

Dietary reference values for vitamins and minerals for infants and children

To: the State Secretary for Youth, Prevention and Sport
No. 2025/06e, The Hague, 23 April 2025

Health Council of the Netherlands



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summary

The Health Council of the Netherlands has derived new dietary reference values (DRVs) for vitamins and minerals for infants aged 7 to 11 months and children aged 1 to 17 years. This advisory report is a partial advisory report within the scope of the evaluation of the Dutch DRVs. The Health Council considers harmonisation of DRVs across the European Union preferable. Accordingly, the Council's committee on Dietary Recommendations for Breastfeeding Women and Young Children has evaluated whether the European Food Safety Authority's (EFSA) DRVs could be adopted for the Netherlands.

Derivation of dietary reference values for infants and children

The nutrient requirement corresponds to the intake that prevents symptoms of deficiency and minimises the risk of chronic diseases. For many nutrients, data on nutrient requirements of infants and children are lacking. Only for a few nutrients studies have been conducted specifically in infants and children. Therefore, DRVs for these age groups are often extrapolated from the values for adults. For infants aged 7 to 11 months, DRVs may also be extrapolated from the estimated nutrient intake via lactation of younger infants. For extrapolation of DRVs, assumptions are made on, among other things, body weight.

For assumptions on body weight, the committee used the Dutch reference weights.



EFSA's method of derivation accepted in almost all cases

The committee has examined whether there were serious objections to the methodology used by EFSA for deriving the DRVs for infants and children. If relevant, the committee also examined other leading international reports on DRVs. The committee concludes that EFSA's methodology could be adopted in almost all cases. Compared to the Dutch DRVs that were valid up until now, there are several shifts, both upwards and downwards. This is due to modifications in derivation methods, age categories, and reference weights.

Not all DRVs are in practice relevant for public education on nutrition and monitoring of dietary intake in the Netherlands. Of some, the substantiation is very limited and deficiencies of these nutrients in the Netherlands do not appear to be present.



Sometimes another type of reference value is recommended for use in the Netherlands

With extrapolation, there is considerable uncertainty about the nutrient requirement due to the assumption about the association of the requirement with body weight and the significant differences between children in terms of growth and timing of growth spurt. The uncertainties surrounding the values of the DRVs are therefore greater for children than for adults. Because of these uncertainties, the committee derived adequate intakes for most nutrients – which in some cases differs from EFSA. This type of DRV is chosen if the nutrient requirement is difficult to determine. This is in line with what the Health Council has done so far regarding DRVs for infants and children.

Not for all nutrients reference values were set

As in adults, there are 2 minerals for which no DRVs have been derived for infants and children in the Netherlands: chromium and fluoride. For chromium this is the case because it is unclear whether chromium is an essential nutrient. Also, fluoride is not considered an essential nutrient. Because of the local effect of fluoride on the prevention of caries, in the Netherlands oral hygiene products contain fluoride. Therefore, a DRV is not needed for fluoride. For sodium and chloride, there are no DRVs in the Netherlands either. Sodium and chloride are, as sodium chloride, part of the Dutch dietary guidelines.

Considerations when using dietary reference values for infants and children

DRVs are derived for healthy infants and children with a healthy weight (who are not pregnant or breastfeeding). DRVs for vitamins and minerals are relevant for public education on nutrition, for example from the Netherlands Nutrition Centre. Furthermore, healthcare professionals, such as dietitians and pediatricians can use these DRVs to advise individuals on healthy eating habits or diets. DRVs are also used by the Institute for Public Health and the Environment to monitor the nutrient intake of the Dutch population. DRVs are important for establishing a healthy diet, but if a child's intake is lower than the DRV, it does not necessarily mean that this specific child's intake is insufficient.

Additional data are needed to determine that, for example, growth data or blood tests.



01 introduction

1.1 Background

Dietary reference values (DRVs) provide information about the amounts of vitamins, minerals, proteins, carbohydrates, and fats that healthy individuals with a healthy weight should consume to stay healthy.

