

Plant-based eating and children

Paula Hallam RD PG Cert
Specialist Paediatric Dietitian
<https://plantbasedkids.uk>



WHAT I WILL COVER...

- Nutrition opportunities
 - Early life nutrition
 - Micronutrients
 - Fibre
 - Decreased risk of obesity
- Nutrition considerations
 - Ensuring adequate growth
 - Introducing animal-based allergens
 - Key nutrients for young children
 - Supplements



NUTRITION OPPORTUNITIES



EARLY LIFE NUTRITION

- Many studies have shown that preferences and eating habits form early during childhood and are likely to track until the beginning of adulthood (1)
- Research suggests that from the very earliest age, children's experiences with food influence both preferences and intake (2)
- The more varied a child's intake is the healthier the child's diet is likely to be later in life (2)
- The nutrition that infants and children receive in their early years has a profound effect on their later health (3)

1. Sajita et al. Healthful and Unhealthful Plant-Based Diets and the Risk of Coronary Heart Disease in U.S. Adults. *Am Coll Cardiol* 2017 Jul 25;70(4):411-422.

2. L. Cook PhD. The importance of exposure for healthy eating in childhood: a review. *JHND* 2007;20(4):294-301

3. Koletzko et al. Nutrition During Pregnancy, Lactation and Early Childhood and its Implications for Maternal and Long-Term Child Health: The Early Nutrition Project Recommendations. *Ann Nutr Metab* 2019;74:93-106.



MICRONUTRIENTS

- Almost one third (29%) of children in the UK aged 5-10 years eat less than one portion of vegetables per day, with those living in the poorest conditions eating the fewest vegetables
- Less than one in five (18%) of children aged 5-15 years eat 5 portions of fruit and vegetables per day in England, according to the Health Survey for England

1. <https://foodfoundation.org.uk/sites/default/files/2021-09/Peas-Please-Veg-Facts-2021-Mobile-Friendly.pdf>
2. http://healthsurvey.hscic.gov.uk/media/1092/_7-fruit-and-vegetable-consumption_7th-proof.pdf



MICRONUTRIENTS

- Plant-based diets are often criticised for lacking certain micronutrients but they are actually abundant in many
- VeChi study (1) found that VG and VN children had the highest intakes of:
 - beta-carotene
 - vitamins E, C and K
 - vitamins B1, B6
 - folate
 - potassium
 - magnesium
 - iron

1. Weder S, Keller M, Fischer M, Becker K, Alexy U. Intake of micronutrients and fatty acids of vegetarian, vegan, and omnivorous children (1-3 years) in Germany (VeChi Diet Study). Eur J Nutr. 2022 Apr;61(3):1507-1520.



Table 2 Median daily intake (without supplements) of vitamins and minerals of vegan (VN), vegetarian (VG), and omnivorous (OM) children in the VeChi Diet Study by diet group

	VN (n = 139)	VG (n = 127)	OM (n = 164)	h-AR	Basic model ^Δ		Fully adjusted model [‡]		
					p	Partial η ²	p	Partial η ²	
Vitamin A (retinol eq) (μg/d) ^a	550 (377–779)	475 (331–654)	560 (372–854)	205	0.008	0.022	0.008	0.024	
β-carotene (mg/d) ^b	3.2 (1.9–5.1)	2.5 (1.4–3.8)	2.3 (1.4–4.6)	–	0.020	0.018	0.002	0.031	
Vitamin E (mg/d) ^c	8.3 (6.1–11.7) ¹	7.4 (5.1–9.9) ¹	5.1 (3.9–7.0) ¹	5.0	<0.0001	0.200	<0.0001	0.196 [§]	
Vitamin K (μg/d) ^d	82 (53–120) ^{1,2}	67 (41–86) ¹	46 (26–72) ²	–	<0.0001	0.099	<0.0001	0.110	
Vitamin B ₁ (μg/d) ^e	569 (437–754) ^{1,2}	513 (377–611) ¹	481 (398–605) ²	400	<0.0001	0.038	<0.0001	0.124	
Vitamin B ₂ (μg/d) ^f	429 (325–537) ¹	461 (375–641) ²	639 (517–800) ^{1,2}	500	<0.0001	0.175	<0.0001	0.202 [§]	
Vitamin B ₆ (mg/d) ^g	0.8 (0.6–1.1) ^{1,2}	0.7 (0.6–0.8) ¹	0.7 (0.6–0.9) ²	0.5	0.002	0.030	<0.0001	0.117	
Folate (μg/d) ^h	143 (106–197) ^{1,2}	116 (96–149) ¹	108 (90–135) ²	90	<0.0001	0.148	<0.0001	0.148 [§]	
Vitamin C (mg/d) ⁱ	63 (44–84) ¹	54 (41–66)	45 (32–63) ¹	15	<0.0001	0.076	<0.0001	0.073 [§]	
Potassium (mg/d) ^j	1839 (1387–2204) ^{1,2}	1567 (1227–1858) ¹	1513 (1309–1861) ²	–	<0.0001	0.065	<0.0001	0.113 [§]	
Calcium (mg/d) ^{k#}	320 (251–453) ¹	399 (280–567)	445 (356–553) ¹	390	<0.0001	0.059	<0.0001	0.060	
Magnesium (mg/d) ^l	241 (180–310) ¹	188 (143–240) ¹	164 (134–195) ¹	65	<0.0001	0.147	<0.0001	0.292 [§]	
Iron (mg/d) ^m	8.9 (6.0–11.6) ¹	7.3 (5.5–9.0) ¹	6.0 (4.7–7.4) ¹	5.0/10.0*	<0.0001	0.111	<0.0001	0.300	
Zinc (mg/d) ⁿ	4.9 (3.7–6.2)	4.7 (3.8–5.6)	5.0 (4.1–5.8)	3.6	0.194	0.008	0.111	0.012	
Iodine (μg/d) ^o	31 (22–44) ¹	33 (23–45) ¹	47 (36–61) ¹	65	<0.0001	0.118	<0.0001	0.167 [§]	
	VN (n = 139)	VG (n = 127)	OM (n = 164)	h-AR	p †	r			
							VN vs VG	VG vs OM	VN vs OM
Vitamin B ₁₂ (μg/d)	0.2 (0.1–0.4) ¹	0.6 (0.3–1.0) ¹	1.5 (1.1–2.3) ¹	0.7	<0.0001	0.399	0.471	0.656	
Vitamin D (μg/d)	0.7 (0.3–1.1)	0.8 (0.4–1.4)	0.8 (0.5–1.6)	10	0.006	0.120	0.017	0.143	

1. Weder S, Keller M, Fischer M, Becker K, Alexy U. Intake of micronutrients and fatty acids of vegetarian, vegan, and omnivorous children (1-3 years) in Germany (VeChi Diet Study). Eur J Nutr. 2022 Apr;61(3):1507-1520.

DECREASED RISK OF OVERWEIGHT AND OBESITY

- 10% of children aged 4-5 years were obese in 2021/22 and a further 12% were overweight (1)
- Children aged 10-11 years, almost 1 in 4 (23.4%) were obese and a further 14.3% were overweight in 2021/22 (1)
- Studies have shown that vegetarian diets are associated with a lower prevalence of obesity in adults and children (2)

1. <https://commonslibrary.parliament.uk/research-briefings/sn03336/>

2. Joan Sabate´ and Michelle Wien. Vegetarian diets and childhood obesity prevention Am J Clin Nutr 2010;91(suppl):1525S–9S

TABLE 1Anthropometric measurements in vegetarians: a meta-analysis of 36 early studies¹

	Vegetarian		Nonvegetarian		<i>P</i> value
	No. of subjects	Weighted mean	No. of subjects	Weighted mean	
Men					
Height (cm)	402	176.6	422	176.8	0.48
Weight (kg)	490	68.2	720	75.8	<0.0001
BMI (kg/m ²)	589	22.6	813	24.7	<0.0001
Women					
Height (cm)	869	161.9	1092	161.5	0.46
Weight (kg)	928	60.5	1350	63.8	0.006
BMI (kg/m ²)	1140	23.6	1556	25.4	0.007

¹ Data are from reference 17.

