Vegan & vegetarian diets in children
is it safe? What are the considerations?

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Accredited Practicing Dietitian
Specialist in infants, children and adolescents
Overview - vegan & vegetarian diet in children

- Research
- At risk nutrients
- Practical Advice - red flags, breast milk
- Meal plans
- Q & A
Definitions

- Vegan (VEG)
- Vegetarian
- Lacto-ovo vegetarian (LOV)

Statistics

- Around 1% Vegan population in Australia, around 10-15% vegetarian in Australia
- Australia and worldwide vegetarian and vegan dietary choices increasing rapidly
- Common restriction to adopt in teens as independent ethics
Paediatric Specific Considerations

- Breastfeeding
- Monitoring nutrition using biochem more challenging
- Growth
- Fussy eating
Vegan Diet

Position of the German Nutrition Society (DGE)

Margrit Richter, Heiner Boeing, Dorle Grünwald-Funk, Helgi Anja Kroke, Eva Leschik-Bonnet, Helmut Oberritter, Daniela S for the German Nutrition Society (DGE)

Complementary Feeding: A Position Paper by the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) Committee on Nutrition

*Mary Fewtrell, †Jiri Bronsky, ‡Cristina Campoy, §Magnus Domellöf, ¶Nicholas Embleton, #Kwok Ng, @Bertha Mis, ‡Iva Hojsak, **Jessie M. Hulst, ||Flavia Indrio, |||Alexandre Lapillonne, and ||||Christian Molgaard

Position of the Academy of Nutrition and Dietetics: Vegetarian Diets

Vesanto Melina, MS, RD * Winston Craig, PhD, MPH, RD * Susan Levin, MS, RD, CSSD

DOI: https://doi.org/10.1016/j.jand.2016.09.025 • Check for updates

Position paper on vegetarian diets from the working group of the Italian Society of Human Nutrition

C. Agnoli, a L. Baroni b, I. Bertini c, S. Ciappellano d, A. Fabbri e, M. Papa c, N. Pellegrini f, R. Sbarbati c, M.L. Scarno g, V. Siani c, S. Sieri a,*

Nutrition, Metabolism & Cardiovascular Diseases (2017) 27, 1037–1052

Food Fact Sheet

Plant-based diet
“It is advisable for infant and young children to follow an omnivorous diet or, at least, an ovo-lacto-vegetarian diet”

This position paper advises use of wholegrains eg grainy bread, wholemeal pasta, brown rice etc as complementary foods
Practice guidelines

Vegan diet in children and adolescents. Recommendations from the French-speaking Pediatric Hepatology, Gastroenterology and Nutrition Group (GFHGNP)

J. Lemalé, E. Mas, C. Jung, M. Bellaiche, P. Tounian, French-speaking Pediatric Hepatology, Gastroenterology and Nutrition Group (GFHGNP)

Published October 2019

Encourage prolonged formula use “up to at least 6 years of age”

Conclusion:

- The level of dietary restriction is maladaptive for humans
- The inevitable nutrient deficiencies are serious and for children have life long impact
- Essential that vegan children are referred to a competent Health Professional who will prescribe the essential nutritional supplements
Veg Plate Junior - a “well planned” Vegan / vegetarian diet defined

- Plate model to assist with demonstrating “well planned” VEG / LOV diet
- 2019 detailed publication
- Excellent Paediatric detail

Supplemental Figure 2. The VegPlate for infants (6 to 12 months).

Perspective

Vegan Nutrition for Mothers and Children: Practical Tools for Healthcare Providers

Luciana Baroni 1, Silvia Goggi 1,2, Roseila Battaglino 1,3, Mario Berveglieri 1, Ilaria Fasan 1,4, Denise Filippin 1, Paul Griffith 1, Gianluca Rizzo 1, Carla Tomasini 1,
Cont...

