# Attachment 6H: Vitamin B6 - Draft Evidence-to-Decision Framework

# Evidence-to-Decision Framework

## Vitamin B6 – Upper Levels

### Background

#### *Vitamin B6 - function and dietary sources*

#### *Function*

Vitamin B6 is a water-soluble and heat sensitive vitamin. Vitamin B6 performs a wide variety of functions in the body as a coenzyme in metabolism of protein, carbohydrates and lipids and helps in the formation of red blood cells.

Vitamin B6 is a group of six related compounds, known as vitamers: pyridoxal, pyridoxine and pyridoxamine, and their 5′-phosphate forms (see table below). All these forms are present in food (EFSA, 2016). The main form found in human tissues is pyridoxal 5′-phosphate (PLP). Most PLP is stored in muscle, where it is bound to phosphorylase. Pyridoxamine 5′-phosphate (PMP) is the next most common form in human tissues. Plant foods mainly contain pyridoxine (PN) and pyridoxine 5′-phosphate (PNP), which may occur as glucosides (NHMRC, 2006).

Before absorption, phosphorylated forms of vitamin B6, such as PLP and PMP, are broken down in the intestine by phosphatases to non-phosphorylated forms. These forms are then absorbed by the intestinal mucosa and transported to the liver, where they can be converted back to phosphorylated forms. Large doses of PLP and PMP are generally well absorbed (Hamm et al 1979). By contrast, PN glucoside is less well absorbed. The main urinary breakdown product is 4-pyridoxic acid, which accounts for about half of the vitamin B6 compounds found in urine (Shultz & Leklem, 1981).

#### Forms and equivalence of Vitamin $B_6$ compounds

*The table below provides measurements and equivalences for various forms of Vitamin B6 compounds (NHMRC, 2006)*





**AI statement:** Microsoft 365 CoPilot was used to refine language to improve clarity and alignment with the Australian Government Style Manual. All content was reviewed and validated.

| Units of measurement | | | |
|---|---|---|---|
| Pyridoxine (PN) | 1g = 5.9 mmol | 1mmol = 170 mg | Three naturally inter-convertible forms in the tissues |
| Pyridoxal (PL) | 1g = 6.0 mmol | 1mmol = 167 mg | Three naturally inter-convertible forms in the tissues |
| Pyridoxamine (PM) | 1g = 6.0 mmol | 1mmol = 168 mg | Three naturally inter-convertible forms in the tissues |
| Pyridoxal-5-phosphate (PLP) | 1g = 4.1 mmol | 1mmol = 247 mg | Principal active form |
| 4-Pyridoxic acid (4-PA) | 1g = 5.5 mmol | 1mmol = 183 mg | Principal excretory form |
| Pyridoxine hydrochloride (PN.HCl) | 1g = 4.9 mmol | 1mmol = 206 mg | Usual form of supplements |

### *Food*

Vitamin B6 is found in a wide range of foods including organ meats, muscle meats, breakfast cereals, vegetables and fruits. Schedule 17 28 and 29 of the Australia New Zealand Food Standards Code (Food Standards Australia New Zealand, 2015, 2026a, 2026b) sets out the permitted forms and maximum claims for Vitamin B6 added to food.

### *Supplements*

Supplement use is a key consideration for the risk of excess vitamin B6 intake, with one in three people in Australia taking a dietary supplement in 2023 (ABS, 2025). The proportion of Aboriginal and Torres Strait Islander people who took a dietary supplement was 17.5% in 2023.

The 2008/09 New Zealand Adult Nutrition Survey reported nearly one in three (30.7%) New Zealanders aged 15 years and over regularly took some type of dietary supplement over the last year, a further 16.7% were occasional users (Ministry of Health, 2011).

Excess vitamin B6 consumption through supplement use is a risk, as Vitamin B6 is present in many multivitamin and mineral supplements, as well as in magnesium and zinc products, which may be taken in combination (TGA, 2026). TGA is updating regulations to try to reduce the risk of adverse effects from excess vitamin B6 intake (TGA, 2026).

### *Bioavailability factors*

Bioavailability is generally in the region of 75% in a mixed diet (Tarr et al., 1981). It has been proposed that vitamin B6 requirements may be increased at higher protein intake (Baker et al., 1964; Hansen et al., 1996; Linkswiler, 1978), although other studies have not shown this (Pannemans et al., 1994). Nevertheless, protein intake is generally taken into consideration in setting requirements for vitamin B6.

Vitamin B6 bioavailability depends on the vitamer form, food matrix and processing. Phosphorylated forms, such as PLP and PMP, are hydrolysed in the intestine before absorption, while non-phosphorylated forms are absorbed mainly in the jejunum and converted in the liver to active PLP. Bioavailability is generally high from animal foods and supplements, but lower from some plant foods because a proportion of pyridoxine occurs as pyridoxine glucoside, which is less completely absorbed and metabolised (Reynolds, 1988).

### *Health effects of excess*

Excess vitamin B6 is mainly associated with peripheral neuropathy, particularly after long-term use of high-dose supplements rather than normal dietary intake. The effect is mainly sensory and may include paraesthesia, hyperaesthesia, numbness, pain, impaired proprioception, sensory ataxia, balance problems, gait disturbance and, in severe cases, difficulty walking (EFSA Panel on Nutrition et al., 2023). Emerging evidence also suggests that pyridoxine toxicity may involve small fibre neuropathy, which can be associated with autonomic dysfunction (dysautonomia), although the evidence for these manifestations is currently limited and requires further investigation (Bacharach et al., 2017; Muhamad et al., 2023). EFSA identified peripheral neuropathy as the critical effect for deriving the vitamin B6 Upper Level, based on **EFSA**'s weight-of-evidence assessment across human evidence, case reports, nutrivigilance data and animal data (EFSA Panel on Nutrition et al., 2023).

SLR (2026) noted that the evidence suggests a dose–duration relationship, where higher intakes may cause symptoms sooner, while lower intakes may require longer exposure before symptoms appear. Evidence has shown symptoms to improve after stopping vitamin B6 supplements, however, it is unclear whether more severe symptoms take longer to abate or are less likely to fully resolve (SLR, 2006).

### *Criteria for measuring vitamin B6 intake and status*

Vitamin B6 intake is usually estimated from dietary assessment methods, such as food records or recalls, with separate consideration of fortified foods and supplements. Estimates can vary because supplement use, food composition data, dietary assessment methods and analytical methods differ between studies. There are limitations in the accuracy of dietary vitamin B6 intake assessment methods, including concerns about reporting bias (including social desirability bias), variability of vitamin B6 content in foods, and the accuracy of food composition data. It is also difficult to ascertain individual status based on dietary intakes which reflect intakes at a specific point in time and fail to account for vitamin B6 stores.

Vitamin B6 status is most commonly assessed using plasma pyridoxal 5′-phosphate (PLP), the main circulating active form. It is considered a reliable marker of vitamin B6 intake and status at usual intake levels as it reflects tissue stores (EFSA Panel on Nutrition et al., 2023; Lui et al., 1985) suggesting that plasma PLP is probably the best single indicator. Urinary 4-pyridoxic acid can reflect short-term intake over about 5–7 days but is not considered a reliable marker of longer-term vitamin B6 status (EFSA Panel on Nutrition et al., 2023). Other indicators used to assess against vitamin B6 NRVs have ranged from measures of vitamin concentrations in plasma, blood cell or urine to functional measures such as erythrocyte aminotransferase saturation by pyridoxal 5′-phosphate or tryptophan metabolites (NHMRC, 2006). Vitamin B6 levels are not accurate if not measured while fasting.