1. Joan Sabaté and Michelle Wien. Vegetarian diets and childhood obesity prevention Am J Clin Nutr 2010;91(suppl):1525S–9S

2. Sabate J, Blix G. Vegetarian diets and obesity prevention. In: Sabate J, ed. Vegetarian nutrition. Boca Raton, FL: CRC Press, 2001:91–107 (referred to above as 'reference 17')

VEGETARIAN DIETS AND CHILDHOOD OBESITY PREVENTION

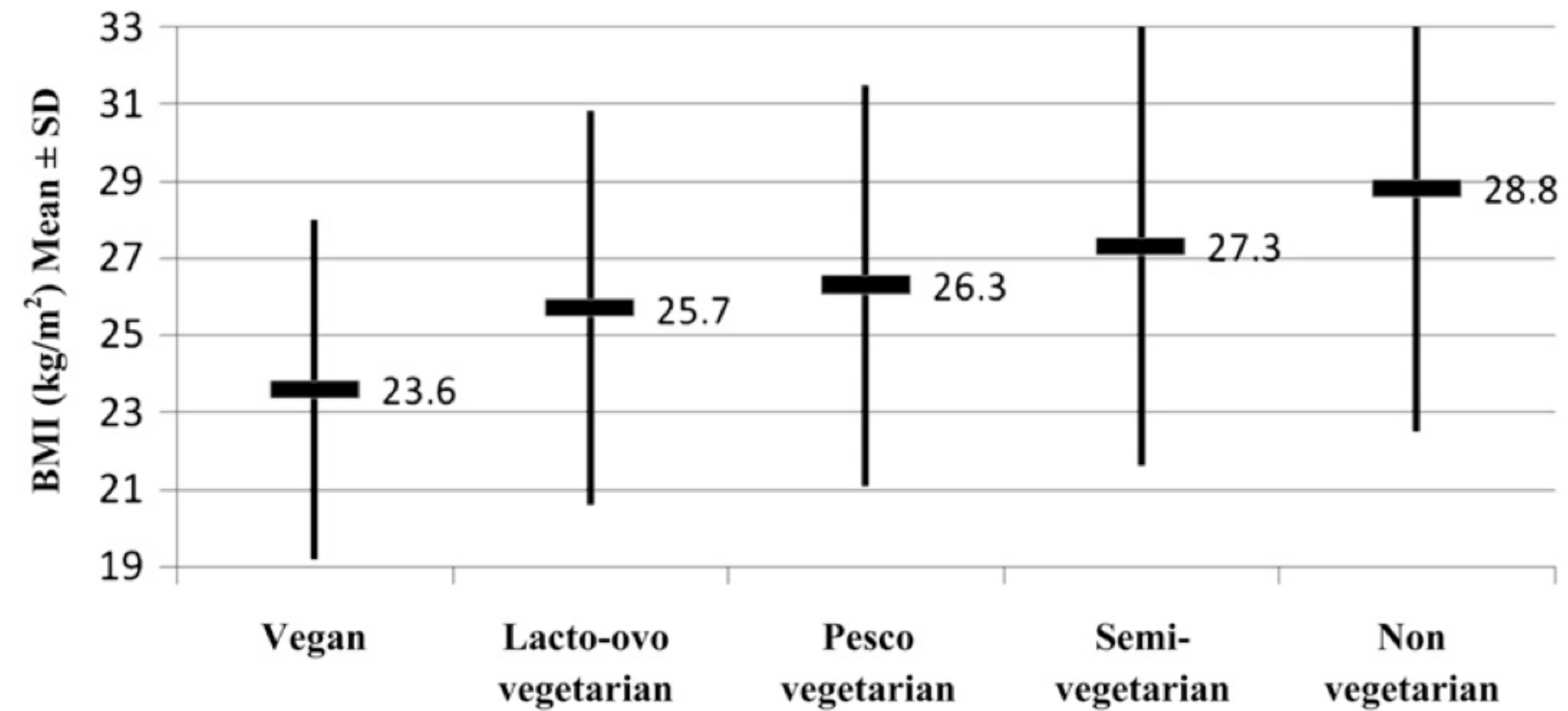


FIGURE 1. BMI according to vegetarian status for participants enrolled in the Adventist Health Study-2. Data are from reference 19.

1. Joan Sabaté and Michelle Wien. Vegetarian diets and childhood obesity prevention *Am J Clin Nutr* 2010;91(suppl):1525S–9S
2. Tonstad S, Butler T, Yan R, Fraser GE. Type of vegetarian diet, body weight, and prevalence of type 2 diabetes. *Diabetes Care* 2009;32:791–6. (referred to above as 'reference 19')

FIBRE

- UK adults - average of 20g fibre per day (30g per day recommended)
- Children in the UK aren't eating enough fibre (1)
 - 10g per day for 1.5 to 3 year olds
 - 14g per day for 4 to 10 year olds
 - 16g per day for 11 to 18 year olds

1. National Diet and Nutrition Survey. Rolling programme Years 9 to 11 (2016/2017 to 2018/2019). A survey carried out on behalf of Public Health England and the Food Standards Agency.



FIBRE RECOMMENDATIONS FOR CHILDREN

2 - 5 years

5 - 11 years

11 - 16 years

15g per day

20g per day

25g per day

NUTRITION CONSIDERATIONS



GROWTH OF CHILDREN FOLLOWING PLANT-BASED DIETS

- Earlier studies:
 - Farm study, 1989 (1)
 - Seventh Day Adventist children, 1991 (2)
- Recent study: VeChi study (3) concluded that VN and VG diets provided sufficient energy and nutrients for adequate growth, similar growth to OM children
- Small % of VN and VG children were classified as stunted - extended BF without introducing complementary foods
- Sufficient calories to optimise growth and development