- Consume large amounts and a wide variety of plant foods, emphasizing the intake of whole or minimally processed foods: a vegan diet can be nutritionally adequate when meeting the calorie requirements from a variety of nutrient-dense foods, mainly unprocessed, belonging to all the plant food groups. The only exception being during late pregnancy, infancy, and early childhood, when fiber must be limited.

- Limit the amount of vegetable fats, as suggested by the Dietary Reference Intakes (DRIs), in order to not displace more nutrient-dense foods nor limit excess calories. Choose vegetable fats carefully, consuming good sources of omega-3 fatty acids and monounsaturated oils, while avoiding trans fats and tropical oils (coconut, palm, and palm kernel oils) in order to emphasize the efficiency of the omega-3 metabolic pathway. The only exception is during infancy and early childhood, when fats should not be limited but should still be carefully chosen.

- Consume adequate amounts of calcium and pay attention to vitamin D status: good calcium sources should be obtained by increasing the intakes of calcium-rich foods from plant sources. Conversely, as no kind of diet can provide adequate amounts of vitamin D, the recommendations for vitamin D are the same as for the general population.

- Consume adequate amounts of vitamin B12: the intake of reliable sources of vitamin B12 is fundamental for a well-planned vegetarian diet, as vitamin B12 status can be compromised, over time, in all vegetarian subjects who do not supplement it.
At Risk nutrients
- Energy / Growth
- Fibre
- Iron
- Zinc
- Iodine
- LC-PUFA’s
- Vitamin D

... and additionally for vegan
- Protein
- Vitamin B12
- Calcium
Energy / Growth

- Evidence shows no caloric deficit in VEG/LOV infants and children
- However, as with all restricted diets VEG/LOV infants and children require intake of calorie-dense foods and growth should be monitored “closely”
- Infants and children have physiologically small stomachs
- High fibre and high volume plant foods can make it more difficult to meet energy requirements
- Lower fibre by peeling fruit, veg and pulses and sieving purees
- Regular growth measures and plotting to be encouraged
- Suboptimal weight gain
  - Lower fibre - “fibre deprived” diet reduce “Whole” fruit and vegetables, reduce wholegrains
  - Increase fats and increase low fibre protein such as tofu / soy milk
Fibre  (NOT at risk)

- Abundant in a plant based diet
  - Leads to early satiety
  - Reduced protein absorption
  - ↑ food volume needed due to ↓ calorie density
- VEG infant complementary foods up to 12 months of age should be as fibre-deprived as possible (Vegplate junior).
- 1-2 year olds - growth velocity remains high but now increase whole fruit and vegetables
- Thereafter gradually increase fibre-rich foods
- Limiting fibre increases iron and zinc absorption
Iron

- All infants and children are at risk for iron deficiency, thus they should receive complementary solid foods rich in iron.
- Vegetarian foods contain only non-haem iron - lower bioavailability.
- Include an iron source at each meal and optimise absorption using co-consumed Vitamin C and limited fibre intake.
- Promoter: Vitamin C promotes the transition of iron to the ferrous state (Fe2+).
- Inhibitors: Reduce these - phytates by fermentation, germination, leaven bread.
- Low iron stores and deficiency are common in all children.
- Supplementation to be individualised.
- Vegan teenagers shown to have higher incidence anaemia in some studies.
Zinc

- Good plant sources are wholegrains, nuts, seeds, cereals and pulses
- Phytates found in larger quantities in vegetarian diets bind zinc, reducing bioavailability
- Oxalates and some fibres reduce zinc absorption
- Increase intake by ~50% to account for reduced bioavailability
- Convert to absorbable state with presence of Vitamin C and phytate reduction as with iron
- Biochem: serum Zinc, Zinc plasma
- Deficiency: poor growth, interferes with bone development, reduced taste, can effect behavioural and sexual development in teens

<table>
<thead>
<tr>
<th>Age</th>
<th>NHMRC RDI Zinc mg/day</th>
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<tr>
<td>7-12 months</td>
<td>3</td>
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<tr>
<td>1-3 years</td>
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<tr>
<td>4-8 years</td>
<td>4</td>
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<tr>
<td>9-13 years</td>
<td>6</td>
</tr>
<tr>
<td>14-18 years</td>
<td>7-13</td>
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Iodine