# Evidence to decision tables: Upper levels

## ADULTS

***Recommendation***

| OPTION 1:<br>Maintain current UL recommendations | | OPTION 2:<br>Decrease the UL | |
|---|---|---|---|
| **Males** | **UL** | **Males** | **UL** |
| 18 years and older | *50 mg/day* | 18 years and older | *14 mg/day* |
| **Females** | **UL** | **Females** | **UL** |
| 18 years and older | *50 mg/day* | 18 years and older | *14 mg/day* |
| *Notes:*<br>UL applies to both sexes, and during pregnancy and lactation. | | *Notes:*<br>UL applies to both sexes, and during pregnancy and lactation.<br>Based on the intake data for the Australia (2023) and New Zealand (2008-2009) populations it is unlikely that most of the general adult population will exceed this UL. Those most at risk of excess intake are regular users of Vitamin B6 supplements, particularly people who take high-doses, multiple supplements or mixed supplements, some of which may contain 'hidden' vitamin B6 and high consumers of formulated caffeinated beverages. | |

## *Health evidence profile and supporting information*

| OPTION 1: Maintain current UL recommendations | OPTION 2: Decrease the UL |
|---|---|
| Current ULs were based on studies of oral pyridoxine use at doses below 1 g/day (Berger & Schaumburg, 1984; Bernstein & Lobitz, 1988; Dalton, 1985; Dalton & Dalton, 1987; Del Tredici et al., 1985; FNB:IOM, 1998; Parry & Bredesen, 1985). Most participants in these studies had taken supplements for 5 to 6 months or less, however, Dalton and Dalton (1987) suggested symptoms may take longer to appear, as participants with symptoms had taken supplements for an average of 2.9 years, compared with 1.9 years for those without symptoms (symptoms resolved 6 months after supplement cessation).<br><br>A NOAEL of 200 mg/day from Bernstein and Lobitz (1988); Del Tredici et al. (1985), was selected as the reference point, in line with the Institute of Medicine (FNB:IOM, 1998). | *An evidence review was contracted to identify the most suitable international guidance for adopting or adapting to the local context, and to identify any new evidence that might impact the UL (SLR, 2006). The following information is from the evidence review.*<br><br>The review found EFSA (2023) to be the only guidance document that met the pre-defined credibility criteria (93.8%, above the 80% threshold) and the only reassessment of the vitamin B6 UL since NHMRC 2006 UL.<br><br>EFSA derived an adult UL of 12 mg/day (applicable also to pregnant and lactating women), based on peripheral neuropathy as the critical effect. EFSA's reference point of 50 mg/day is not derived from a single study but reflects a weight-of-evidence (WoE) assessment across multiple converging lines of evidence, anchored by the Dalton and Dalton (1987) case-control study and supported by a positive rechallenge case, additional case reports, and Dutch and French nutrivigilance data. This human-based derivation (uncertainty factor (UF) of 4[1], giving 12.5 mg/day) was cross-checked against an independent animal-based derivation (Phillips et al. 1978 dog LOAEL of 50 mg/kg bw/day, uncertainty factor (UF) of 300[2], giving 11.7 mg/day); the agreement between these values increased confidence in the final UL of 12 mg/day.<br><br>An evidence review of recent literature (2022 onwards) identified several relevant primary studies, however the new evidence identified was not considered sufficient to warrant revision of EFSAs 2023 Vitamin B6 ULs (SLR, 2006).<br><br>SLR (2026) noted that 'although published case series (Gdynia et al., 2025) or case reports (Paluszny et al., 2023) reported neuropathy with intakes between 6 and 10 mg/day in some |

[1] The uncertainty factor of 4 comprised a factor of 2 for uncertainty regarding the duration of exposure needed to account for the inverse dose–duration relationship for peripheral neuropathy, and a further factor of 2 for limitations in the available data, including uncertainty in the LOAEL, representativeness of the Dalton and Dalton (1987) study population, interindividual variability and coverage of sensitive groups.

[2] A composite UF of 300 was applied, comprising: ×2 for interspecies toxicokinetics (reduced from the default of 4 based on evidence of shared vitamin B6 metabolism between dogs and humans); ×2.5 for interspecies toxicodynamics (default); ×10 for intraspecies variability in humans (default); ×2 for subchronic-to-chronic duration extrapolation; and ×3 to account for the absence of a NOAEL in this study.

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| A UF of 4 was applied to derive the UL to account for:<br>• the limitations of the data on pyridoxine doses below 500 mg/day (Berger & Schaumburg, 1984; Dalton, 1985; Dalton & Dalton, 1987; FNB:IOM, 1998; Parry & Bredesen, 1985), and<br>• the short study durations - most participants were followed for only 4 to 5 months.<br><br>The adult UL was set at 50 mg/day. The same value was set for pregnancy and lactation as there was no evidence of teratogenicity at this level. ULs for other ages and life stages, except infancy, were based on metabolic body size and growth. A UL could not be set for infants, so intake is recommended from food, milk or formula.<br><br>An evidence review commissioned by NHMRC in 2026 assessed the key historical studies underpinning both NHMRC and EFSAs guidance values. They found that, Dalton and Dalton (1987) for EFSA, and Bernstein and | individuals, these data were considered insufficiently reliable for basing population-level recommendations. Instead, they signal the need for ongoing pharmacovigilance monitoring.'<br><br>**Rationale for revised UL 14 mg/day**<br><br>Recommendations were based on evidence from both human and animal studies examining the association between vitamin B6 intake and peripheral neuropathy, the critical adverse effect associated with excessive vitamin B6 exposure. Human evidence identified a reference point of 50 mg/day, derived from a weight-of-evidence assessment across multiple converging lines of evidence, including the Dalton and Dalton (1987) case-control study, a positive rechallenge case, additional case reports, and nutrivigilance data. Animal evidence provided a reference point based on a dog LOAEL of 50 mg/kg body weight/day (Phillips et al. 1978), equivalent to 3,145 mg/day when scaled to an adult reference ideal body weight of 62.9kg.<br><br>For the human evidence, application of an Uncertainty Factor (UF) of 3, reflecting uncertainty in the threshold for adverse effects, limitations in the evidence base, and potential interindividual variability in susceptibility, resulted in a UL of 16.7 mg/day. For the animal evidence, application of an UF of 270, comprising factors for interspecies extrapolation, intraspecies variability, subchronic-to-chronic extrapolation and the absence of a NOAEL, resulted in a UL of 11.6 mg/day. For further information on the choice of uncertainty factor, see the NHMRC NRVs Methodological Framework (NHMRC 2026). An UL of 14.2 mg/day was estimated as the midpoint between the human-derived UL (16.7 mg/day) and animal-derived UL (11.6 mg/day). This value was rounded down to 14 mg/day to provide a simple and health-protective guidance value. The selected UL reflects the balance of evidence across both human and animal studies and accounts for remaining uncertainties regarding susceptibility, duration of exposure and the dose-response relationship for peripheral neuropathy. *See 'additional considerations' below for more detail on the choice of UF and the weighting of human and animal data*.<br><br>While not robust evidence, Australian adverse event reporting data suggests that the 2006 NHMRC UL of 50 mg/day may not be as protective as previously thought. |