The Dutch DRVs are derived by the Health Council of the Netherlands.¹

The Health Council considers harmonisation of DRVs across the European Union preferable. For most vitamins and minerals, the reference values that have been derived for Europe as a whole may also apply to the Netherlands. DRVs are often established for larger regions: for example, the United States and Canada have the same reference values,² as well as the Nordic countries,³ and the World Health Organization (WHO)/United Nations Food and Agriculture Organization (FAO) DRVs are also intended for use in various countries. This is why the Health Council evaluates the DRVs published by the *European Food Safety Authority* (EFSA),⁵⁻³¹ to determine to what extent they can also apply to the Netherlands. Sodium and chloride,^{32,33} in the form of table salt (sodium chloride), are part of the *Dutch Dietary Guidelines* and have therefore not been included in this advisory report.

Since 2018, the Health Council of the Netherlands has published 7 advisory reports on DRVs for different nutrients and for different target groups:

1. Vitamins and minerals for adults (2018),³⁴
2. Protein for all target groups (2021),³⁵
3. Vitamins and minerals for pregnant women (2021),³⁶
4. Energy (caloric intake) for all target groups (August 2022),³⁷
5. Tolerable upper intake levels for all nutrients and all target groups (2023),³⁸
6. Adaptation of the qualification of DRVs for selenium (2024),³⁹
7. Vitamins and minerals for lactating women (2024).⁴⁰

This 8th advisory report on DRVs for infants and children addresses the same vitamins and minerals as the 1st, 3rd, and 7th advisory report. DRVs for carbohydrates and fats will be published at a later date.

The present advisory report was prepared by the committee on *Dietary Recommendations for Breastfeeding Women and for Young Children* (hereinafter 'the committee'). The committee members are listed at the end of this advisory report. The committee also used expertise from the Health Council's permanent committee on Nutrition.

DRVs are derived based on an estimate of the intake needed for maintenance of the body and, in the case of infants and children, for healthy growth and development. For infants up to 6 months, the starting point is that (full) breastfeeding meets the requirements for nutrients.³⁵ The composition of infant formula, regulated by the European Union, is



based on this. For that reason, EFSA did not derive DRVs for infants up to 6 months, nor does the committee. DRVs that up until now applied in the Netherlands for this age group do hereby not apply anymore.

The DRVs relate to the desirable total intake of a vitamin or mineral and not whether supplementation is needed. The Health Council will advise on vitamin K supplementation in newborns in a separate publication. That advisory report does not address the DRVs of vitamin K, but the need for providing extra vitamin K to newborns to prevent vitamin K deficiency bleedings.

The Council will advise on dietary recommendations for children up to 2 years of age at a later date. Dietary recommendations concern broader advice on a healthy diet including aspects of food safety. The DRVs are also considered.

1.2 Application and types of dietary reference values

In the *2015 Dutch Dietary Guidelines*, the Health Council described the recommended intake of foods and beverages to prevent the 10 most important chronic diseases in the general population.⁴¹ DRVs do not focus on foods and beverages, but on the nutrients that they contain: vitamins, minerals, energy, proteins, fats, carbohydrates, and dietary fiber. If the intake of, for example, a vitamin or mineral is too low, symptoms of deficiency may arise and/or there may be an increased risk of disease.

Most DRVs focus on preventing nutrient-specific symptoms of deficiency and are therefore complementary to the *Dutch Dietary Guidelines*. The Health Council is tasked with deriving dietary guidelines, dietary recommendations, and DRVs that are based on the latest scientific knowledge. The Netherlands Nutrition Centre (in Dutch: Voedingscentrum) provides public education on nutrition.

Regarding DRVs, a distinction is made between the average requirement, the population reference intake derived from that, and the adequate intake (see the Types of dietary reference values text box). More about the methodology to establish DRVs can be found in the background document *Establishing and applying average requirements and population reference intakes or adequate intake in adults*, which can be found at healthcouncil.nl.

In many cases, the application of the population reference intake and the adequate intake is similar. DRVs provide information about the intake that the body needs to function properly or avoid illness, as well as about the highest long-term intake levels that are considered unlikely to pose a risk of adverse health effects (tolerable upper intake levels). This advisory report focuses on DRVs that relate to risks of low intake rather than tolerable upper intake levels. Tolerable upper intake levels are derived if there is sufficient evidence that a high intake may have adverse effects. Since 2023, these are being adopted directly from EFSA for application in the Netherlands.³⁸



DRVs for vitamins and minerals for infants and children are, as mentioned above, relevant for public education on nutrition provided by, for example, the Netherlands Nutrition Centre. Furthermore, healthcare professionals, such as dietitians and pediatricians can use these DRVs to advise individuals on a healthy diet. The DRVs are also used to monitor the nutrient intake of the Dutch population by the Institute for Public Health and the Environment.⁴³