- Deficiency can stunt growth and cause intellectual impairment
- Ensure adequate supplementation in Breast feeding mothers to optimise infants iodine status
- Iodine rich foods: packaged bread, seaweed, fortified soy milk
- Limit sea vegetables to 1 x week due to highly variable iodine content
- 55ug in 2 slices packaged bread, 1g iodised salt
- What age to start supps? - No consensus in research and it was difficult to apply to our local food supply
- I have started supplements at 5 years old on my meal plans. It would also be reasonable to start as early at 1 year old

<table>
<thead>
<tr>
<th>Age</th>
<th>NHMRC RDI Iodine ug/day</th>
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<tr>
<td>0-6 months</td>
<td>90 (AI)</td>
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<tr>
<td>7-12 months</td>
<td>110 (AI)</td>
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<tr>
<td>1-8 years</td>
<td>90</td>
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<td>9-13 years</td>
<td>120</td>
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<tr>
<td>14-18 years</td>
<td>150</td>
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</table>
Low amounts of EPA and DHA in vegetarian diets, only ALA (precursor)

Essential FA's

Omega 3 pathway needs optimal ratio to favour the conversion of ALA $\rightarrow$ EPA/DHA

Conversion rate is low when using plant sources of omega 3

Optimise omega-6/omega-3 ratio

2-3 serves Good plant sources of omega-3 fatty acids include ground flaxseeds and flaxseed oil, chia seeds, soya products, canola and walnuts

Limit sources of omega-6 fatty acids, trans fats, coconut oil, palm oil, corn, sunflower oil. Limit processed and deep fried foods.

Supplement when demand is high and ALA conversion may not keep up

Supplement 100mg DHA per day when under 3 years old

1 serve Flaxseed oil per day for infants - high omega 3, high energy density, low fibre

add to smoothie, mashed with avocado, add to hummus dip, pancakes, oats, yoghurts
Vitamin D

- Status depends more on sun exposure and supplements than dietary intake
- Supplement starting with 400IU per day (10ug) for infants and increase to up to 1500IU for teens
- Recommendation for all infants and from birth (general population guidelines apply)
- Consequences of severe deficiency = nutritional rickets → bone fractures and abnormal growth
- Mushrooms with enhanced levels of vitamin D₂ from being exposed to ultraviolet light under controlled conditions are also available 9.2ug in ½ cup
- Many variables influencing status

<table>
<thead>
<tr>
<th>Age</th>
<th>RDI Vit D ug/day</th>
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<tr>
<td>0-12months</td>
<td>5 (AI)</td>
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<tr>
<td>1-18years</td>
<td>5 (AI)</td>
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</table>
...and additionally for Vegans
Protein

- Consistent data shows VEG/LOV meet requirements for protein
- General population RDI should be increased by 10-15% for VEG/LOV
- Varied sources are important to ensure all essential amino acid requirements are met
- All essential amino acids are found in plant foods
- No need for specific protein combining at each meal, but a variety of sources throughout the day
- Protein source at each meal of wide variety is ideal for children
Vitamin B12

- Consensus to supplement B12 in vegan diets of all ages
- Vegan intake the only reliable sources of B12 are fortified foods and supplements
- To preserve normal B12 levels Supplement at least 5-10ug/day
- Fortified foods provide at best 4ug per day - unreliable
- Intrinsic factor is need for absorption. Bioavailability is saturated at 1.5-2.5ug / meal thereafter reduced bioavailability.
- Infants of vegan mothers are at particular risk of this deficiency
- Blood measures:
  - Holotranscobalamin or “Active B12” is the more sensitive measure of B12 status
  - Homocysteine and MMA increase indicates B12 being absorbed has reduced
  - Serum B12 sensitivity low
- Deficiency: irreversible neurological damage, failure to thrive, lethargy, hypotonia, and arrest or regression of developmental skills