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| Lobitz (1988) and Del Tredici et al. (1985) for NHMRC, showed high risk of bias, reflecting self-report, lack of blinding or randomisation, absent or inadequate control groups, non-representative study populations and inherent risk of bias based on study designs (which rank low on the hierarchy of evidence). The animal study underpinning EFSA's UL (Phillips et al., 1978) was rated low risk of bias (however, it is a non-guideline, non-GLP peer review published study that lacks the level of study reporting associated with regulatory quality studies) (SLR, 2006). This pattern is a key consideration in interpreting the reliability of the vitamin B6 UL regardless of which guidance value is adopted. | TGA Notice of final decision to amend (or not amend) the current Poisons Standard in relation to pyridoxine, pyridoxal or pyridoxamine (vitamin B6) 25 November 2025 noted:<br><br>*As of 31 October 2025, there were 250 reports of peripheral neuropathy, peripheral sensory neuropathy, peripheral sensorimotor neuropathy, small fibre neuropathy, polyneuropathy or chronic polyneuropathy for products containing vitamin B6 on the TGA's Database of Adverse Event Notifications (DAEN). Of these, 152 also reported 'Hypervitaminosis B6' and/or 'Vitamin B6 increased'. There were another 162 reports of 'Hypervitaminosis B6' and/or 'Vitamin B6 increased' with less specific reaction terms such as paraesthesia, burning sensation etc. possibly suggestive of neuropathies. A majority of the 250 adverse events in DAEN were reported since 1 January 2023 (208 events, 83%), with 130 events being reported in 2025 until 31 October 2025.*<br><br>*Between 1 January 2024 and 30 June 2025, the NSW Poisons Information Centre received 14 calls from patients experiencing symptoms of neuropathy. Patients reported adverse effects after taking daily pyridoxine doses between 25 mg to 400 mg for as little as 2 weeks, but up to as long as 10 years. Of these 14 patients, 2 were taking 50 mg or less of pyridoxine daily, and 8 reported blood tests results with higher-than-normal levels of pyridoxine (110 mg per day, 120 mg per day, other 6 unknown dosage)* ***(TGA, 2025)***<br><br>The adult UL was also applied to pregnant and lactating populations. There is currently insufficient evidence to indicate that pregnancy or lactation modifies susceptibility to vitamin B6-induced peripheral neuropathy at intake levels below the adult UL.<br><br>*Most of evidence for vitamin B6 toxicity comes from pyridoxine, there is insufficient evidence for other vitamer forms. As the vitamer forms are inter-convertible in the body tissue, the UL applies to all forms based on a precautionary approach.* |

**Additional considerations** *(committee input not captured in the research evidence)*

Uncertainty factors

- Human and animal responses to drugs and poisons are log-normally distributed so it is usual to choose UFs of 10 and 3. These correspond to shifts of approximately 1.0 and 0.5 units, respectively, on a $\log_{10}$ dose scale and provide a convenient framework for accounting for uncertainty and biological variability. Dividing a NOAEL value by 3 reduces the value by approximately half (0.477) a log unit.
- That is if a NOAEL of 50 is divided by 3 we get 16.67 and this corresponds to Log(50) = 1.699 THEN è 1.699 – 0.477 (log(3)) = 1.222 AND è 10^1.222 = 16.7.
- Since we are looking at an essential nutrient 3 is an appropriate UF for intra-individual variability because the substances are normal constituents of human physiology and human exposure data is available.

Human and Animal data

- Using a weight of evidence approach there was discussion about the relative value of human and animal data. Usually, human data would be prioritised. In this case it was noted that there was similar confidence in the human and animal data. Different weight of the human and animal data was considered. Different weightings were modelled and would have made small differences to the final value. However, the justification for a particular weighting was not clear and the mid-point of the human and animal data was chosen.

## *Vitamin B6 exposure in Australia and New Zealand*

### *Food Supply*

In Australia in 2023, nearly one third (32.9%) of dietary vitamin B6 intake came from three food categories: electrolyte, energy and fortified drinks; cereal-based mixed dishes, such as sandwiches and pasta or noodle dishes; and poultry and feathered game (ABS, 2026). New Zealand adult data from the 2008/09 New Zealand Adult Nutrition Survey reported dietary vitamin B6 intakes from food and supplements. In that survey, the main dietary contributors were fruit (13%), vegetables, potatoes, kumara and taro (each 10%), poultry (7%), breakfast cereals (6%), and bread, non-alcoholic beverages, grains and pasta, and beef and veal (each 5%) (Ministry of Health, 2011).

Vitamin B6 intake data for adults in Australia (2023) and Aboriginal and Torres Strait Islanders (2023) are presented in Table 1 and Table 2.

**Table 1.** Vitamin B6 dietary intake in Australian adults (general population), National Nutrition and Physical Activity Survey: Usual Nutrient Intakes (2023)

| Age groups (years) | Sex | Mean Intake (mg/day) | EAR (mg/day) | % less than EAR | 95th percentile intake (mg/day) | RDI (mg/day) |
|---|---|---|---|---|---|---|
| **18-29** | Males | 1.5 | 1.1 | 25.7 | 2.7 | 1.3 |
| | Females | 1.1 | 1.1 | 58.7 | 1.8 | 1.3 |
| **30-49** | Males | 1.5 | 1.1 | 27.6 | 2.6 | 1.3 |
| | Females | 1.1 | 1.1 | 60.2 | 1.8 | 1.3 |
| **50-64** | Males | 1.4 | 1.4 | 56.9 | 2.5 | 1.7 |
| | Females | 1.0 | 1.3 | 77.7 | 1.8 | 1.5 |
| **65-74** | Males | 1.3 | 1.4 | 62.1 | 2.4 | 1.7 |
| | Females | 1.0 | 1.3 | 80.2 | 1.7 | 1.5 |
| **75 and over** | Males | 1.3 | 1.4 | 65.0 | 2.3 | 1.7 |
| | Females | 1.0 | 1.3 | 80.0 | 1.7 | 1.5 |