Types of dietary reference values

There are several types of dietary reference values:

1. The *average requirement* refers to the intake level that would meet the individual requirements of half of all people, but not those of the other half.
2. The *population reference intake* is the level considered sufficient for almost everyone in the targeted population group. This level can only be determined if there is sufficient scientific data to estimate an average requirement. In theory, the population reference intake is the intake level that is adequate for exactly 97.5% of the target group. The population reference intake is calculated based on a coefficient of variation. This coefficient can differ between nutrients.
3. The *adequate intake* is an intake level that can be assumed to meet the requirements of almost everyone in the targeted population group. This type of dietary reference value is determined if the average requirement and, as a result, the population reference intake, cannot be determined.
4. The *tolerable upper intake level* is the highest intake level at which no harmful effects are to be expected from long-term exposure. The tolerable upper intake level is not the ideal intake level. An increase in intake above the population reference intake or adequate intake is not expected to provide further health

benefit, and a higher intake than the tolerable upper intake level is potentially unhealthy.

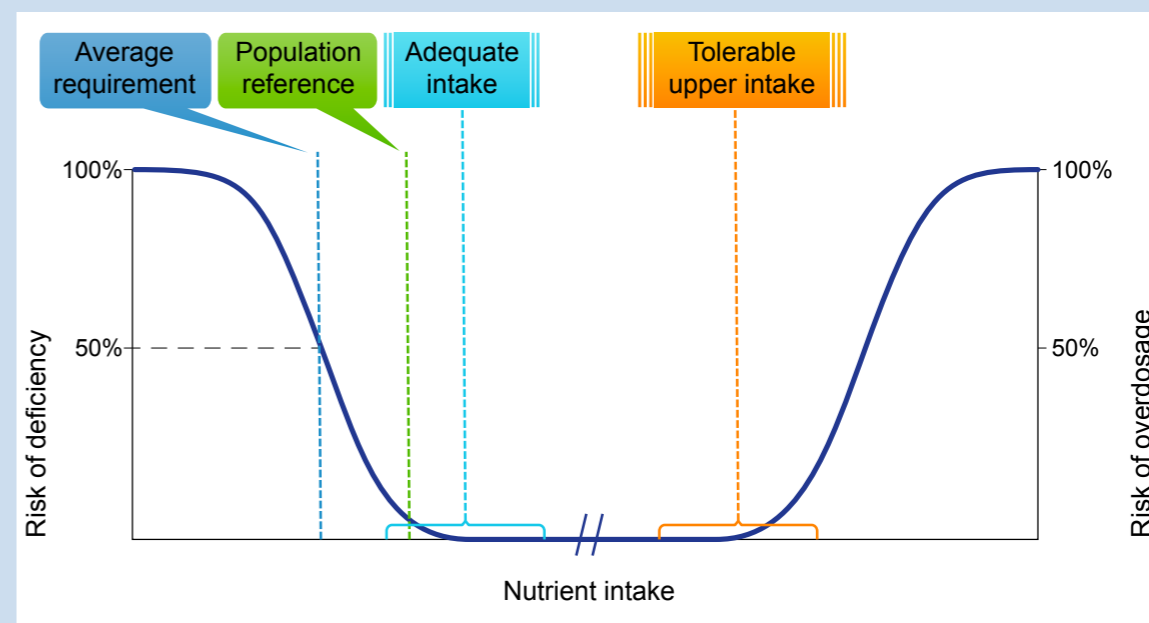


Figure 1 The types of dietary reference values in relation to nutrient intake (x-axis) and the probability that this intake is too low or too high (y-axis)

1.3 Principles for setting dietary reference values

DRVs refer to the average conditions in larger population groups. Dietary patterns can account for differences in requirement between individuals in those population groups (e.g., some nutrients can influence each other's absorption in the body), as are personal characteristics such as height, weight, body composition, physiological and genetic characteristics, and growth rate. In this advisory report, the committee focuses on healthy infants and children with a healthy weight. In teenagers who are pregnant



or breastfeeding, the requirement for nutrients is generally higher. That has not been addressed in this advisory report. When deriving DRVs, it is assumed that the intake of the other nutrients is sufficient. This advice does not address whether the requirements for certain vitamins and minerals is different in children with obesity.