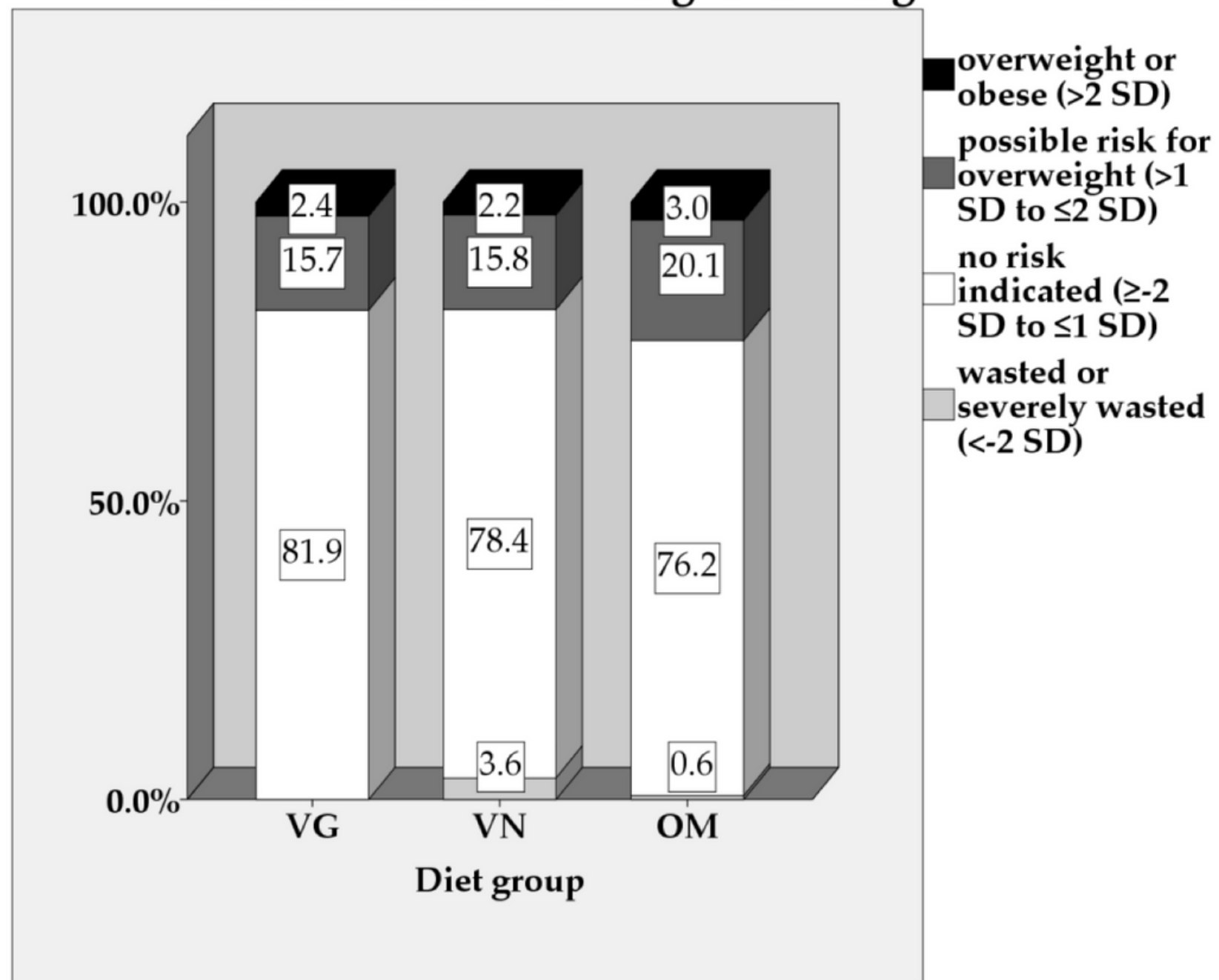
1. O'Connell JM, Dibley MJ, Sierra J, Wallace B, Marks JS, Yip R. Growth of vegetarian children: The Farm Study. *Pediatrics*. 1989 Sep;84(3):475-81.

2. Sabaté J, Lindsted KD, Harris RD, Sanchez A. Attained height of lacto-ovo vegetarian children and adolescents. *Eur J Clin Nutr*. 1991 Jan;45(1):51-8.

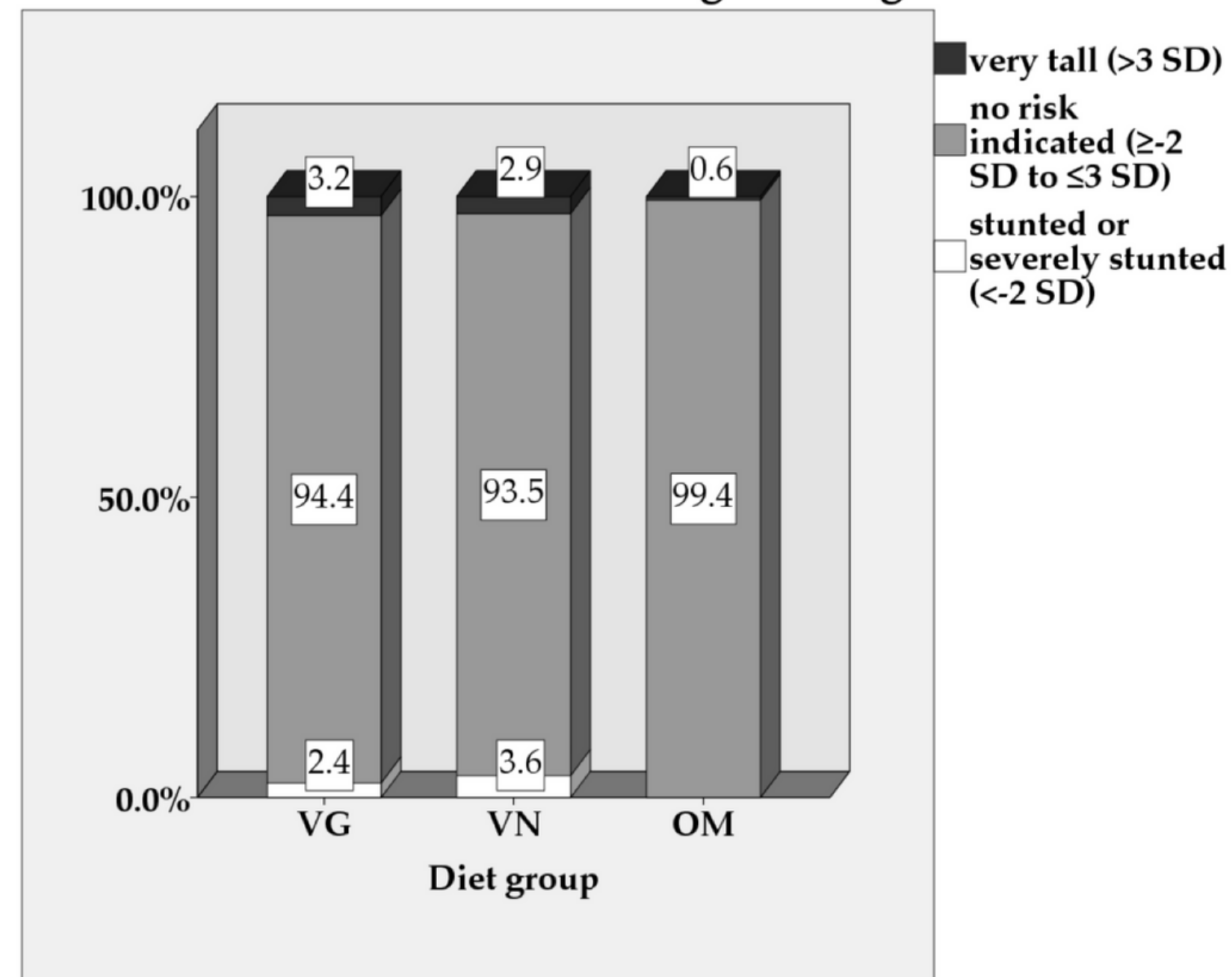
3. Weder S, Hoffmann M, Becker K, Alexy U, Keller M. Energy, Macronutrient Intake, and Anthropometrics of Vegetarian, Vegan, and Omnivorous Children (1-3 Years) in Germany (VeChi Diet Study). *Nutrients*. 2019 Apr 12;11(4):832.



WHO classification for weight-for-height z-score



WHO classification of height-for-age z-score



Weder S, Hoffmann M, Becker K, Alexy U, Keller M. Energy, Macronutrient Intake, and Anthropometrics of Vegetarian, Vegan, and Omnivorous Children (1-3 Years) in Germany (VeChi Diet Study). *Nutrients*. 2019 Apr 12;11(4):832.