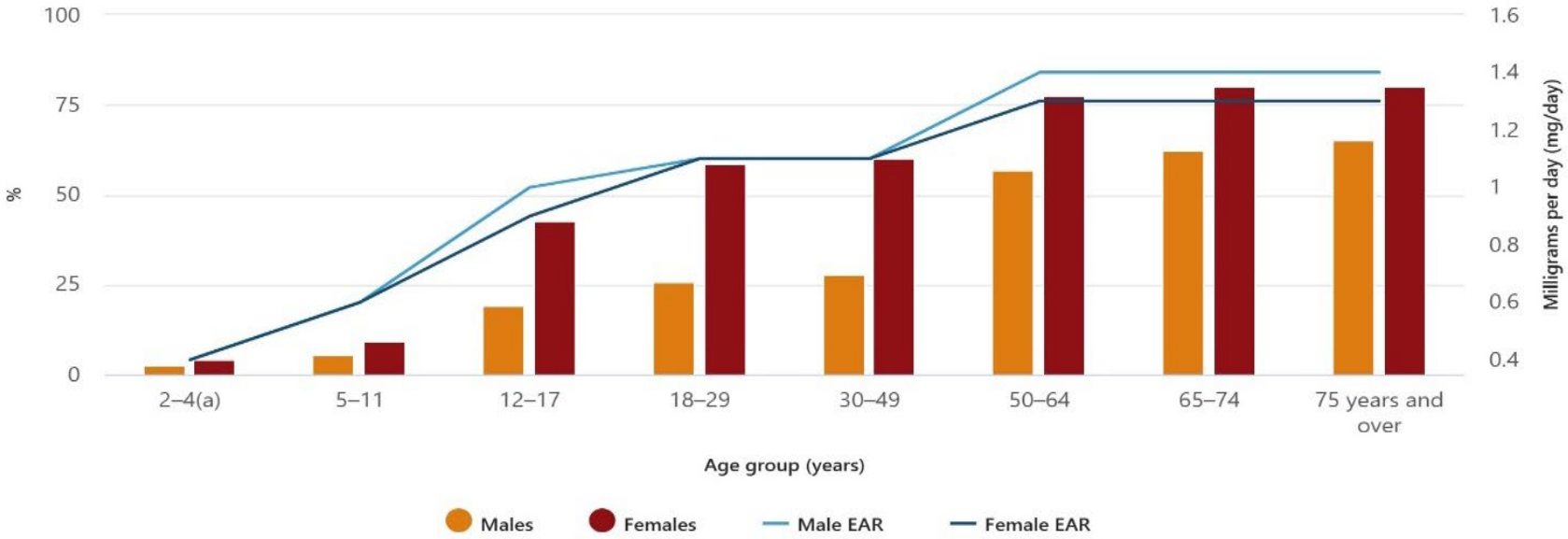
**Source:** https://www.abs.gov.au/statistics/health/food-and-nutrition/usual-nutrient-intakes/latest-release

**Abbreviations:** EAR - estimated average requirement, RDI - Recommended dietary intake

In Australia, almost one in two (46.7% or 11.5 million) people aged 2 years and over had an intake of vitamin B6 intake from food and beverages below the EAR in 2023. The proportion of people with an inadequate vitamin B6 intake was:

- higher for females than males (59.1% compared to 34.6%)
- higher for adults aged 18 years and over than children aged 2–17 years (54.9% compared to 15.3%)
- lower for adults aged 18–29 years and 30–49 years than adults in age groups over 50 years (Figure 1).

**Figure 1.** Proportion of people with an inadequate vitamin B6 intake and weighted Estimated Average Requirement (EAR), by age and sex, 2023




a. The proportions for 'Males' and 'Females' have high margins of error and should be used with caution.

Source: Australian Bureau of Statistics, Usual nutrient intakes 2023

Analysis of the distribution of vitamin B6 intakes shows that over the past decade for adults aged 18 years and over, usual intakes for at least 75% of the population have decreased.

The absolute change in the distributions of vitamin B6 usual intake between 2011–12 and 2023 was small (ranging between 0.1 mg/day and 0.3 mg/day across each percentile). The small reduction in intake has meant that a much higher proportion of adults had a vitamin B6 intake below the EAR in 2023 than did in 2011–12. These results do not consider the contribution of dietary supplements to vitamin B6 intake (ABS, 2025).

**Table 2.** Vitamin B6 dietary intake in National Aboringinal and Torres Strait Islander Nutrition and Physical Activity Survey: Food and Nutrients (2023)

| Age groups (years) | Sex | Mean Intake (mg/day) |
|---|---|---|
| **18-29** | Males | 2.2 |
| | Females | 1.1 |
| **30-49** | Males | 1.7 |
| | Females | 1.1 |
| **50-64** | Males | 1.4 |
| | Females | 1.3 |
| **65 and over** | Males | 1.4 |
| | Females | 1.3 |

Table 3 outlines the usual intake of Vitamin B6 for adults in New Zealand in 2008-09 from diet and supplements

**Table 3.** Vitamin B6 dietary and supplement intake in New Zealand adults (general population), 2008-09 New Zealand Adult Nutrition Survey

| Age groups (years) | Sex | Mean Intake (mg/day) | % less than EAR | 90th Percentile intake (mg/day) |
|---|---|---|---|---|
| **15-18** | Males | 2.7 | 0.0* | 3.9 |
| | Females | 2.2 | 19.0 | 4.0 |
| **19-30** | Males | 3.3 | 1.5* | 5.5 |
| | Females | 2.3 | 0.8* | 3.3 |
| **31-50** | Males | 2.6 | 0.2* | 3.6 |
| | Females | 1.8 | 17.0 | 2.8 |
| **51-70** | Males | 1.9 | 27.5 | 2.9 |
| | Females | 1.5 | 36.6 | 2.0 |
| **71 and over** | Males | 1.6 | 28.8 | 2.1 |
| | Females | 1.3 | 53.0 | 1.9 |

**Source:** https://www.health.govt.nz/system/files/2011-10/a-focus-on-nutrition-v2.pdf

**Abbreviations:** EAR, estimated average requirement.

# Coefficient of variation of estimated inadequate intake is greater than 50% and confidence interval lies outside range (0–5%). Estimate should be interpreted with caution due to the high level of imprecision relative to the estimate.

Among Māori and Pacific males and females there were no differences in vitamin B6 intake by age group.

The 2008/09 New Zealand Adult Nutrition Survey collected data regarding Vitamin B6 intake for 'dietary supplements' (ref NZANS) These were defined as 'anything the participant considered to be a supplement to their diet. Supplements therefore included a range of substances, from vitamins and minerals to 'other' dietary supplements such as flaxseed oil, garlic and spirulina' (Winsome 2011).

Overall, dietary vitamin B6 intake remains well below the proposed UL in both Australia and New Zealand for all population groups, with usual intake data including dietary supplements for New Zealand but not for Australia.

This is an important limitation because high-dose supplemental vitamin B6, rather than intake from foods and fortified beverages, is the main exposure source relevant to peripheral neuropathy risk (SLR, 2006).

### *Food Supply Regulation*

The Australia New Zealand Food Standards Code regulates when vitamin B6 can be added to foods. Vitamin B6 may only be added where the Code provides a permission. Relevant permissions and requirements are set out across Standard 1.3.2, Standard 2.9, Schedule 17, 28 and Schedule 29, including for formulated caffeinated beverages and special purpose foods such as formulated meal

replacements, formulated supplementary foods, formulated supplementary sports foods, foods for special medical purposes and infant formula products. A summary of permissions is included in Table 4

- The Code does not permit general discretionary fortification with vitamin B6. Vitamins and minerals can only be added to foods where there is a specific permission in the Code.
- For formulated caffeinated beverages, the Code permits the addition of specified vitamins, including vitamin B6, and requires labelling information such as the recommended maximum daily quantity of the beverage.
- For special purpose foods, vitamin B6 permissions and compositional limits vary by food category. These include formulated meal replacements, formulated supplementary foods, formulated supplementary sports foods, foods for special medical purposes and infant formula products.