1.4 Reading guide

In Chapter 2, the committee explains the methodology used in the evaluation of EFSA's DRVs for infants and children. Chapter 3 describes the findings of the evaluation.



02 evaluation of the EFSA's dietary reference values

DRVs for infants and children are often based on extrapolation of the DRVs for adults based on body weight. The Dutch reference body weights are used for this extrapolation. Not all DRVs are relevant in practice for public education on nutrition and nutrient intake monitoring. For the DRVs that are relevant, the committee evaluates whether EFSA's derivation method can be adopted.

2.1 Derivation method for infants and children

2.1.1 Age groups

This advisory report concerns infants (from 7 up to and including 11 months of age) and children (from 1 up to and including 17 years of age). The committee followed EFSA's age (sub)groups as the Health Council previously decided upon.³⁴

2.1.2 Extrapolation

For many nutrients data is lacking on the requirements of infants and children; few studies have been conducted specifically in infants and children. Therefore, the DRVs for these groups are usually derived based on extrapolation according to body weight. If the requirement for a nutrient mainly depends on metabolically active tissue (such as muscle mass),

then body weight to power 0.75 is usually used for the extrapolation of the DRV.⁴⁴ In addition, the extrapolation takes into account the growth of infants and children.

The DRVs for children are in many cases extrapolated from the DRVs of non-pregnant and non-lactating adults. The reference values for children are therefore dependent on decisions of the Health Council regarding the reference values for adults.³⁴ In the case of adults, the Health Council derived lower DRVs for a number of nutrients compared to EFSA, because the Council considered it important that the DRVs were not set unnecessarily high. Insufficient substantiation may unjustifiably raise concerns about suspected too low intakes. Reference values for infants from 7 months of age and older are derived, where possible, based on the estimated nutrient intake of fully breast-fed babies from 0 to 7 months of age.

For some DRVs, a factorial model is used, adding up individual factors that determine the requirement for a nutrient. This concerns, for example, the amount of a nutrient that leaves the body via stool, urine and skin, and the amounts needed for growth and maintenance of the body.

With extrapolation, there is considerable uncertainty about the nutrient requirement due to the assumption about the association of the requirement with body weight and the significant differences between



children in terms of growth and timing of growth spurt. The uncertainties surrounding the values of the DRVs are therefore greater for children than for adults.

If the DRVs for adults between men and women are numerically the same, then the committee also derived the same DRVs for boys and girls. In other cases, this has been evaluated on a case-by-case basis.

2.1.3 Reference weights

For the extrapolation of DRVs from adults to infants and children, assumptions are being made about, among other things, body weight. For this purpose, EFSA used median weights of children from different European countries. Because Dutch people are relatively tall, the committee used Dutch reference weights (see Table 1). The Health Council revised these in 2021 (Advisory report on DRVs for proteins).³⁵ The reference weights are available for children per year of age,³⁵ but for this advisory report they have been converted into the age groups. For the Dutch reference weights, height data (length-by-age) collected within the Fifth National Growth Study from 2009,^{45,46} were used. In recent decades, Dutch children are, however, as in many other countries and as well as adults, increasingly overweight for their height. As a result, the data on body weight of the Fifth National Growth Study are not valid as a reference for healthy growth. The Health Council has therefore determined the corresponding healthy weight per reference length based on TNO's

weight-for-length growth diagrams of the Third National Growth Study from 1980.^{46,47}

Table 1 Reference weights (in kilograms) for infants and children in the Netherlands^a

| Age | Boys / Men | Girls / Women | Average |
|-------------|------------|---------------|---------|
| 3 months | 5.7 | 5.4 | 5.6 |
| 6 months | 7.6 | 7.2 | 7.4 |
| 9 months | 9.0 | 8.5 | 8.8 |
| 1-3 years | 12.7 | 12.2 | 12.5 |
| 4-6 years | 19.6 | 19.2 | 19.4 |
| 7-10 years | 29.0 | 28.8 | 28.9 |
| 11-14 years | 44.2 | 45.1 | 44.6 |
| 15-17 years | 63.7 | 56.4 | 60.1 |

^a The reference weights are available for children per year of age, but the committee converted these to the age groups used in this advisory report.