INTRODUCING ALLERGENS

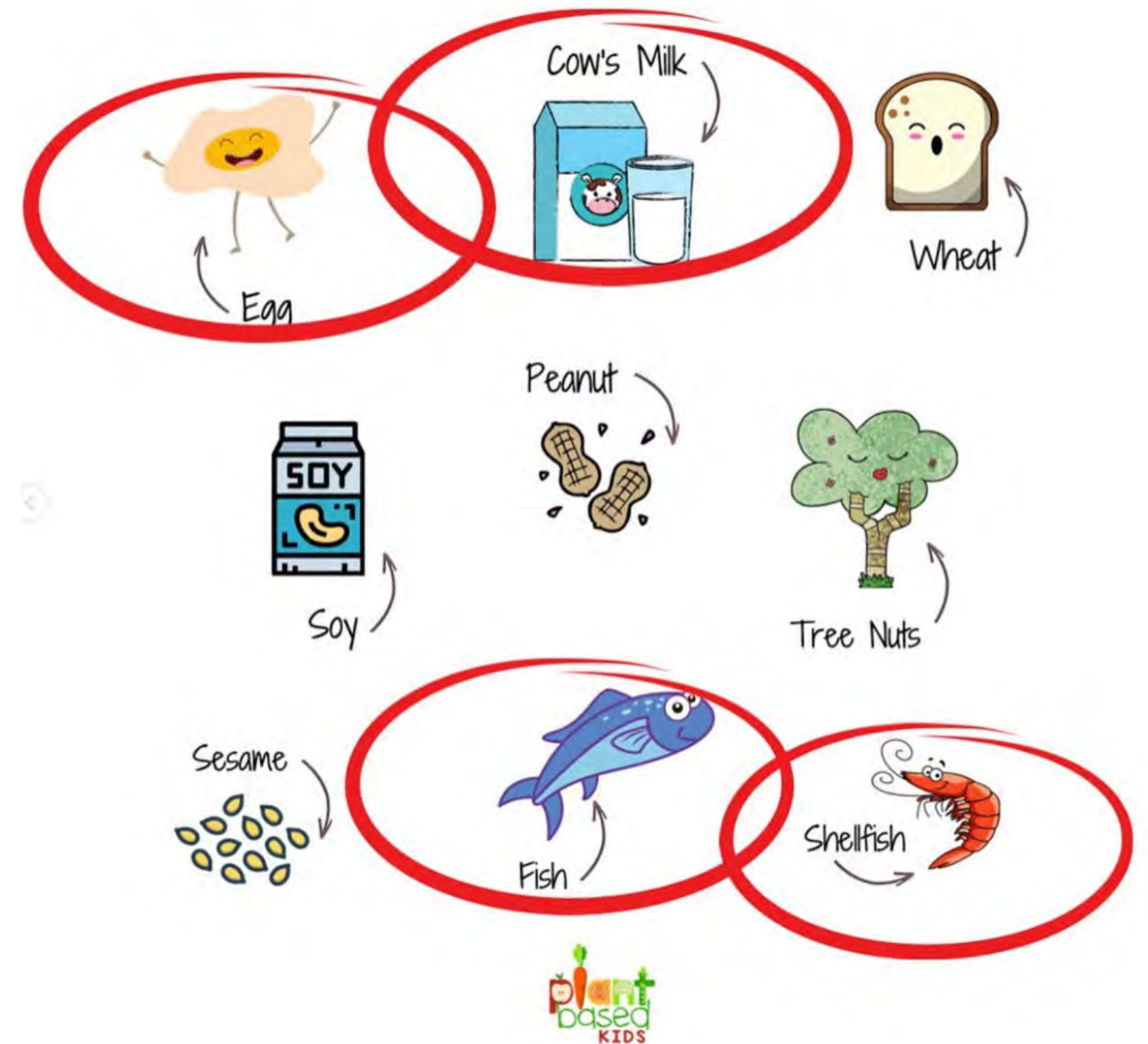
- Accumulating evidence that introducing food allergens - particularly egg and peanuts - to babies within the first year of life may help prevent allergies to those foods from developing later in life (1, 2, 3)
- However, 4 of the top 9 food allergens are animal-based



1. Du Toit et al. Randomized trial of peanut consumption in infants at risk for peanut allergy. N Engl J Med. 2015 Feb 26;372(9):803-13.
2. Logan et al. Early introduction of peanut reduces peanut allergy across risk groups in pooled and causal inference analyses. Allergy. 2023 May;78(5):1307-1318
3. Perkin et al. Enquiring About Tolerance (EAT) study: Feasibility of an early allergenic food introduction regimen. J Allergy Clin Immunol. 2016 May;137(5):1477-1486.e8

INTRODUCING ALLERGENS

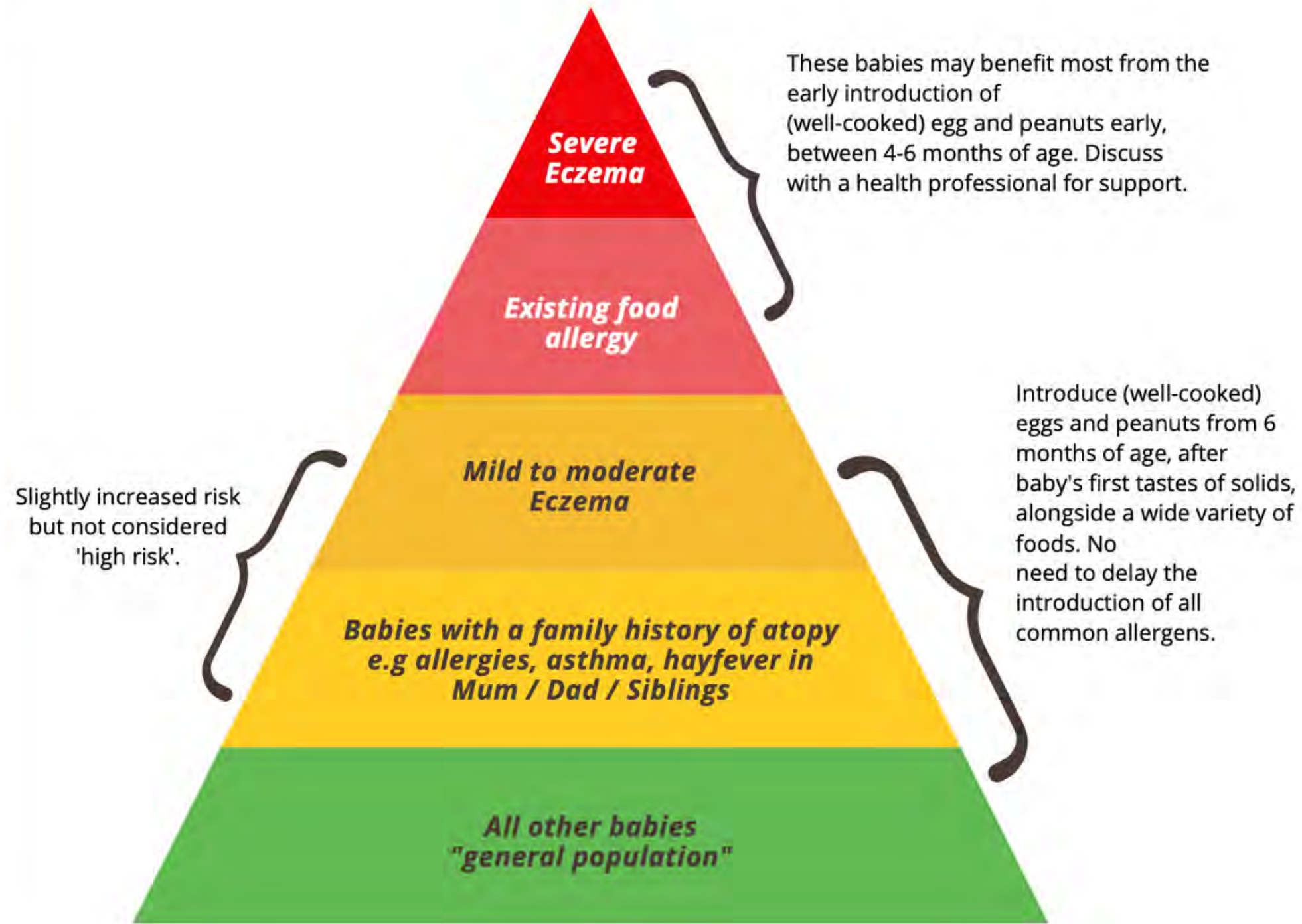
- Considerations:
 - Food allergy risk factors
 - Continued exposure - is this realistic?
 - Likelihood of coming into contact with the allergens
 - milk/egg vs fish/seafood