**Table 4.** Summary of Vitamin B6 permissions in Australia and New Zealand

| *Food* | *Maximum claim per reference quantity (maximum percentage RDI claim)* | *Maximum permitted amount* |
|---|---|---|
| Cereals and cereal products (biscuits, containing not more than 200 g/kg fat and not more than 50 g/kg sugars, bread, breakfast cereals, cereal flours, pasta) | 0.4 mg (25%) | |
| Extracts of meat, vegetable or yeast | 0.4 mg (25%) | |
| Beverages containing no less than 3% m/m protein derived from legumes | no claim permitted | 0.12 mg/reference quantity |
| Analogues of meat, where no less than 12% of the energy value of the food is derived from protein, and the food contains no less than 5 g protein per serve of the food | 0.5 mg (30%) | |
| Analogues of yoghurt and dairy desserts containing no less than 3.1% m/m protein derived from legumes | no claim permitted | 0.11 mg/reference quantity |
| Beverages containing no less than 0.3% m/m protein derived from cereals, nuts, seeds, or a combination of those ingredients | no claim permitted | 0.12 mg/reference quantity |
| Special Purpose foods | | |
| formulated beverages | 0.4 mg (25%) | |
| formulated meal replacements | 0.8 mg (50%) | |
| formulated supplementary foods | 0.8 mg (50%) | |
| formulated supplementary food for young children | 0.35 mg (50%) | |
| formulated supplementary sports foods | | 3.2 mg/one day quantity |
| formulated caffeinated beverages | | 10 mg/one day quantity |
| | *Minimum amount* | *Maximum amount* |
| food for special medical purposes represented as a sole source of nutrition | 0.2 mg/MJ | 1.2 mg/MJ |
| very low energy diet | 2 mg/daily intake | |
| *Food* | *Minimum amount* | *Guidance upper level* |
| infant formula | 8 µg/100 KJ | 42 µg/100 KJ |
| follow-on formula | 8 µg/100 KJ | 42 µg/100 KJ |

**Sources:** FSANZ, *Vitamins and minerals added to food*, https://www.foodstandards.gov.au/consumer/food-fortification/vitamin-added; Federal Register of Legislation, *Australia New Zealand Food Standards Code – Standard 1.3.2 – Vitamins and minerals*, https://www.legislation.gov.au/Latest/F2017C00048; *Schedule 17 – Vitamins and minerals*, https://www.legislation.gov.au/F2015L00449/latest; *Schedule 29 – Special purpose foods*, https://www.legislation.gov.au/F2015L00463/latest.

### *Supplements*

#### *Australia*

In Australia, supplement use is common and is a key consideration for vitamin B6 toxicity risk. In 2023, the ABS reported that one in three people (33.6%) took a dietary supplement, an increase from 28.5% in 2011–12. Females were more likely to take a supplement than males (38.8% compared to 28.3%) across all adult age groups. Among children aged 2–17 years, the proportion of males and females that took a supplement were similar (19.2% and 18.0%). Children aged 12–17 years (15.0%) were less likely to take a supplement than any other age group. Among adults, the proportion of people who took supplements increased with age, from one in four (24.5%) people aged 18–29 years to two in four (50.9%) people aged 75 years and over (ABS, 2025).

Vitamin or mineral supplements were the most common type of supplement consumed among people 2 years and over, increasing from over two in ten (21.9%) people in 2011–12 to three in ten (29.7%) people in 2023. Just over one in seven (15.5%) people took a multivitamin or multimineral supplement. Adult females were more likely to take a multivitamin or multimineral supplement than males in every age group (except those aged 75 years and over where the difference was not significant), while for children aged 2–17 years the proportions for males and females were similar (10.1% and 9.2%). Children aged 12–17 years (5.8%) were the least likely to take a multivitamin or multimineral supplement. Among adults, the proportion of people who took a multivitamin or multimineral supplement increased with age, to one in five people aged 65–74 years (21.3%) and 75 years and over (19.7%) (ABS, 2025).

< *At the time of writing, 2023 ABS data specific to Vitamin B6 supplements was not available. Data from this publication will be added when it becomes available* >

A study of vitamin B6 supplement sales in Australia found that 20.32 million products containing 5 mg or more of vitamin B6 were sold across 15.8 million transactions between 2023 and 2025. Products containing 10–49 mg accounted for more than half of all units sold, while products containing 50 mg or more accounted for 16.75% of units and 21.63% of transactions. The study also found evidence of multiple or duplicate purchases, which may increase cumulative intake. Sales were otherwise stable, apart from the 2023 withdrawal of products containing more than 100 mg. The authors concluded that Australians continue to buy large volumes of vitamin B6 products above recommended intake levels, including combinations of lower-dose products that may not be affected by proposed rescheduling. They also noted that the implementation period for scheduling changes may allow high-risk exposure to continue unless stronger risk communication is provided (Chan et al., 2026).

#### *New Zealand*

The 2008/09 New Zealand Adult Nutrition Survey collected data regarding Vitamin B6 intake for ‘dietary supplements’ (Ministry of Health, 2011) however, these were defined as ‘anything the participant considered to be a supplement to their diet. Supplements therefore included a range of substances, from vitamins and minerals to ‘other’ dietary supplements such as flaxseed oil, garlic and spirulina’ (Parnell et al., 2011).

### *Supplement Regulation*

In Australia, the Therapeutic Goods Administration has strengthened controls for vitamin B6-containing medicines and supplements because of the risk of peripheral neuropathy from high-dose or cumulative intake. Vitamin B6 is present in many multivitamin, B-complex, magnesium, zinc, as well as products marketed for stress, sleep, nerve support, immunity, depression, premenstrual symptoms or general wellbeing. Consumers may take more than one product without recognising their total exposure. Since March 2022 products providing more than 10 mg/day must carry a peripheral neuropathy warning. The maximum permitted daily dose in listed medicines was reduced from 200 mg to 100 mg for adults. From 1 June 2027, oral products providing more than 50 mg and not more than 200 mg per recommended daily dose will become Pharmacist Only Medicines (Schedule 3), while products above 200 mg will remain Prescription Only Medicines (Schedule 4). TGA has also indicated that should there be a change following the NHMRC review of the vitamin B6 UL, the appropriateness of the new limits will be re-evaluated (TGA, 2025).

## *Vitamin B6 exposure in Australia and New Zealand – Special Populations*

### *Pregnancy and Lactation*

There is no evidence that special considerations are needed during pregnancy and lactation.

For pregnancy and lactation, the available evidence does not indicate a need for a separate vitamin B6 UL or a different uncertainty factor. Lowering the UL may provide an additional margin of safety for people who are pregnant or lactating and use vitamin B6-containing supplements, including pregnancy multivitamins or products used for nausea and vomiting. However, evidence remains limited on high-dose exposure during pregnancy and lactation, including in utero exposure, infant exposure through breastmilk and vitamin B6 metabolism in neonates. This supports clear advice to avoid unnecessary high-dose vitamin B6 supplementation during pregnancy and lactation unless clinically indicated and supervised by a health professional (EFSA Panel on Nutrition et al., 2023; SLR Consulting Australia Pty Ltd, 2006). People taking pregnancy multivitamins or using vitamin B6 for sever nausea and vomiting or hyperemesis gravidarum may be at risk of excess intake. LEAPP Australia Pregnancy Care Guidelines state: ‘Conditional recommendation against - Do not routinely recommend vitamin B6 supplementation during pregnancy’ (ALEC, 2026).

### *Sensitive populations*

Several populations may be more sensitive to vitamin B6, such as patients with pre-existing neuropathy, renal impairment, genetic sensitivity, impaired vitamin B6 metabolism (van Hunsel et al., 2025), Parkinson’s disease patients on levodopa therapy (Lizárraga & Lang, 2022), genetic polymorphisms (like homocysteineuria), people with pre-existing autonomic nervous system issues/dysautonomia, or gut dysbiosis, people with lower body weight or eating disorders, bariatric surgery patients (altered absorption, post-surgery multivitamin use) (SLR, 2006). However, there is currently insufficient evidence to set separate ULs for any of these populations.