2.2 Whether or not dietary reference values were derived

This advisory report addresses the same vitamins and minerals⁵⁻³¹ as in previous advisory reports on DRVs for adults,³⁴ pregnant women,³⁶ and lactating women.⁴⁰ For chromium and fluoride, the Health Council did not derive DRVs for the Netherlands in those previous advisory reports. For chromium – for which EFSA also has no DRVs – this is the case because it is unclear whether chromium is an essential nutrient. No DRVs have been set for fluoride because fluoride is not considered an essential nutrient.⁴² Fluoride does have a local effect in the prevention of caries, and therefore fluoride is added to oral hygiene products in the Netherlands.



2.3 Relevance for public information on nutrition and monitoring

Not all DRVs are relevant in practice for the general population in the Netherlands. Of some, the substantiation is very limited, and deficiencies of these nutrients do not appear to occur in the Netherlands. Because these are still essential nutrients that cannot be synthesised by the body, DRVs are needed, but it is not necessary to use these DRVs in the Netherlands for public education on nutrition or for monitoring of nutrient intakes. Previously, the Health Council considered the following DRVs for adults not relevant for public education on nutrition or monitoring of intake: pantothenic acid, biotin, vitamin E, choline, phosphorus, manganese and molybdenum.^{34,36} There is no information available on deficiencies in the Netherlands of these 7 nutrients specifically regarding infants and children. The committee therefore has no reason to believe that the DRVs for these nutrients would be relevant for public education on nutrition and monitoring of nutrient intakes for infants and children.

2.4 Comparison with other reports on dietary reference values

For the evaluation of EFSA's DRVs, the committee examined other reports on DRVs which it considered most relevant for the Dutch situation:

- Dietary reference values of the Health Council⁴⁸⁻⁵²
- *Nordic Nutrition Recommendations of the Nordic Council of Ministers (NCM)*^{3,53}

- *Dietary Reference Intakes of the American Institute of Medicine (IOM Health and Medicine Division of the National Academies since 2016)*⁵⁴⁻⁵⁹

The NCM's DRVs for the Nordic countries³ are relevant because they have been revised recently and concern reference values for a large European region. The IOM's dietary reference intakes describe the derivation of the reference values for the United States and Canada.⁵⁴⁻⁵⁹ Because the focus is on evaluating EFSA's DRVs, the committee did not conduct its own update of the literature. This was also the case for the DRVs for adults. However, the committee has used recent publications on calcium, vitamin D and zinc published for the purpose of new DRVs for 0 to 2-year-olds of the WHO.⁶⁰⁻⁶⁵ These publications did not give rise to deviations from EFSA's DRVs for calcium and zinc. For vitamin D, too, the publications did not give rise to a different reference value.

2.5 Weighting the reports

Because European harmonisation was a key basic principle, the committee judged whether there were any serious objections to EFSA's methodology for deriving the requirements of infants and children.^{5-31,66} Detailed information on the derivation of the DRVs can be found in the background document *Evaluation of the dietary reference values for vitamins and minerals for infants and children*, which can be found at healthcouncil.nl.



03 revised dietary reference values for infants and children

The committee has concluded that EFSA's methodology for deriving the requirements for infants and children could almost always be adopted. The final numerical values of the DRVs for Dutch children may turn out to be slightly different from those of EFSA. Sometimes the committee derived the same DRVs for boys and girls, while EFSA did not. The type of DRV that is derived for the application in the Netherlands sometimes differs from that of EFSA.

3.1 Dietary reference values for infants and children in the Netherlands

When deriving DRVs for adults, the Health Council concluded that the following 18 DRVs are the most important for public education on nutrition and monitoring of intake in the Netherlands.^{34,39} These include vitamin A, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, C, D, K1, calcium, iodine, potassium, copper, magnesium, selenium, iron, and zinc. According to the committee, for most of these, EFSA's method of derivation (such as a factorial model or extrapolation) to reach the reference values for infants and children could be adopted. Only in the case of copper, vitamin D, and iron the committee derived the reference values for children differently than EFSA did. This is because the Health

Council had not adopted the (higher) EFSA reference values for adults (based on intake data) (see also 2.1.2).³⁴ For copper, the committee extrapolated the reference values for the adults to children, whereas EFSA used intake data of children. For vitamin D, the committee maintains the existing Dutch DRVs.⁴⁸ For iron, unlike EFSA, the committee has derived separate DRVs for menstruating or non-menstruating girls. The iron requirement varies substantially between girls, depending on (the degree of) blood loss and the level of iron absorption.

