



Is a vegetarian diet adequate? Concepts and Controversies in Plant-based Nutrition

Meeting the Nutrient Reference Values on a Vegetarian Diet: *Full Analyses of Meal Plans Summary Tables*

An Australian first, scientific literature review of vegetarian diets was recently conducted by a group of Accredited Practising Dietitians (APDs) and university academics with expertise in the area of vegetarian nutrition. As a result, a 40-page peer-reviewed Supplement to the Medical Journal of Australia was published in June 2012.

From a practical perspective, the 'Meeting the Nutrient Reference Values on a Vegetarian Diet' paper looks at meeting nutritional requirements in a suite of meal plans, which cover both males and females and different life stages. Sample single-day lacto-ovo vegetarian meal plans were developed to meet the Nutrient Reference Values, including increased requirements for iron and zinc at 180% RDI and 150% RDI respectively for vegetarians

This document contains the full analyses of the meal plans. For a discussion on these results, please refer to the full NRV paper available on the **MJA OPEN** website (<https://www.mja.com.au/open/2012/1/2/meeting-nutrient-reference-values-vegetarian-diet>).



Abbreviations and Footnotes Associated with Meal Plan Summary Tables

ALA = α -linolenic acid.

CHO = carbohydrate.

LC n-3 PUFA = long-chain omega-3 polyunsaturated fatty acids.

MUFA = monounsaturated fatty acids.

NRV = Nutrient Reference Value.

PAL = Physical activity level.

PUFA = polyunsaturated fatty acids.

RDI = recommended dietary intake.

SFA = saturated fatty acids.

UL = upper level of intake.

y = years.

* NRVs for Australia and New Zealand (RDI and adequate intake).

† Energy value range is applicable to both male and female for the youngest in this NRV age group (males being the higher and females being the lower value).
If additional energy is required in an individual diet for an older child, add discretionary kJ from foods including avocado, dried fruit, fresh juice, peanut butter and olive oil spread. Nutritional requirements are still met.

^ Energy value range is applicable to both male and female in this NRV age group (males being the higher and females being the lower value).
If additional energy is required in an individual diet, add discretionary kJ. Nutritional requirements are still met.

Energy value is applicable to the youngest in this age group. If additional energy is required in an individual diet, add discretionary kJ. Nutritional requirements are still met.

‡ The energy in this meal plan meets the requirements for a lower PAL of 1.6 (light activity), associated with an estimated energy requirement of 8900–9200 kJ.
If additional energy is required in an individual diet, add discretionary kJ. Nutritional requirements are still met.

§ Energy range is provided to be applicable to the large age range in this NRV group. If additional energy is required, add discretionary kJ. Nutritional requirements are still met.

¶ Acceptable macronutrient distribution range.

** This sample meal plan did not meet the extended RDI for iron (providing 180% of RDI for iron during pregnancy results in a level that is above the UL).

Ref: NHMRC, *Nutrient Reference Values for Australia and New Zealand--Including Recommended Dietary Intakes* (2006). 2006, Australian Government: Canberra.

Nutrient Analysis software: FoodWorks Professional, version 5 2007 (Xyris Software, Australia), utilising AusNut 1999 food composition database.