<table>
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<tr>
<th>Age</th>
<th>Daily Single Dose B12ug/day</th>
<th>Daily Multi Dose B12</th>
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<tr>
<td>0-6mths</td>
<td>Nil - Check Breastfeeding Mother is supplementing</td>
<td></td>
</tr>
<tr>
<td>6-12mths</td>
<td>5</td>
<td>1ug x 2 doses</td>
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<tr>
<td>1-3years</td>
<td>5</td>
<td>1ug x 2 doses</td>
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<tr>
<td>4-6years</td>
<td>25</td>
<td>2ug x 2 doses</td>
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<td>7-10years</td>
<td>25</td>
<td>2ug x 2 doses</td>
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<tr>
<td>11-14years</td>
<td>50</td>
<td>2ug x 3 doses</td>
</tr>
<tr>
<td>15-65years</td>
<td>50</td>
<td>2ug x 3 doses</td>
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<tr>
<th>Age</th>
<th>NHMRC RDI B12ug/day</th>
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<tbody>
<tr>
<td>0-6months</td>
<td>0.4 (AI)</td>
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<tr>
<td>7-12 months</td>
<td>0.5 (AI)</td>
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<tr>
<td>1-3years</td>
<td>0.9</td>
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<tr>
<td>4-8years</td>
<td>1.2</td>
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<tr>
<td>9-13years</td>
<td>1.8</td>
</tr>
<tr>
<td>14-18years</td>
<td>2.4</td>
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Calcium

- Full fat calcium fortified Soy milk is the ideal option for vegan child
- Calcium rich foods to include (3-5 serves per day as per “Veg Plate Junior”)
  - Fortified plant milk and yoghurt
  - Hard/Firm tofu
  - Almonds
  - Unhulled tahini (sesame seed paste)
  - Green leafy vegetables like kale and Asian greens (e.g. bok choy, Chinese broccoli)
- Biochemistry:
  - Not serum calcium – unrelated to dietary adequacy
  - Can do BMD

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<th>NHMRC RDI Calcium mg/day</th>
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<tbody>
<tr>
<td>0-6 months</td>
<td>100 (AI)</td>
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<tr>
<td>7-12 months</td>
<td>275 (AI)</td>
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<tr>
<td>1-3 years</td>
<td>460</td>
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<td>4-8 years</td>
<td>500</td>
</tr>
<tr>
<td>9-18 years</td>
<td>1250</td>
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Practical Advice
Breastmilk

- Vegan choices are: Breast milk or soy-based infant formula
- Extend the breastfeeding and formula period until 2 years
- Use rice based if soy allergy
- Vitamin B12, iodine and LC PUFA content of breastmilk is dependent on the mothers intake
- Vitamin D and vitamin B12 deficiency is most frequently diagnosed in exclusively breastfed infants of vegetarian or vegan mothers
- No homemade formula - commercial only. Deficiency and toxicity important to avoid.
Individualising Dietetic Input

- Establish if medical (GP or paediatrician) input regarding diet
- Family diet - important to clarify
- Maternal nutritional status including supplements if breast feeding
- Longitudinal growth data collection important
- Establish if any medical history that heightens risk
- Diet History
  - Target at risk nutrients
  - Supplements - dose and frequency
- Increased dietary risk and vulnerability in first 2 years of life - follow up accordingly
Red Flags

**OBJECTIVE**
- Suboptimal growth / underweight
- Symptoms or evidence of deficiency
- Food allergy / medically necessary additional dietary restrictions
- Excessive reliance on milk feeds in infants (lack of complementary food)
- Clear caloric inadequacy
- Additional dietary restrictions without medical need eg Gluten
- Use of homemade formula or plant milk as a breast milk alternative

**SUBJECTIVE**
- Eating Disorder suspicion
- Unwilling to use supplementation
- Maternal disordered eating pattern or maternal malnutrition
- Disregard of risks when explained / explored
- Non-compliance with dietary recommendations
Meal Plans
8 months old