Even if EFSA's derivation method has been adopted, there may be differences between the numerical values of the Dutch DRVs and EFSA's DRVs because Dutch reference weights were used for the extrapolations of the Dutch DRVs. Differences could also arise, for example, by extrapolating from Dutch DRVs for adults that are sometimes lower than those of EFSA (such as vitamin B6, B12, C, D, and folate, copper, and zinc).

Because of the uncertainties surrounding the values of the DRVs in infants and children, the Health Council has in the past derived adequate intakes for these groups and no average requirements and population reference intakes. Also now, the committee is of the opinion that due to the large uncertainties in estimating nutrient requirements by extrapolation of body weight alone, adequate intakes in that situation are more appropriate for the application of DRVs in the Netherlands than average



requirements and population reference intakes. Therefore, the committee sometimes deviates from EFSA for the type of DRV, as is the case with vitamins B2, B6, C and folate. If the nutrient requirements have been estimated based on supporting evidence in children (e.g., a factorial model), the committee adopted the type of DRV used by EFSA as well as the derivation method. This is the case for vitamin A, calcium, iron, iodine, and zinc. The requirements of the vitamins thiamin and niacin are energy dependent. EFSA assumes that this energy dependency is similar at all ages. Different (gender-specific) formulas for energy requirements were used to calculate energy requirements for different age groups.³⁷

The adjusted age groups and derivation methods (which are now even more than before related to the growth curves) have resulted in shifts for many nutrients compared to the hitherto valid DRVs. Sometimes this applies to all ages and sometimes to subgroups. For example, the adequate intake of folate has increased for infants and children up to and including 3 years of age and that of magnesium has increased for children from 1 up to and including 9 years of age. The adequate intake of potassium has decreased for all age groups. For zinc, the population reference intake for infants has decreased and it has increased for children from 11 years of age.

Tables 2, 3 and 4 give an overview of the new DRVs for infants and children in the Netherlands. Tables 2 and 3 show the nutrients with an

average requirement (Table 2) and population reference intake (Table 3). For the other nutrients, adequate intakes apply (Table 4).



Table 2 Average requirements of vitamins and minerals for infants and children

| Nutrients | 7-11 months (boys & girls) | 1-3 years (boys & girls) | 4-6 years (boys & girls) | 7-10 years (boys & girls) | 11-14 years (boys & girls) | 15-17 years (boys & girls) |
|-----------------------------------|----------------------------|--------------------------|--------------------------|---------------------------|---|----------------------------|
| Vitamin A (µg RAE/d) ^a | 195 | 220 | 250 | 320 | Boys 480 Girls 475 | Boys 580 Girls 490 |
| Thiamin (mg/MJ) | 0.072 | 0.072 | 0.072 | 0.072 | 0.072 | 0.072 |
| Niacin (NE/MJ) ^b | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Calcium (mg/d) | N/A ^c | 390 | 680 | 670 | 940 | 970 |
| Zinc (mg/d) | 2.5 | 3.6 | 4.6 | 6.2 | Boys 8.7 Girls 8.5 | Boys 11.5 Girls 9.8 |
| Nutrients | 7-11 months (boys & girls) | 1-3 years (boys & girls) | 4-6 years (boys & girls) | 7-11 years (boys & girls) | 12-17 years | |
| Iron (mg/d) | 8 | 5 | 5 | 8 | Boys 8 Girls before menarche 9 ^{d,e} Girls after menarche 7 ^{d,e} | |

Abbreviations: RAE: retinol activity equivalents, NE: Niacin equivalents, N/A: not applicable.

^a 1 µg RAE = 1 µg retinol = 12 µg β-carotene = 24 µg other carotenoids.

^b NE: 1 mg NE = 1 mg of niacin = 60 mg tryptophan.

^c The average requirement for calcium for the group of 7 up to and including 11-month-old infants is not applicable, as an adequate intake has been derived for this group (see Table 4).

^d For all girls from 12 years of age and older, the average requirement cannot be used for monitoring due to uncertainties surrounding the skewed distribution of iron losses due to menstruation and the absorption efficiency.

^e For girls before the menarche, a lower iron absorption efficiency (10%) has been applied than for girls after the menarche (16%). This lower absorption efficiency (10%) corresponds to the absorption efficiency for girls aged 7 up to and including 11 years who are not yet menstruating. Due to the lower absorption efficiency for girls before the menarche compared to after the menarche, the average requirement for girls before the menarche is higher than for girls after the menarche.