NRVs are intended as public health advice that applies to the general population. While the UL aims to be protective for almost all individuals in the general population, people who may have specific sensitivities, or need nuanced advice due to specific health conditions or other circumstances, such as those listed above, should seek individualised advice from a health professional.

### *Populations more likely to have excess Vitamin B6 intake*

Some groups may be more likely to have excess vitamin B6 intake because of cumulative exposure from multiple products, particularly where vitamin B6 is not obvious on the label or is included in combination products (Gdynia et al., 2025). Products that may contribute to cumulative intake include multivitamins, B-complex products, magnesium or zinc supplements with added vitamin B6, protein supplements, formulated caffeinated beverages (often referred to as energy drinks) and fortified foods, as well as products marketed for stress, sleep, nerve support, immunity, depression, premenstrual symptoms or general wellbeing.

Other potentially higher-risk groups include people who are prescribed or advised to take vitamin B6-containing supplements, include transplant recipients, people undergoing or following bariatric surgery, women with premenstrual symptoms, athletes, children with neurodevelopmental disorders receiving integrative medicine treatment, people with depressive symptoms and older adults. Older adults may be more likely to develop neuropathy from chronic lower-dose vitamin B6 supplement use (Gdynia et al., 2025).

## *Benchmarking against comparable international jurisdictions*

| | UL for adults | Evidence-base | Reference point | Uncertainty factor |
|---|---|---|---|---|
| EFSA (2023) Europe | *12 mg/day* | - Dalton and Dalton (1987) *supported by other case reports (Dalton, 1985; Blackburn and Warren, 2017) and Member States' vigilance data*<br>- Phillips et al. (1978) | Reference point of *50 mg/day* identified from human study<br>LOAEL of *50 mg/kg body weight per day* from animal study | UF of 4 applied to reference point from human data<br>UF of 300 applied to LOAEL from animal data<br>Final UL is the midpoint of the human data UL and the animal data UL, rounded down |
| NNR (2023) | *12.5mg/day* | adopted EFSA (2023) | adopted EFSA (2023) | UF of 4 applied to reference point from human data<br>UF of 300 applied to LOAEL from animal data<br>Final UL is the midpoint of the human data UL and the animal data UL, |
| SCF (2000) Europe | *25 mg/day* | Dalton and Dalton (1987) | Used a reference point of *100 mg/day* | UF of 4 applied |
| IOM (1998) US | *100 mg/day* | Bernstein and Lobitz (1988) and Del Tredici et al. (1985) | Used a NOAEL of *200 mg/day* | UF of 2 applied |
| EVM (2003) UK | *10 mg/day* | Phillips et al. (1978) | Used a LOAEL of *50 mg/kg body weight per day* | UF of 300 applied (animal study, short duration, inter-individual variability) |
| WHO/FAO (2004) Global | *100 mg/day* | *Adopted IOM recommendation* | - | - |
| NHMRC (2006) Aus/NZ | *50 mg/day* | Bernstein and Lobitz (1988) and Del Tredici et al. (1985) | identified a NOAEL of *200 mg/day.* | UF of 4 applied, under the assumption that the exposure period (5-6 months or less) may not have been long enough for symptoms to appear |

**Studies:**

- Bernstein and Lobitz (1988) and Del Tredici et al. (1985) - studies on patients with diabetic neuropathy or carpal tunnel syndrome (CTS) in whom neuropathy did not get worse following vitamin B6 intakes of 100–300 mg/day
- Dalton and Dalton (1987) - case-control study (IOM and WHO considered evidence not reliable enough in terms of administered vitamin B6 doses)
- Phillips et al., (1978) - LOAEL of 50 mg/kg body weight per day determined from a study in beagle dogs

## *Balance of effects (health benefits and harms)*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| Ongoing concerns with increased reporting of adverse effects with levels of vitamin B6 below the UL | Decreasing the level is more protective of the population, and more consistent with recent international values. |

### Additional considerations (*committee input not captured in the research evidence)*

- The balance of effects is in relation to the health effects only, with the recommendations applying to the general population.
- The uncertainty factors were discussed for human and animal studies based on conventions of e base log The balance of effects is in relation to the health effects only, with the recommendations applying to the general population.
- The likelihood of harm is very low as the UL is in the magnitude of 10x higher than requirements (EAR)
- Establishing a more protective UL reduces the risk when vitamin B6 toxicity is not diagnosed early, as ongoing exposure to excess vitamin B6 can continue to impact severity of neuropathy, duration or reversibility

### Judgement - The balance of effects (health benefits and harms)

| | | | | | | |
|---|---|---|---|---|---|---|
| Favours Option 1 | Probably favours Option 1 | Favours neither | Probably favours Option 2 | Favours Option 2 ✓ | Varies | Don't know |

This decision was made by consensus at a committee meeting with 10 of 12 members present.

## *Certainty of the evidence*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| Papers used to set NHMRCs 2006 Upper Level of Intake of vitamin B6<br>• Bernstein & Lobitz (1988): 70 diabetic patients, most studied for no more than 5 months at 100–150 mg/day. No adverse effects reported. (Survey data)<br>• Dalton & Dalton (1987): Retrospective assessment of symptoms in a treated cohort with PMT. Mean B6 levels in those with symptoms were the same as in those without, but those with symptoms had been on pills for 2.9 years compared with 1.6 years for those without. (Survey data)<br>• Del Tredici et al (1985): Carpel tunnel patients. No adverse effects seen at 4 months at 100–300 mg/day. (Survey data)<br>An evidence review commissioned by NHMRC in 2026 assessed the key historical studies underpinning both NHMRC and EFSAs guidance values. They found that, Dalton & Dalton (1987), Bernstein & Lobitz (1988) and Del Tredici et al. (1985) showed high risk of bias, reflecting self-report, lack of blinding or randomisation, absent or inadequate control groups, non-representative study populations and inherent risk of bias based on study designs (which rank low on the hierarchy of evidence). This is a key consideration in interpreting the reliability of the vitamin B6 UL regardless of which guidance value is adopted. | An evidence review commissioned by NHMRC in 2026 assessed the key historical studies underpinning both NHMRC and EFSAs guidance values. Assessment of the key human study underpinning EFSAs guidance values found that Dalton & Dalton (1987), showed high risk of bias, reflecting self-report, lack of blinding or randomisation, absent or inadequate control groups, non-representative study populations and inherent risk of bias based on study design (which rank low on the hierarchy of evidence). The animal study underpinning EFSA's UL (Phillips et al. 1978) was rated low risk of bias (however, it is a non-guideline, non-GLP (good laboratory practice) peer review published study that lacks the level of study reporting associated with regulatory quality studies) (SLR, 2006).<br>This is a key consideration in interpreting the reliability of the vitamin B6 UL regardless of which guidance value is adopted. |

**Additional considerations** *(committee input not captured in the research evidence)*

- The human data is considered to have a low certainty of evidence due to the high risk of bias
- The animal data is considered to have a very low certainty of evidence as although Phillips (1978) study was rated as low risk of bias, there were concerns about the study type (non-guideline, non-GLP), which lacks the level of study reporting associated with regulatory quality studies and indirectness due to the taxonomic differences between species (humans and dogs).