Nutrient	NRV age group: Children 1-3yrs 1 year-old (15 month old) PAL 1.6 Reference weight 10.3kg (girls), 11.1kg (boys)		NRV age group: Children 1-3yrs 2 year-old PAL 1.6 Reference weight 12.1kg (girls), 12.7kg (boys)		NRV age group: Children 1-3yrs 3 year-old PAL 1.6 Reference weight 13.9kg (girls), 14.3kg (boys). Reference height 0.94m (girls), 0.95m (boys).	
	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	3,800	3,500-3,800^	4,200	4,200-4,400^	5,400	5,300-5,600^
Protein (g)	41	14	45	14	56	14
% total energy	18%	15-25%¶	18%	15-25%¶	18%	15-25%¶
CHO (g)	122	-	135	-	159	-
% total energy	55%	45-65%¶	54%	45-65%¶	50%	45-65%¶
Fat (g)	22	-	28	-	44	-
% total energy	22%	20-35%¶	24%	20-35%¶	30%	20-35%¶
SFA (g)	3	-	5	-	10	-
% total energy	2%	<10%¶	4%	<10%¶	8%	<10%¶
% total fat	13%	-	18%	-	25%	-
PUFA (g)	13	-	14	-	15	-
% total fat	59%	-	50%	-	34%	-
MUFA (g)	6	-	9	-	15	-
% total fat	27%	-	32%	-	34%	-
ALA (g)	1.0	0.5	1.4	0.5	0.5	0.5
LC n-3 [EPA/DHA/DPA] (mg)	-	40	-	40	-	40
Fibre (g)	25	14	30	14	21	14
Iron (mg)	16.5	16.2 (180% RDI)	17.9	16.2 (180% RDI)	17.2	16.2 (180% RDI)
Zinc (mg)	4.8	4.5 (150% RDI)	4.9	4.5 (150% RDI)	5.6	4.5 (150% RDI)
Vitamin B12 (µg)	1.0	0.9	1.0	0.9	2.0	0.9
Calcium (mg)	659	500 (UL 2,500)	568	500 (UL 2,500)	753	500 (UL 2,500)
Folate (µg)	336	150 (UL 300)	377	150 (UL 300)	384	150 (UL 300)
Vitamin A equivalentents (µg)	442	300 (UL 600)	406	300 (UL 600)	596	300 (UL 600)
Vitamin E (mg)	30	5 (UL 70)	30	5 (UL 70)	5	5 (UL 70)
Vitamin D (µg)	<1	5	<1	5	<1	5
Vitamin C (mg)	46	35 (No UL)	39	35 (No UL)	57	35 (No UL)
Sodium (mg)	771	200-400 (UL 1,000)	727	200-400 (UL 1,000)	725	200-400 (UL 1,000)



Nutrient	NRV age group: Children 4-8yrs 4 year-old PAL 1.6 Reference weight 15.8kg (girls), 16.2kg (boys) Reference height 1.01m (girls), 1.025m (boys)		NRV age group: Children 9-13yrs 9 year-old PAL 1.8 Reference weight 29.0kg (girls), 28.6kg (boys) Reference height 1.33m (girls), 1.34m (boys)	
	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	5,800	5,500-5,900†	8,200	8,200-8,900†
Protein (g)	55	20	74	40
% total energy	16%	15-25%¶	15%	15-25%¶
CHO (g)	186	-	268	-
% total energy	55%	45-65%¶	55%	45-65%¶
Fat (g)	38	-	60	-
% total energy	24%	20-35%¶	27%	20-35%¶
SFA (g)	8	-	12	-
% total energy	5%	<10%¶	5%	<10%¶
% total fat	21%	-	20%	-
PUFA (g)	17	-	19	-
% total fat	45%	-	32%	-
MUFA (g)	13	-	29	-
% total fat	34%	-	48%	-
ALA (g)	1.4	0.8	1.9	1.0
LC n-3 [EPA/DHA/DPA] (mg)	-	55	-	70
Fibre (g)	31	18	32	24
Iron (mg)	18	18 (180% RDI)	16.8	14.4(180% RDI)
Zinc (mg)	7	6 (150% RDI)	10	9 (150% RDI)
Vitamin B12 (µg)	1.5	1.2	3.1	1.8
Calcium (mg)	824	700 (UL 2,500)	1,080	1,000-1,300 (UL 2,500)
Folate (µg)	463	200 (UL 400)	470	300 (UL 600)
Vitamin A equivalentents (µg)	429	400 (UL 900)	773	600 (UL 1,700)
Vitamin E (mg)	40	6 (UL 100)	30	9 (UL 180)
Vitamin D (µg)	<1	5	<2	5
Vitamin C(mg)	80	35 (No UL)	144	40 (No UL)
Sodium (mg)	1,298	300-600(UL 1,400)	1,689	400-800 (UL 2,000)