Highest Risk



Standard Risk



KEY NUTRIENTS FOR YOUNG CHILDREN



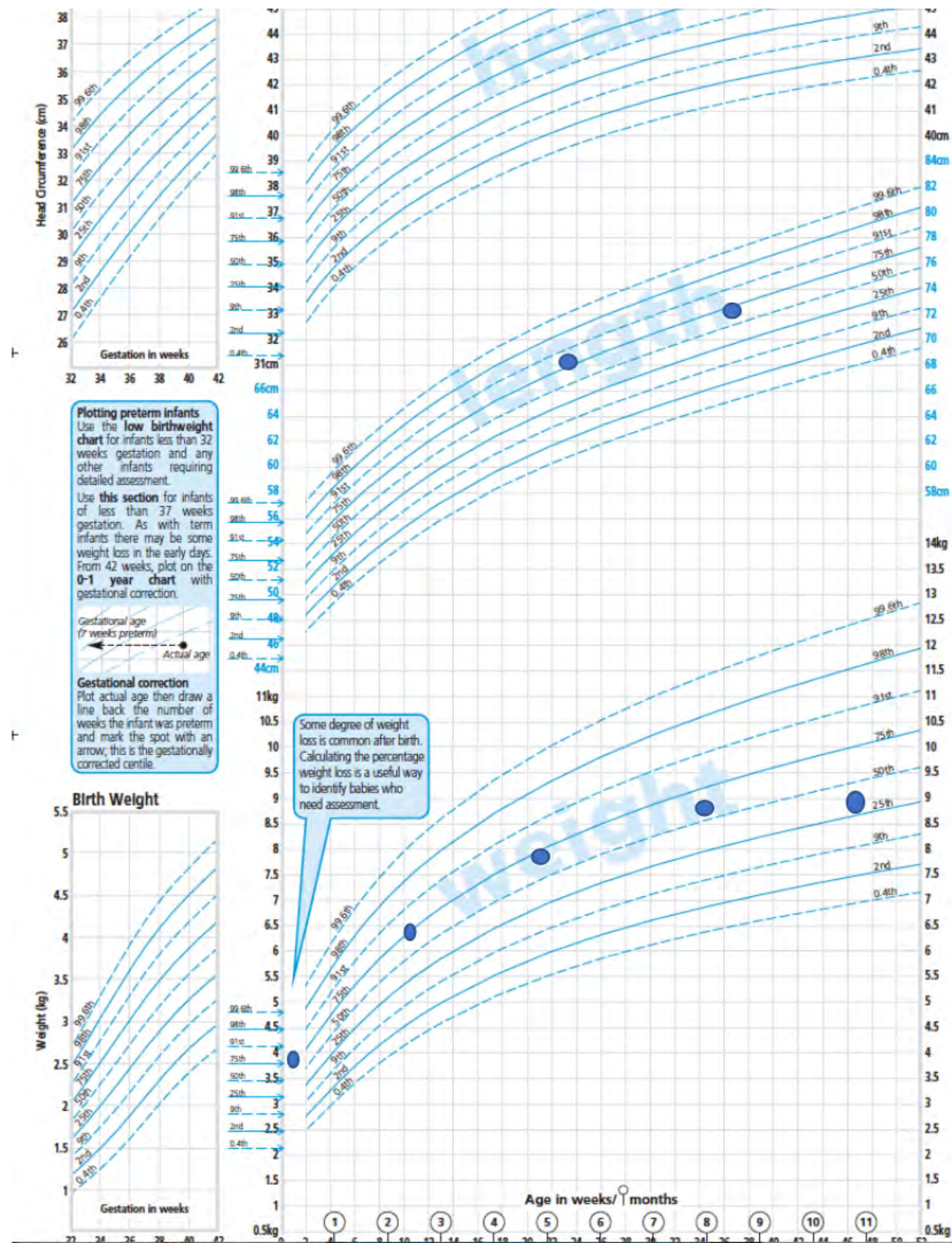


CASE STUDY

CASE STUDY

- Jack is 3 years and 4 months of age and his parents are vegans for environmental and health reasons
- He was breastfed until 2 years of age
- Complementary foods were introduced at 6 months of age:
 - From 2 years of age, home-made almond milk as dairy alternative drink
 - Organic soya yoghurt (unfortified)
 - Lentils 1-2x per day as protein source
 - No nut butters as parents are afraid of nut allergy
 - No vitamin/mineral supplement
- Parents commented that Jack is often lethargic and pale

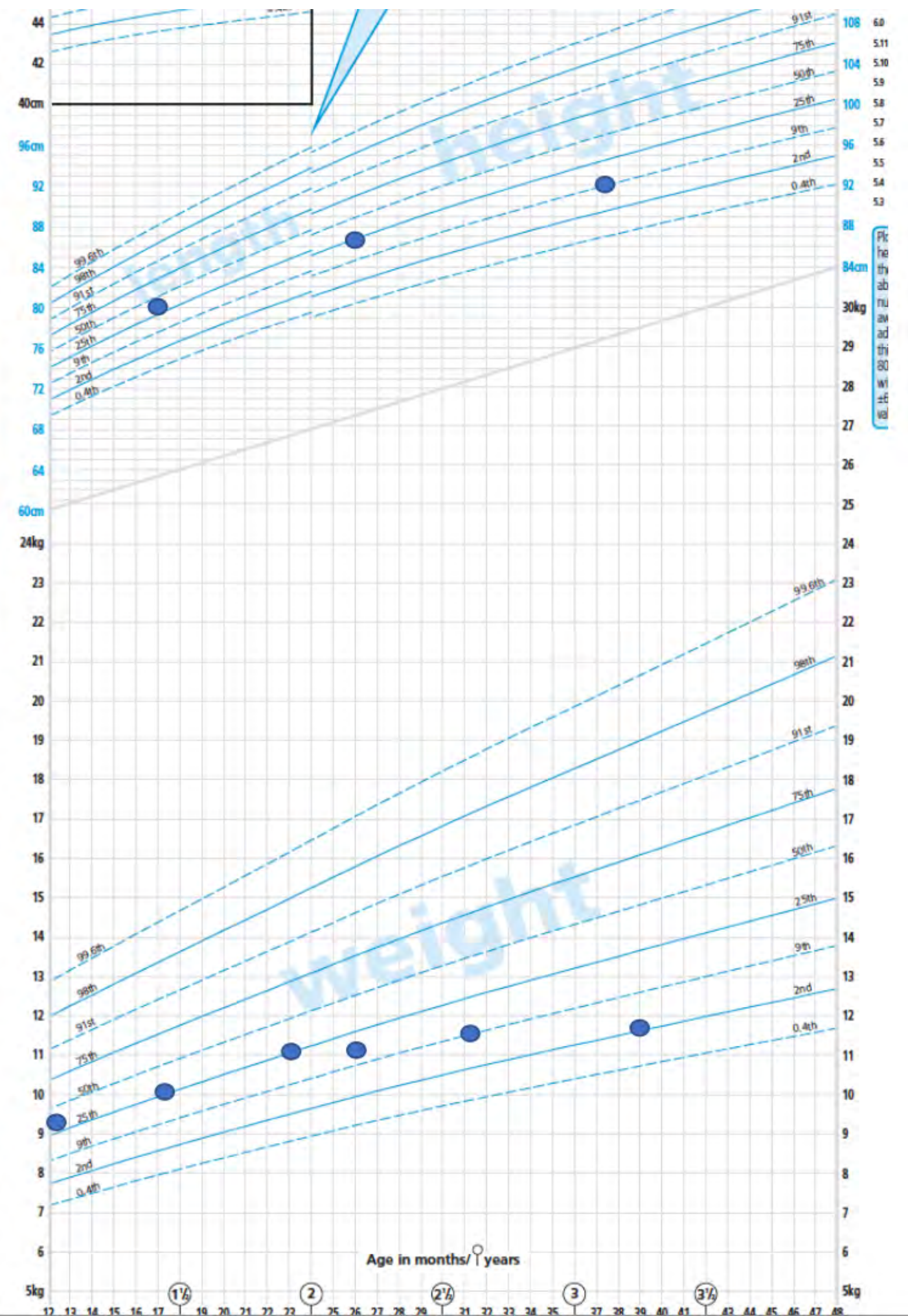




Plotting preterm infants
 Use the **low birthweight chart** for infants less than 32 weeks gestation and any other infants requiring detailed assessment.
 Use **this section** for infants of less than 37 weeks gestation. As with term infants there may be some weight loss in the early days. From 42 weeks, plot on the **0-1 year chart** with gestational correction.