- 3 meals per day, puree with small lumps + finger foods offered
- Energy dense, fibre deprived, foods from all food groups
- 4-6 Breast milk or soy-based infant formula feeds in 24 hours
- Water offered regularly
- No set meal plan but priority introduction of
  - Tofu / Tempeh
  - Iron fortified baby cereal, iron fortified bread as a finger food
  - Oils, Avocado, Hummus, bubaganoush
  - Nut & seed pastes, and meals (ground nuts) - including walnuts, sesame
  - White rice, oats, gnocchi, White potato, white pasta, buckwheat soba noodles, wheat raman noodles
  - Full fat calcium and B12 fortified soy milk to cook and prepare cereals, Calcium fortified Soy / almond / coconut yoghurt
  - Nutritional yeast / yeast spread
  - Sun exposed mushrooms
  - Mixed pulses in limited amounts
    ...And if vegetarian
  - Eggs well cooked, cheese, yoghurt, ricotta, cream cheese, cottage cheese (not honey)
- By 9 months old 10g nuts and 10g fats should be included at lunch and dinner to meet requirements. Iron-rich foods with Vit C at most meals.

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Dose / day</th>
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<tbody>
<tr>
<td>B12</td>
<td>5-10ug</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>400IU (10ug)</td>
</tr>
<tr>
<td>DHA</td>
<td>100mg</td>
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<tr>
<td>Flaxseed Oil</td>
<td>5-10ml</td>
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10-12 months old

- **Breakfast:** 1 tablespoon iron fortified rice cereal + Soy milk + 1/3 cup ground nuts and seeds mix (including chia and walnuts) + 1-2 tbsp fruit puree
- **Snack:** Oat, chia and banana pancakes with 10g nut butter
- **Lunch:** Sandwich with avocado / hummus / grated carrot on iron fortified white bread + kiwi pieces
- **Snack:** Fruit, Crackers with spread eg Nuttlex or white bean puree
- **Dinner:** White Rice + Tofu + vegies stir fried with nutritional yeast, toasted sesame and Flaxseed oil
- **Milk feeds:** 2-3 breast feeds / soy formula bottles + 1 other high calcium food
- **Milk for cooking and cereal:** full fat calcium, B12, Vit D fortified soy milk

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<td>Flaxseed Oil</td>
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5 year old

- **Breakfast:** 2 WeetBix + soy milk + 1/3 cup nuts and seeds mix + 1/4 cup fruit
- **Snack:** 1 Toast or crumpet with nut butter + 1/2 cup soy milk or yoghurt
- **Lunch:** Tempeh and sesame patty on a roll with avocado + tomato
- **Snack:** Fruit and Crackers with dip eg babagounoush
- **Dinner:** Gnocchi with tomato and lentils and nutritional yeast topping
- **Snack:** 1/2 - 1 cup soy milk
- **Milk:** full fat calcium, B12, Vit D fortified soy milk

### Supplement Dose / day

<table>
<thead>
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<tr>
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<td>25ug</td>
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<tr>
<td>Vitamin D</td>
<td>600-1200IU (15-30ug)</td>
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<tr>
<td>Iodine</td>
<td>75-150ug + salt</td>
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</table>
15 year old

- Breakfast: Cereal + full fat B12/calcium fortified Soy milk + toast with nut butter if desired
- Snack: “trail mix” ½ cup nuts, dried fruit and seeds and dry cereal (iron fortified) mix
- Lunch: Wrap with felafel, avocado, hummus and salad + fruit
- Snack: Smoothie fruit w full fat B12/calcium fortified Soy milk.
- Dinner: Pasta with nut and flaxseed pesto + garlic bread + salad
- Snack: Fruit and crackers
- Milk alternatives: calcium, B12, Vit D and iodine fortified full fat soy milk

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<tbody>
<tr>
<td>B12</td>
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<tr>
<td>Vitamin D</td>
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<td>Iodine</td>
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Thank you