	NRV age group: Teenager 14-18yrs 14 year-old male PAL 1.8 Reference weight 51kg Reference height 1.64m (average height)		NRV age group: Teenager 14-18yrs 14 year-old female PAL 1.8 Reference weight 49.4kg Reference height 1.60m (average height)	
Nutrient	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	11,600	11,900#	10,200	10,300#
Protein (g)	113	65	97	45
% total energy	17%	15-25%¶	16%	15-25%¶
CHO (g)	349	-	319	-
% total energy	58%	45-65%¶	53%	45-65%¶
Fat (g)	91	-	76	-
% total energy	29%	20-35%¶	27%	20-35%¶
SFA (g)	18	-	11	-
% total energy	6%	<10%¶	4%	<10%¶
% total fat	20%	-	14%	-
PUFA (g)	37	-	31	-
% total fat	41%	-	41%	-
MUFA (g)	36	-	34	-
% total fat	40%	-	45%	-
ALA (g)	1.2	1.2	1.3	0.8
LC n-3 [EPA/DHA/DPA] (mg)	-	125	-	85
Fibre (g)	58	28	53	22
Iron (mg)	31	19.8 (180% RDI)	27	27 (180% RDI)
Zinc (mg)	19.5	19.5 (150% RDI)	12.9	10.5 (150% RDI)
Vitamin B12 (µg)	3.4	2.4	3.2	2.4
Calcium (mg)	1,756	1300 (UL 2,500)	1,575	1300 (UL 2,500)
Folate (µg)	597	400 (UL 800)	549	400 (UL 800)
Vitamin A equivalent (µg)	1,058	900 (UL 2,800)	1,213	700 (UL 2,800)
Vitamin E (mg)	20	10 (UL 250)	40	8 (UL 250)
Vitamin D (µg)	<1	5	<1	5
Vitamin C (mg)	195	40 (No UL)	379	40 (No UL)
Sodium (mg)	1,942	460-920 (UL 2,300)	1,560	460-920 (UL 2,300)



	NRV age group: Men 19-30 & 31-50 35 year-old male PAL 1.8 Reference weight 67.5kg Reference height 1.75m (average height)		NRV age group: Women 19-30 & 31-50 35 year-old female PAL 1.8 Reference weight 60kg Reference height 1.65m (average height)	
Nutrient	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	12,700	12,400 - 12,800\$	8600‡	10,050-10,350\$
Protein (g)	121	64	90	46
% total energy	16%	15-25%¶	18%	15-25%¶
CHO (g)	353	-	262	-
% total energy	47%	45-65%¶	52%	45-65%¶
Fat (g)	114	-	64	-
% total energy	33%	20-35%¶	27%	20-35%¶
SFA (g)	21	-	12	-
% total energy	6%	<10%¶	5%	<10%¶
% total fat	18%	-	19%	-
PUFA (g)	37	-	22	-
% total fat	32%	-	34%	-
MUFA (g)	56	-	30	-
% total fat	49%	-	47%	-
ALA (g)	1.4	1.3	2.8	0.8
LC n-3 [EPA/DHA/DPA] (mg)	-	160	-	90
Fibre (g)	64	30	46	25
Iron (mg)	40	14.4 (180% RDI)	32.6	32.4 (180% RDI)
Zinc (mg)	21	21 (150% RDI)	13	12 (150% RDI)
Vitamin B12 (µg)	3.7	2.4	3.2	2.4
Calcium (mg)	1,935	1000 (UL 2,500)	1,386	1000 (UL 2,500)
Folate (µg)	789	400 (UL 1,000)	517	400 (UL 1,000)
Vitamin A equivalents (µg)	1,899	900 (UL 3,000)	748	700 (UL 3,000)
Vitamin E (mg)	15	10 (UL 300)	10	7 (UL 300)
Vitamin D (µg)	<1	5	<1	5
Vitamin C(mg)	337	45 (No UL)	115	45 (No UL)
Sodium (mg)	1,669	460-920(UL 2,300)	1,738	460-920 (UL 2,300)