Gestational correction
 Plot actual age then draw a line back the number of weeks the infant was preterm and mark the spot with an arrow; this is the gestationally corrected centile.

Some degree of weight loss is common after birth. Calculating the percentage weight loss is a useful way to identify babies who need assessment.



Plot the baby's weight at birth

NUTRITIONAL BLOOD RESULTS

- Iron status
 - Haemoglobin - low
 - MCV - low
 - Ferritin - low (4)
- vitamin B12
 - vitamin B12 - low
 - MMA - raised
 - Hcy - raised
- vitamin D markers
 - 17nmol/L (deficiency <30nmol/L)
 - Phosphate and calcium normal



NUTRITIONAL CONCERNS (I)

- Growth
 - low weight-for-age (-2 z-score)
 - low height-for-age (-1.7 Z-score)
- Iron deficiency anaemia
 - Correct through supplementation
 - Assess iron intake
 - Assess phytate content of the diet and meal combinations
- Vitamin B12 deficiency
 - Correct through supplementation
- Vitamin D deficiency
 - Correct through supplementation

NUTRITIONAL CONCERNS (2)

- Low fat intake
 - growth faltering - inadequate calorie intake
 - no nut butters
 - low calorie almond drink
- Low calcium intake
 - unfortified soya yoghurt
 - homemade almond drink
- No vitamin / mineral supplement



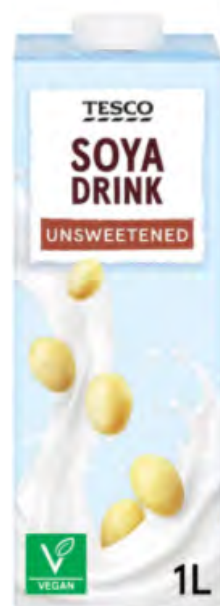
NUTRITIONAL ADVICE (I)

CALCIUM

- Opt for a fortified dairy alternative drink instead of home-made
- Fortified soya yoghurt to provide an additional calcium source
- Calcium-set tofu: 400-500mg calcium/100g
- Try to include foods that are naturally high in calcium:
 - low oxalate green vegetables
 - oranges
 - tahini



DAIRY ALTERNATIVE DRINKS



NUTRITIONAL ADVICE (2)

PROTEIN

- Ensure a source of protein at every meal
 - Tofu, soya milk, edamame beans
 - Lentils, beans, hummus
 - Ground nuts/seeds, nut and seed butters
 - Grains such as quinoa, wheat, oats
- Suggest soya/pea-based dairy alternative drinks

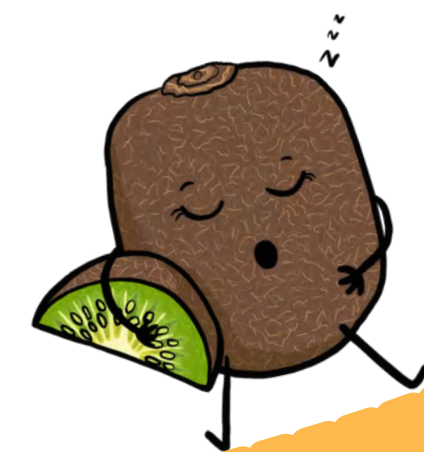
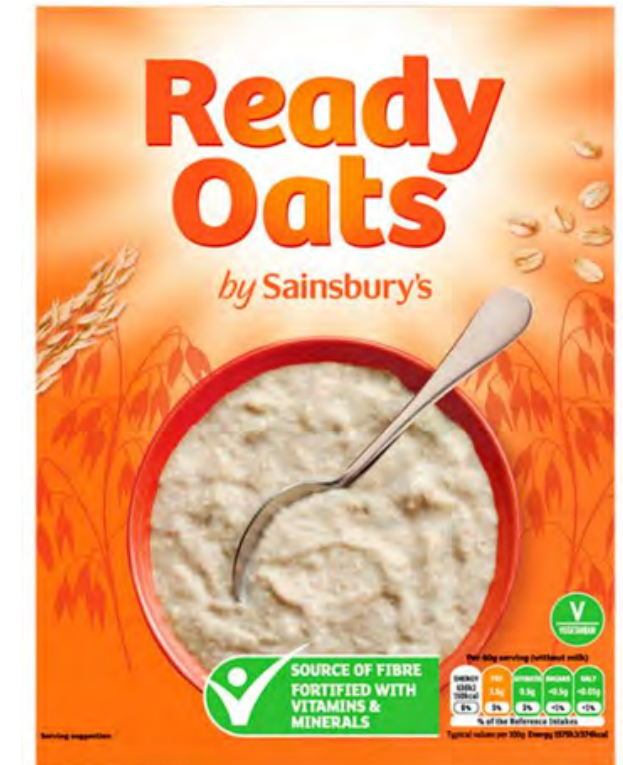


NUTRITIONAL ADVICE (3)

IRON

- Iron rich foods at every meal
 - iron fortified cereals
 - legumes
 - tofu, edamame beans
 - nuts and seeds
- Iron enhancers to maximise absorption (1, 2, 3)
 - vitamin C
 - beta-carotene
 - onion and garlic

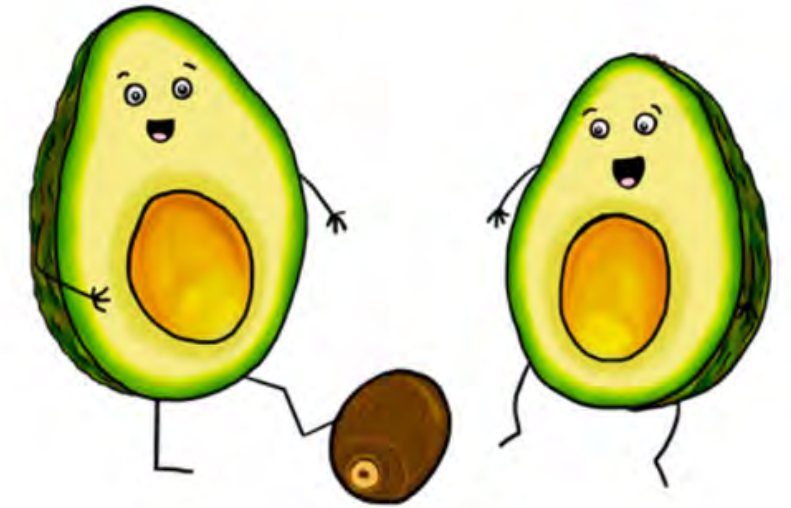
1. Gautam S, Platel K, Srinivasan K. Higher bioaccessibility of iron and zinc from food grains in the presence of garlic and onion. *J Agric Food Chem*. 2010 Jul 28;58(14):8426-9.
2. Skolmowska D, Głabska D. Effectiveness of Dietary Intervention with Iron and Vitamin C Administered Separately in Improving Iron Status in Young Women. *Int J Environ Res Public Health*. 2022 Sep 20;19(19):11877.
3. García-Casal MN, Layrisse M, Solano L, Barón MA, Arguello F, Llovera D, Ramírez J, Leets I, Tropper E. Vitamin A and beta-carotene can improve nonheme iron absorption from rice, wheat and corn by humans. *J Nutr*. 1998 Mar;128(3):646-50.