- The difference in certainty of evidence for human and animal data may impact the midpoint chosen when using a weight of evidence approach for deriving the UL, with the result potentially closer to that from human data
- Even though the research studies are largely conducted using only one vitamer of B6 (pyroxidine), it is the vitamer that is largely included in supplements, therefore a downgrading the certainty due to indirectness was not considered necessary

Judgement - **The certainty of the evidence is considered to be**

Human data

| | | | |
|---|---|---|---|
| Very low | Low ✓ | Moderate | High |

Animal data

| | | | |
|---|---|---|---|
| Very low ✓ | Low | Moderate | High |

Decisions made by consensus at a committee meeting with a 10 of 12 members present.

## *Values and preferences (consumers, communities)*

No literature search specific to vales and preferences was undertaken.

As dietary intake is unlikely to result in vitamin B6 levels high enough to cause toxicity, those most likely to be affected by a change in the UL are consumers of supplements. Consumers who use supplements may value choice, access and autonomy, particularly where they perceive vitamin B6-containing products may support wellbeing, energy, stress, sleep or specific health concerns. However, excess vitamin B6 intake is likely to be unintentional for many consumers, as vitamin B6 can be present in multiple products, including multivitamins, B-complex products, magnesium or zinc supplements and formulated caffeinated beverages as well as products marketed for stress, sleep, nerve support, immunity, depression, premenstrual symptoms or general wellbeing. Consumers may not recognise cumulative intake across products or understand that long-term use can increase the risk of peripheral neuropathy.

A lower UL may better align with the values of consumers who prioritise safety and clear risk information, particularly where the health benefit of higher-dose supplementation has not been clearly demonstrated. Some consumers may not support reduced access to higher-dose products, especially if they use them for perceived or advised benefits. In practice, population intake is likely to be influenced more by regulatory settings, product reformulation, labelling and health professional advice than by individual consumer preference alone.

Additional considerations *(committee input not captured in the research evidence)*

Values

- committee considered that it is unlikely that anyone would not place any value on being protected from adverse effects from excess intake/people care about not experiencing toxicity
- GP experience brings lived-experience evidence that patients suffering toxic effects of excess vitamin B6 wish they had known more about the effects or that there were better safety measures in place
- A lower UL would give a greater safety margin, where greater effort would be needed to exceed to UL making it less likely to be exceeded by mistake
- People taking high levels of vitamin B6 who are not experiencing adverse health effects might not value a decreased UL

Preferences

- From a health perspective, any impacts of a lower UL it should only impact the high consumers of vitamin B6
- Industry/key interest-holders may be impacted if FSANZ or TGA consider changes to regulatory levels of vitamin B6, which could result in regulatory costs associated with requirements for registration/reformulation/relabelling
- Although impacts to industry may be significant, the remit of NHMRC is to produce guidelines to improve the health of the general population. While impact to industry was considered, decisions were made on the basis of population health.

**Judgement - Values: is there important variability in how people value the main health outcomes?**

| Few people will value the main outcomes | Most people will value the main outcomes | Almost everyone will value the main outcomes ✓ | Everyone will value the main outcomes |
|---|---|---|---|

Decision was made by consensus at a committee meeting with 10 of 12 members present.

Almost everyone will value health outcomes from reducing the UL for vitamin B6

**Judgement - Preferences: Is the option acceptable to key interest-holders?**

| No | Probably no | Probably yes | Yes ✓ | Varies ✓ | Don't know |
|---|---|---|---|---|---|

Decision was made by consensus at a committee meeting with 10 of 12 members present.

Overall, the consensus judgement was that acceptability of reducing UL for vitamin B6 will vary.

The general population is considered find the reduced UL acceptable.

The people likely to find the reduced UL unacceptable are people taking high doses of vitamin B6 who have not yet had any ill effects or those with commercial interests in vitamin B6 if changes to the UL result in regulatory or business costs.

## *Feasibility (consumers, communities)*

According to the most recent dietary surveys, Vitamin B6 intake data shows that Australia tends to have lower intakes than New Zealand (see Tables 1 and 2). It should be noted that the data may not be directly comparable as the data for Australia was collected in 2023, and the data for New Zealand collected in 2008/09 and also included dietary supplements. Changes in the amount of Vitamin B6 in the food supply, and dietary patterns may have changed during this time, which could also account for some of the discrepancy.

The modelled intakes below are significantly lower than the current NHMRC UL (50 mg/day) and proposed NHMRC UL (14mg/day), with B6 intake not exceeding 2.33 mg/day across the range of diets modelled. This pattern is consistent across pregnant and lactating populations, who use the same adult UL values (Table 5). This suggests that a reduction in the UL would be safe and feasible.

It should be noted that the food modelling data presented below relied on incomplete data and interpolation, however, intake patterns from empirical survey findings (Tables 1 and 2) are generally lower that the modelled intakes. Overall, both modelled and measured intakes support the feasibility of implementing a lower UL without requiring dietary changes.

**Table 5.** **Food modelling data in adults**

| Age group (years) | Core food groups | Foundation diets – overall | | Rice-based | | Pasta-based | | Lacto-ovo-vego | |
|---|---|---|---|---|---|---|---|---|---|
| | Intake in persons (mg/day) | Intake in males (mg/day) | Intake in females (mg/day) | Intake in males (mg/day) | Intake in females (mg/day) | Intake in males (mg/day) | Intake in females (mg/day) | Intake in males (mg/day) | Intake in females (mg/day) |
| 19-30 yr | - | 2.09 | 1.74 | 2.17 | 1.83 | 2.21 | 2.03 | 2.33 | 1.65 |
| 31-50 yr | 1.2 | 1.99 | 1.74 | 2.07 | 1.82 | 2.11 | 1.93 | 2.18 | 1.66 |
| 51-70 yr | - | 1.81 | 1.79 | 2.00 | 1.53 | 2.04 | 1.80 | 1.98 | 1.57 |
| 70+ yr | - | 1.76 | 1.67 | 1.52 | 1.45 | 1.52 | 1.50 | 1.59 | 1.50 |

*Note: food modelling based on incomplete dataset from AUSNUT07, and should be treated with caution*

**Source:** A modelling system to inform the revision of the Australian Guide to Healthy Eating (Baghurst et al., 2011)

**Abbreviation:** veg, vegetarian.

**Table 6.** Food modelling data for pregnancy and lactation

| Age group | Foundation diet | |
|---|---|---|
| | Pregnancy | Lactation |
| 19-30 yr | 2.12 | 1.99 |
| 31-50 yr | 2.11 | 1.98 |

*note food modelling based on incomplete dataset from AUSNUT07, and should be treated with caution*

**Source:** A modelling system to inform the revision of the Australian Guide to Healthy Eating (Baghurst et al., 2011)

## Additional considerations *(committee input not captured in the research evidence)*

- Lowering the UL would lead to greater international inconsistency with jurisdictions that have reviewed their ULs more recently, based on similar evidence.
- There may be a subsection of the integrative/alternative medicine community who recommend higher levels for particular conditions that may object to these changes in terms of their clinical experience of prescribing these medications, however, changes to the UL and any subsequent regulatory changes to supplement scheduling will not deny access to products, rather it will only allow access via prescription of with medical advice from a pharmacist.