Table 3 Population reference intakes of vitamins and minerals for infants and children

| Nutrients | 7-11 months (boys & girls) | 1-3 years (boys & girls) | 4-6 years (boys & girls) | 7-10 years (boys & girls) | 11-14 years (boys & girls) | 15-17 years (boys & girls) |
|-----------------------------------|----------------------------|--------------------------|--------------------------|--|--|----------------------------|
| Vitamin A (µg RAE/d) ^a | 250 | 285 | 325 | 415 | Boys 625 Girls 620 | Boys 750 Girls 635 |
| Thiamin (mg/MJ) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Niacin (NE/MJ) ^b | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Calcium (mg/d) | N/A ^f | 450 | 800 | 800 | 1100 | 1150 |
| Zinc (mg/d) | 3.0 | 4.4 | 5.6 | 7.4 | Boys 10.4 Girls 10.2 | Boys 13.8 Girls 11.8 |
| Nutrients | 7-11 months (boys & girls) | 1-3 years (boys & girls) | 4-6 years (boys & girls) | 7-11 years | 12-17 years | |
| Iron (mg/d) | 11 | 8 | 7 | Boys & girls before menarche 11 Girls after menarche 13 ^c | Boys 11 Girls before menarche 13 ^d Girls after menarche 13 ^e | |

Abbreviations: RAE: retinol activity equivalents, NE: Niacin equivalents, N/A: not applicable.

^a 1 µg RAE = 1 µg retinol = 12 µg β-carotene = 24 µg other carotenoids.

^b 1 mg NE = 1 mg niacin = 60 mg tryptophan.

^c Girls from 7 up to and including 11 years of age who are already menstruating are advised to apply the population reference intake for menstruating girls from 12 up to and including 17 years of age (13 mg/d).

^d For girls before the menarche, a lower iron absorption efficiency (10%) has been applied than for girls after the menarche (16%). This lower absorption efficiency (10%) corresponds to the absorption efficiency for girls aged 7 up to and including 11 who are not yet menstruating. Due to the lower absorption efficiency for girls before the menarche compared to after the menarche, the average requirement (and therefore also the calculated population reference intake) for girls before the menarche (13.2 mg/d) is higher than for girls after the menarche (10.1 mg/d).

^e The population reference intake for the group of 12 up to and including 17-year-old girls (after menarche) was calculated as the average between the calculated population reference intake of this group (10.1 mg/d) and the population reference intake for premenopausal adult women (16 mg/d). As a result, the population reference intake for both girls before the menarche and after the menarche is 13 mg/d.

^f The population reference intake for calcium for the group of 7 up to and including 11-month-old infants is not applicable, as an adequate intake has been derived for this group (see Table 4).



Table 4 Adequate intakes for vitamins and minerals for infants and children

| Nutrients | 7-11 months (boys & girls) | 1-3 years (boys & girls) | 4-6 years (boys & girls) | 7-10 years (boys & girls) | 11-14 years (boys & girls) | 15-17 years (boys & girls) |
|-----------------------------------|----------------------------|--------------------------|--------------------------|---------------------------|----------------------------|----------------------------|
| Riboflavin (mg/d) | 0.4 | 0.5 | 0.6 | 0.9 | 1.2 | 1.5 |
| Pantothenic acid (mg/d) | 3 | 4 | 4 | 4 | 5 | 5 |
| Vitamin B6 (mg/d) | 0.3 | 0.5 | 0.6 | 0.9 | 1.2 | 1.4 |
| Biotin (µg/d) | 6 | 20 | 25 | 25 | 35 | 35 |
| Choline (mg/d) | 160 | 140 | 160 | 230 | 310 | 380 |
| Folate (µg DFE/d) ^a | 90 | 100 | 120 | 170 | 230 | 280 |
| Vitamin B12 (µg/d) | 0.9 | 1.0 | 1.1 | 1.6 | 2.2 | 2.6 |
| Vitamin C (mg/d) | 20 | 20 | 20 | 30 | 45 | Boys 65 Girls 55 |
| Vitamin D (µg/d) | 10 | 10 | 10 | 10 | 10 | 10 |
| Vitamin K1 (µg/d) | 10 | 15 | 20 | 30 | 45 | 60 |
| Calcium | 315 | N/A, see Tables 2 and 3 | N/A, see Tables 2 and 3 | N/A, see Tables 2 and 3 | N/A, see Tables 2 and 3 | N/A, see Tables 2 and 3 |
| Phosphorus (mg/d) | 170 | 250 | 440 | 440 | 610 | 630 |
| Iodine (µg/d) | 70 | 90 | 90 | 90 | 120 | 130 |
| Potassium (mg/d) | 700 | 800 | 1000 | 1600 | 2400 | 3200 |
| Copper (mg/d) | 0.4 | 0.4 | 0.4 | 0.5 | 0.7 | 0.9 |
| Manganese (mg/d) | 0.2 – 0.5 | 0.5 | 1 | 1 | 2 | 2.5 |
| Molybdenum (µg/d) | 10 | 10 | 20 | 25 | 40 | 55 |
| Selenium (µg/d) | 20 | 20 | 20 | 35 | 50 | 65 |
| Nutrients | 7-11 months (boys & girls) | 1-2 years (boys & girls) | 3-9 years (boys & girls) | 10-17 years | | |
| Vitamin E (mg alpha-tocopherol/d) | 5 | 6 | 9 | Boys 13 Girls 11 | | |
| Magnesium (mg/d) | 80 | 170 | 230 | Boys 300 Girls 250 | | |