NUTRITIONAL ADVICE (4)

FATS

- Support the family to introduce nut butters
- Recommend Algal oil DHA supplement
- Education around plant-based sources of fat and the importance of fat as an energy source in young children
- Food exchange system for educating parents (1, 2)



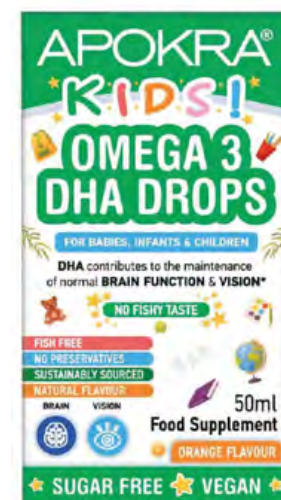
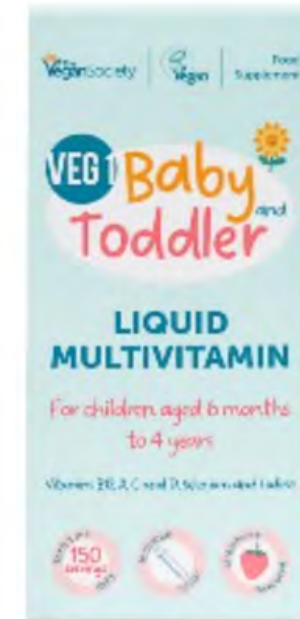
1. Menal-Puey S, Martínez-Biarge M, Marques-Lopes I. Developing a Food Exchange System for Meal Planning in Vegan Children and Adolescents. *Nutrients*. 2018 Dec 25;11(1):43.

2. Baroni L, Goggi S, Battino M. Planning Well-Balanced Vegetarian Diets in Infants, Children, and Adolescents: The VegPlate Junior. *J Acad Nutr Diet*. 2019 Jul;119(7):1067-1074.

NUTRITIONAL ADVICE (5)

SUPPLEMENTS

- Supplement to include adequate amounts of:
 - vitamin B12
 - Iodine
- Algal oil DHA supplement



IODINE, VITAMIN B12, DHA

- Iodine
 - The main sources of iodine are dairy products and fish/seafood (seaweed too but can contain excessive amounts)
 - Iodine intakes were low in ALL groups in the VeChi study and VN children had the lowest intakes (1)
- Vitamin B12
 - Vitamin B12 is formed by bacteria
 - Plant foods are not a reliable source
 - Supplement is recommended for all predominantly plant-based
- DHA/EPA
 - microalgae contain significant amounts
 - Main sources in UK diet are oily fish and some eggs



SUPPLEMENTS FOR PLANT-BASED CHILDREN

VITAMINS A AND D


- In the UK, the Department of Health recommends that all breastfed infants are supplemented with 8.5-10ug vitamin D per day from birth
- From 6 months of age, vitamins A and D are recommended (regardless of eating pattern) UNLESS drinking more than 500ml infant formula per day
- Amounts recommended in the UK
 - 10ug vitamin D
 - 233ug vitamin A

SUPPLEMENTS I RECOMMEND FOR PLANT-BASED INFANTS AND CHILDREN (1)

- Vitamin B12
 - start when infant is eating 3 meals per day
 - 2.5 - 5µg/day
- Iodine
 - start at 1 year of age
 - 50-70µg/day(1-3 years)
 - 100µg/day (4-6 years)
- DHA
 - start at 1 year of age
 - 100mg per day (1-2 years)
 - 100-150mg per day (2-4 years)

1. Plant Based Health Professionals UK





**RECOMMENDED
RESOURCES**



Eating well: vegan infants
and under-5s



FIRST STEPS NUTRITION TRUST 



<https://www.firststepsnutrition.org/vegan-infants>

Feeding your vegan baby

The first year

Dr Miriam Martinez-Biarge,
Paediatrician



0-6 months

Breastmilk is the ideal food for babies.

It provides all nutrients babies need except for vitamin D, and promotes healthy growth and development. It contains antibodies that help to protect babies against infections; as well as prebiotics and probiotics that contribute to developing a healthy gut microbiome.

Try to breastfeed your baby as long as you can. Even if you cannot breastfeed exclusively, providing some breastmilk feeds will still be very beneficial for you and your baby.

Dietary recommendations for breastfeeding mothers

Remember to include in your diet:

CAROTENOID-RICH

sweet potato
carrot
pumpkin
spinach
peppers

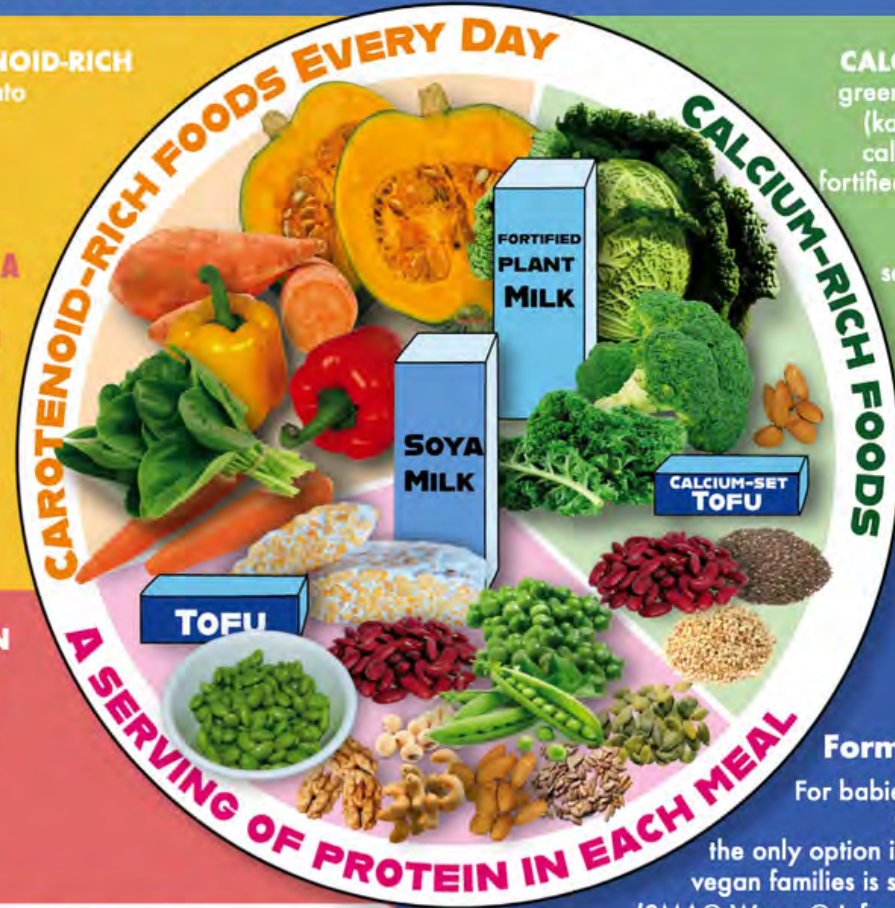
Vitamin A
requirements
double during
breastfeeding

PROTEIN

beans
legumes
soya milk
tofu
tempeh
nuts
seeds

Supplements for breastfeeding women

- B12** Vitamin B12 (cyanocobalamin): 10-25mcg a day or 1,000 mcg 2 times per week
- D3** Vitamin D3 (plant-based): 600 IU a day
- IODINE** Iodine: 150-200 mcg a day
- OMEGA 3** Long chain omega-3 fatty acid (plant-based): 400-500 mg a day (at least 250 mg of DHA)



CALCIUM-RICH

green vegetables
(kale, broccoli)
calcium-set tofu
fortified plant milks
legumes
chia seeds
sesame seeds
almonds

Formula Milk

For babies who need formula milk the only option in the UK for vegan families is soya formula (SMA® Wysoy® Infant Formula*). This formula can be used safely from the day of birth.

