fat present in nuts is located in cell walls, it is not fully accessible to be absorbed by the body, meaning that a proportion of the fat (and therefore energy) is instead excreted in the faeces.[35,36] Consequently, the metabolisable energy available from nuts has been estimated to be up to 30% lower than that calculated by Atwater factors.[37,38]



CANCER

Several reviews have investigated the association of nut consumption and the risk of cancer, as well as cancer mortality.[1,39,40] An SLR and meta-analysis of 31 observational studies (19 case-control and 12 cohort studies), published in *BMC Medicine*, found that nut consumption was associated with a 15% reduced risk of overall cancer and inversely associated with colorectal cancer, endometrial cancer and pancreatic cancer, but not other cancer types.[1] A study from the Mayo Clinic in the USA, published in *Nutrition Reviews*, also reported significant associations between nut consumption and colorectal, endometrial and pancreatic cancers.[40] Finally, a systematic review and meta-analysis showed that nut consumption reduced the risk of cancer mortality.[39] Importantly, the available evidence on individual cancer types is limited and more research, particularly from prospective cohorts, is required to better understand these associations.

Nuts contain a number of nutrients that can be cancer protective, including antioxidants such as vitamin E, selenium, quercetin, resveratrol and polyphenols, as well as folic acid, fibre and oleic acid. In addition, studies have shown reduced endothelial dysfunction,[41] lipid peroxidation,[42] and insulin resistance[43] with a higher intake of nuts. Oxidative damage and insulin resistance are important pathogenic drivers of cancer.[44] Nuts, particularly walnuts and pecans have a high antioxidant content,[45] and could prevent cancer by reducing oxidative DNA damage,[46] cell proliferation,[47,48] inflammation,[49,50] and circulating insulin-like growth factor 1 concentrations[51] and by inducing apoptosis,[47] suppressing angiogenesis,[52] and altering the gut microbiota.[18]

EMERGING EVIDENCE

Solid and consistent evidence supports nuts' position as part of a healthy diet with evidence continuing to emerge, further strengthening the role of nuts in promoting good health.

COGNITION

Nut consumption is associated with better cognitive performance, with greater benefits observed in those with higher, long-term total nut intake [53,54] and in those with the highest consumption of nuts. The PREDIMED trial tested dietary patterns among elderly participants at high cardiovascular risk and found that participants who consumed a Mediterranean diet (supplemented with either extra virgin olive oil or a 30g handful of nuts a day) had improved cognitive ability, compared to those who had consumed a low fat diet.[55,56]

A Spanish study led by the Barcelona Institute for Global Health (which included more than 2,200 mothers and their children) found children, whose mothers ate more nuts during the first trimester of pregnancy (a weekly average of around three 30g servings), achieved the best results in tests measuring cognitive function, attention capacity and working memory.[57] Associations with nuts and memory have also been found in older adults.[58]

DEPRESSION

A few studies have investigated the association between nut consumption and depression. A recent cross-sectional study, conducted in more than 13,000 Chinese adults, showed that nut consumption was independently associated with depressive symptoms.[59] The researchers suggested that nut consumption may be beneficial to the prevention of depressive symptoms.

The SMILES intervention trial was a 12 week randomised controlled trial in adults with major depression.[60] The dietary intervention comprised of a *Modi*MedDiet – based on a Mediterranean style diet, which included one serve of nuts a day. The researchers found improvements in rating of depression after 12 weeks of dietary modification.[60]

SPERM QUALITY

The Spanish FERTINUTS study found a 60g portion of nuts a day (including almonds, hazelnuts and walnuts) increased sperm count in healthy young men by an average of 16% compared to those eating no nuts.[61] Published in the *American Journal of Clinical Nutrition*, the randomised controlled trial of healthy men showed modest improvements in the proportion of living sperm, their shape and their swimming prowess. The researchers suggested that the improvements in sperm quality could be linked to a diet rich in nutrients like polyunsaturated fats such as omega-3, antioxidants including vitamins C and E, selenium and zinc, and folate - all of which are abundant in nuts.

GUT HEALTH AND INFLAMMATION

The gut microbiome is an increasingly popular area of study among researchers and is now believed to impact the development of chronic diseases, such as obesity. Nuts can impact on the amount and diversity of bacteria.[17,18,62 & 63] Nuts are foods (prebiotics) for the bacteria (probiotics). Nut skins, in particular, appear to play an important role as they are rich in fibre and polyphenols, with antioxidant and anti-inflammatory properties.[64] In a small randomised controlled study, published in the *British Journal of Nutrition*, researchers found that the consumption of almonds and pistachios had positive effects on the gut microbiota composition, as well as increasing the number of beneficial butyrate-producing bacteria.[18]

A recent randomised cross-over study, of 18 healthy men and women,[65] showed that walnut consumption affected the composition and function of the human gastrointestinal microbiota. Specifically, the addition of 42g of walnuts a day increased the relative abundance of Firmicutes species in the Clostridium clusters XIVa and IV, including *Faecalibacterium, Roseburia*, and *Clostridium*. The study, published in the *Journal of Nutrition*, also found that walnuts reduced microbially derived, proinflammatory secondary bile acids and LDL cholesterol.

While our understanding of the gut microbiota is still in its infancy, this new area of study offers promising results for the overall beneficial effects of nuts on gut health.

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Enjoy a healthy handful every day.

ABOUT NUTS FOR LIFE

Nuts for Life is the health education initiative from the Australian tree nut industry. We are Australia's leading independent authority on the nutrition and health benefits of tree nuts. Our mission is to promote regular nut consumption by collating the latest evidence-based information, and informing Australians about the positive impact regular nut consumption can have on their health.

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