Abbreviations: DFE: Dietary folate equivalents, N/A: not applicable

^a 1 µg DFE = 0.6 µg folic acid in fortified foods or folic acid taken as a supplement with food = 0.5 µg folic acid taken as a supplement on an empty stomach.



3.2 Considerations in the use of dietary reference values

All vitamins and minerals play a vital role in the body. DRVs are important for establishing a healthy diet, but they also have their limitations.

One limitation is that for some of the nutrients, little to no underlying data are available for deriving DRVs. This applies even more to target groups such as infants and children. The committee therefore considers it important that more research is conducted on nutrient requirements, especially in infants and children. In particular, she mentions iron, because the requirement for iron differs substantially between girls resulting in a skewed distribution of the iron requirement. As a consequence, it is difficult to monitor the iron status and adequacy. Furthermore, the DRVs can be unnecessarily high for many girls.

3.2.1 Application at the individual level

Because population reference intakes and adequate intakes are considered to reflect a sufficient intake level in almost the entire population, these DRVs are used for applications at the level of the individual: if a person's intake is equal or greater than the population reference intake or adequate intake (and lower than the tolerable upper intake level), it can be considered to be adequate. However, if a person's intake is lower than the population reference intake or adequate intake, it does not necessarily mean that this specific individual's intake is insufficient. An intake at the population reference intake or adequate intake is (much) more than necessary for most people. An intake at the

level of the average requirement is already sufficient for half of the group concerned. However, the individual requirement is unknown. Whether the intake level is sufficient for the specific individual concerned can only be determined with additional data on the nutritional status, for example from blood tests or urine tests, or based on any (clinical) symptoms. For infants and children, additionally a healthy growth and development is an important indicator of nutritional status.

3.2.2 Application at the population level

At the population level, DRVs can be used to assess whether the intake of the population is adequate. Once an average requirement has been established, it is possible to determine which part of the population has an average intake below this average requirement. If this part is 10% or more, then the intake at the population level may be too low.

The comparison with the average requirement can only be made if the DRVs and the intake data meet certain conditions, such as that the distribution of the requirement is normally distributed.⁴³ For iron, this prerequisite is not met in menstruating girls and women. In that case, information is needed on the shape of the distribution of the requirement in these groups. For menstruating women, this information is available through EFSA, but it is not available for menstruating girls. If no average requirement or distribution of the requirement is known, only a qualitative estimate can be made based on the adequate intake. If the median intake of the population group concerned is above the adequate intake, the



provision of the nutrient seems adequate, but if it is below, no (quantitative) statement can be made. In the latter case, it is advisable to do additional research to evaluate if there may be a (public health) problem.



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^a Consulted experts are consulted by the committee because their expertise. Consulted experts and observers are entitled to speak during the meeting. They do not have any voting rights and do not bear any responsibility for the content of the committee's advisory report.



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Preferred citation:

Health Council of the Netherlands. Dietary reference values for vitamins and minerals for infants and children.

The Hague: Health Council of the Netherlands, 2025; publication no. 2025/06e.

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