Supplements for breastfeeding babies

- D3** 400 IU a day of plant-based vitamin D3

*This formula is >99% vegan. The source of vitamin D is vegetarian not vegan. It is the only non-dairy formula option in the UK

Feeding your vegan baby

The first year

Dr Miriam Martinez-Biarge,
Paediatrician



6-12 months

Offer foods from these four food groups every day:

RIPE FRUIT:
Apple, pear, banana, all types of berries, peach, plums, orange, clementine, kiwi, avocado, mango, pineapple, melon

PROTEIN-RICH FOODS:
Tofu, tempeh, hummus and other legume spreads, cooked chickpeas and other pulses, peanut butter and nut butters (thin layers)

WHOLE GRAINS:
Sourdough bread, cooked pasta, cooked rice and millet, oat crackers, couscous, quinoa, chapatti and pita bread

COOKED VEGETABLES:
Carrots, potatoes and sweet potatoes, cooked pumpkin, steamed broccoli, cauliflower, peas, courgette, asparagus, cabbage, kale

BABY LED WEANING PLATE
All foods should squish easily between thumb and forefinger

Offer iron-rich foods early, combined with vitamin C-rich foods in the same meal

VITAMIN C - RICH FOODS:
Orange, grapefruit, pineapple, mango, kiwi, strawberries, broccoli, tomatoes

IRON - RICH FOODS:
Lentils, hummus, tofu, wholemeal bread, ground seeds



Supplement recommendations for **PLANT-BASED KIDS & BREASTFEEDING MUMS**

Paula Hallam RD, PG Cert
Specialist Paediatric Dietitian
Plant Based Kids

Food Sources of **KEY NUTRIENTS FOR PLANT-BASED KIDS**

VITAMIN B12
(Eggs)
(Dairy Products)
Fortified Foods
e.g. Nutritional yeast
or Fortified plant-based drinks
Supplement*



IODINE
(Dairy products)
(Eggs)
Nori seaweed
Supplement*



IRON
All types of beans
Lentils
Soya beans
Tofu
Chickpeas
Quinoa
Lentil/chickpea pasta
Nuts and seeds
Dried fruits
Fortified breakfast cereals

VITAMIN B2 (RIBOFLAVIN)
Wheat germ
Nutritional yeast
Mushrooms
Almonds
(Dairy products)



ZINC
Beans, lentils, chickpeas
Oats and wheatgrain cereals
Pumpkin seeds
Nutritional yeast
Nut butters
Wheat germ
(Eggs)
(Dairy products)

OMEGA-3 FATS
Walnuts
Chia/flax/hemp seeds
Tofu, soya beans
(Some eggs)
Rapeseed Oil
Supplement*



CALCIUM
Calcium-set tofu
Calcium fortified drinks and yoghurts
Calcium fortified breads and cereals
Low oxalate green vegetables such as
broccoli, kale, Brussel sprouts, bok choy
Oranges
Dried figs
Sesame seeds and tahini
Almonds
(Dairy products)



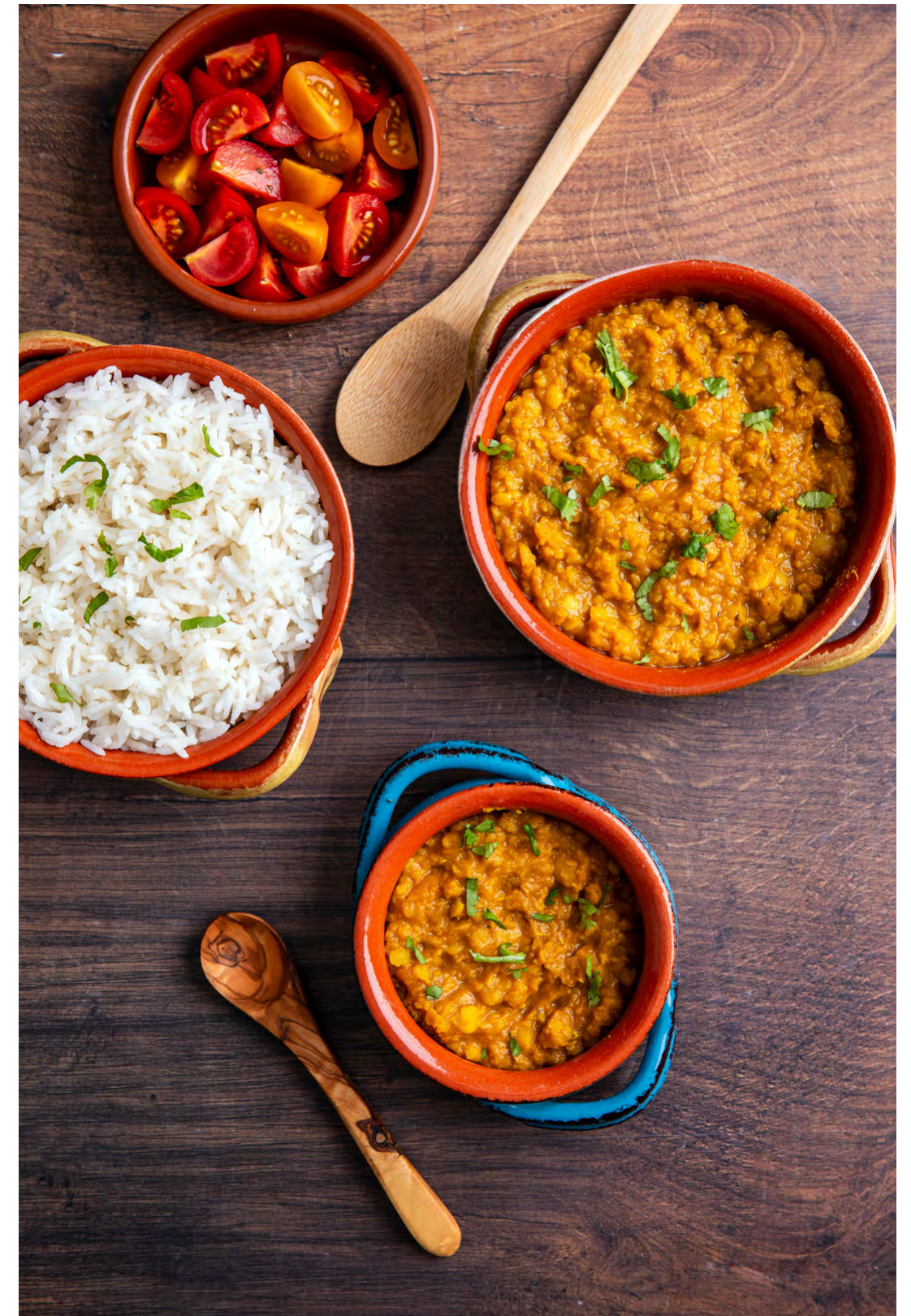
SELENIUM
Brazil nuts

VITAMIN D
(Eggs)
Supplement*



PLANT POWERED LITTLE PEOPLE BOOK

- For parents of children under the age of 5 who would like to include more plants in their family's eating pattern
- Part-nutrition guide, part-recipe book
- In the book I cover:
 - why plant-based?
 - micronutrients and macronutrients
 - plant based nutrition essentials for babies and toddlers
 - meal planning
 - 36 recipes
- Published on 23rd November 2023



CONTACT DETAILS



@plantbasedkids.uk



paula@tinytotsnutrition.co.uk



www.plantbasedkids.uk



QUESTIONS

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