	NRV age group: Adult 50 - 70+ 71 year-old male PAL 1.6 Reference weight 67.5kg Reference height 1.75m (average height)		NRV age group: Adult 50 - 70+ 71 year-old female PAL 1.6 Reference weight 60kg Reference height 1.65m (average height)	
Nutrient	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	9,700	9,200 - 10,100\$	8,400	8,050-8,500\$
Protein (g)	101	81	98	57
% total energy	18%	15-25%¶	20%	15-25%¶
CHO (g)	277	-	254	-
% total energy	48%	45-65%¶	51	45-65%¶
Fat (g)	80	-	61	-
% total energy	30%	20-35%¶	27%	20-35%¶
SFA (g)	14	-	18	-
% total energy	5%	<10%¶	8%	<10%¶
% total fat	18%	-	30%	-
PUFA (g)	34	-	20	-
% total fat	43%	-	33%	-
MUFA (g)	32	-	23	-
% total fat	40%	-	38%	-
ALA (g)	1.3	1.3	3.3	0.8
LC n-3 [EPA/DHA/DPA] (mg)	-	160	-	90
Fibre (g)	48	30	34	25
Iron (mg)	24.8	14.4(180% RDI)	23.4	14.4 (180% RDI)
Zinc (mg)	21.3	21 (150% RDI)	12	12 (150% RDI)
Vitamin B12 (µg)	2.9	2.4	3.6	2.4
Calcium (mg)	1,489	1300 (UL 2,500)	1,737	1300 (UL 2,500)
Folate (µg)	494	400 (UL 1,000)	484	400 (UL 1,000)
Vitamin A equivalents (µg)	928	900 (UL 3,000)	1,136	700 (UL 3,000)
Vitamin E (mg)	65	10 (UL 300)	10	7 (UL 300)
Vitamin D (µg)	<2	15	<2	15
Vitamin C(mg)	106	45 (No UL)	423	45 (No UL)
Sodium (mg)	1,786	460-920 (UL 2,300)	1,721	460-920 (UL 2,300)



Nutrient	NRV age group: Pregnancy 25 year-old female PAL 1.6 Reference height 1.65m (average height) Additional 1.4MJ/d for pregnancy		NRV age group: Lactation 25 year-old female PAL 1.6 Reference height 1.65m (average height) Additional 2.0MJ/d for lactation	
	Meal Plan Provides	NRV/Goal*	Meal Plan Provides	NRV/Goal*
Energy (kJ)	10,600	10,300-10,600\$	11,200	10,900-11,200\$
Protein (g)	119	60	121	67
% total energy	19%	15-25%¶	18%	15-25%¶
CHO (g)	284	-	310	-
% total energy	46%	45-65%¶	47%	45-65%¶
Fat (g)	91	-	96	-
% total energy	32%	20-35%¶	32%	20-35%¶
SFA (g)	17	-	21	-
% total energy	6%	<10%¶	7%	<10%¶
% total fat	19%	-	22%	-
PUFA (g)	26	-	36	-
% total fat	29%	-	38%	-
MUFA (g)	48	-	40	-
% total fat	53%	-	42%	-
ALA (g)	2.1	1.0	2.5	1.2
LC n-3 [EPA/DHA/DPA] (mg)	-	115	-	145
Fibre (g)	53	28	56	30
Iron (mg)	36.6**	48.6 (180% RDI)	33.6	16.2 (180% RDI)
Zinc (mg)	16.5	16.5 (150% RDI)	18	18 (150% RDI)
Vitamin B12 (µg)	3.2	2.6	2.8	2.8
Calcium (mg)	2,083	1000 (UL 2,500)	2,142	1000 (UL 2,500)
Folate (µg)	716	600 (UL 1,000)	623	500 (UL 1,000)
Vitamin A equivalent (µg)	992	800 (UL 2,800-3,000)	1,182	1100 (UL 2,800-3,000)
Vitamin E (mg)	25	7 (UL 300)	20	11 (UL 300)
Vitamin D (µg)	<2	5	<2	5
Vitamin C(mg)	175	60 (No UL)	150	85 (No UL)
Sodium (mg)	1,908	460-920 (UL 2,300)	1,808	460-920 (UL 2,300)