## Judgement - Feasibility: Is the option feasible to implement?

| No | Probably no | Probably yes ✓ | Yes | Varies | Don't know |
|---|---|---|---|---|---|

This decision was made by vote (4 members voted 'probably yes' or 'yes'; 1 member voted 'varies'). This did not meet quorum; however, a follow-up email was sent to all members whose response indicated that this was considered feasible.

The feasibility for different interest holders will vary but overall is probably feasible. Changes to the UL are unlikely to have tangible impact for most people/users of vitamin B6. Most foods are fortified at levels that would be unlikely to result in consumption close to the UL. Formulated caffeinated beverages are the exception. Changes to the regulatory maximum levels could have cost implications for manufacturers in the food and supplement industries if reformulation or relabelling are required. NHMRC set ULs based on population health considerations. FSANZ is responsible for setting food standards and TGA is responsible for regulating listed and registered medicines.

## *Resource impacts for public health*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| There is potential for increased medical costs associated with vitamin B6 associated peripheral neuropathy at levels of intake lower than the current UL. | Changes to the regulatory maximum levels by FSANZ or TGA could have cost implications for manufacturers in the food and supplement industries if reformulation or relabelling are required, which may be passed on the consumer.<br><br>Decreasing the UL might incur some costs to individuals who wish to continue to take high dose vitamin B6 |

### Additional considerations *(committee input not captured in the research evidence)*

No literature search specific to resource impacts was undertaken.

While there are potential cost implications for manufacturers in the food and supplement industries, regulatory ULs for these industries are the remit of TGA and FSANZ. Cost implications to industry should not be a deciding factor in public health decision making.

Potential costs to industry can be mitigated by providing advance notice of proposed regulatory changes and a transition period for reformulation/relabelling

### Judgement – Resource impacts: the resource impacts are considered to be

| Large costs | Moderate costs | Negligible | Moderate savings | Large savings | Varies ✓ | Don't know |
|---|---|---|---|---|---|---|

9 members of a 12 member committee voted. Overall, the costs will vary, votes were split by which interest-holder the resource impacts were anticipated to affect. Potential moderate to large costs were considered from the perspective of industry, with the potential for some of these costs being passed on to the consumer. Potential large savings were considered from the reduction in cost to both the individual, health system and society from reduced medical costs, peripheral neuropathy associated disability, and increased productivity associated with a reduction in neuropathy. These savings have the potential to far exceed the costs to the supplement industry. Votes for 'don't know' reflected the lack of economic analysis data to inform this judgement.

| *Other factors (health equity impacts)* | |
|---|---|
| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
| Education/awareness raising and clearer public health messaging are needed, even if the current UL remains | Lowering the UL is likely to provide greater protection for people at higher risk of excess vitamin B6 intake, particularly consumers who take multiple supplements or long-term high-dose products. It may also provide a wider margin of safety for people who may be more sensitive to adverse effects, such as people with pre-existing neuropathy, renal impairment, altered vitamin B6 metabolism, lower body weight, or conditions requiring complex supplement use. However, there is currently insufficient evidence to set separate ULs for these groups.<br><br>Health equity considerations include the need for clear, accessible information about cumulative vitamin B6 exposure across supplements. People with lower health literacy, limited access to health information or different language needs may be less likely to identify vitamin B6 in combination products or understand the risk of long-term use. Education and labelling should therefore be designed for diverse consumers, not only for people who already understand NRVs, supplement labels or nutrition terminology.<br><br>Lowering the UL would not remove the need for consumer and health professional education. Consumers may have existing supplies of higher-dose products, may not read labels, or may continue to use products for perceived benefits such as energy, stress, sleep, premenstrual symptoms, immunity or general wellbeing. Health professionals may also need support to explain the difference between recommended intakes and upper levels, and to advise on appropriate supplement use.<br><br>Overall, a lower UL may better support public health protection where excess intake is mainly driven by supplements and where consumers may not recognise cumulative exposure. Implementation should be supported by clear public messaging, health professional guidance and consideration of groups who may be more likely to use supplements or have difficulty interpreting risk information<br><br>*Note: NHMRC generally sets the UL for combined diet and supplements for the general population. Regulatory ULs for supplements and food products are informed by the NHMRC UL but are set by TGA and FSANZ, who are also responsible for labelling and monitoring.* |

**Additional considerations** *(committee input not captured in the research evidence)*

Option 2 is the most equitable approach, as the general population would be better protected. Those with conditions requiring medicinal doses above a revised UL would still have access via health professionals (pharmacists and doctors) ensuring equity for those with a medical indication or those with an established benefit over risk ratio.

**Judgement - Health equity is considered to be:**

| Reduced | Probably reduced | Probably no impact | Probably increased ✓ | Increased ✓ | Varies | Don't know |
|---|---|---|---|---|---|---|

Decision was made by vote (9 members of a 12 member committee voted). The majority considered decreasing the UL to increase health equity.

## *Other factors (sustainability)*

| OPTION 1: Maintain current UL recommendations | OPTION 2: Decrease the UL |
|---|---|
| | Sustainability impacts are likely to be limited. A lower UL may lead to reformulation or relabelling of some supplement products if regulators change product requirements. This could create short-term costs for industry and some waste from discontinued labels or stock, although transition periods could reduce these impacts. Any costs passed on to consumers are likely to depend on regulatory implementation and market responses rather than the UL itself. |

**Additional considerations** *(committee input not captured in the research evidence)*

- If there is a regulatory change by FSANZ or TGA a suitable transition period would mitigate costs incurred by industry
- In general, supplement manufacturing consumes electricity, water, and processing materials. Higher-dose products typically require greater quantities of ingredients to be extracted, purified, transported, and formulated and from a sustainability perspective, producing nutrients that are not biologically needed represents avoidable resource use. Further Bioactive compounds from some supplement ingredients can enter wastewater through excretion or disposal. Environmental concerns are best documented for pharmaceuticals, but the broader principle is that excess bioactive chemicals can contribute to environmental contamination.

Judgement - **Sustainability is considered to be:**

| Reduced | Probably reduced | Probably no impact | Probably increased ✓ | Increased | Varies | Don't know |
|---|---|---|---|---|---|---|

9 members of a 12 member committee voted. The results were mixed on sustainability. Overall members voted that reducing the UL for vitamin B6 would probably increase sustainability.

## *DECISION*

**Option 2** was selected: a strong recommendation to decrease the UL to 14 mg/day

### Justification

The certainty of evidence regarding the health benefits and harms was low from human data, and very low from animal data. The Working Group made a strong recommendation due to the asymmetry of consequences. The Working Group favoured a lower UL maintaining that the current UL carried a plausible risk of harm with no evidence of offsetting benefit. The downside of lowering the UL for public health is negligible, as 14mg/day remains well above requirements, so it does not meaningfully increase the risk of inadequacy. The working group advised that a precautionary approach was appropriate to protect public health. This reflects a situation in which a strong recommendation may be warranted despite low-certainty evidence.

### Implementation considerations

Reducing the UL would likely reduce the risk of Vitamin B6 toxicity in the community. The likelihood of harm is very low as the UL in an order of magnitude 10x higher than requirements.

Implementation should be supported by clear public messaging, health professional guidance and consideration of groups who may be more likely to use supplements or have difficulty interpreting risk information.

### Research priorities

There are significant data gaps, the quality and recency of evidence is limited, there is no paediatric toxicity data, and exposure characterisation does not support dose-response modelling.

## CHILDREN AND ADOLESCENTS

***Example recommendation***

| OPTION 1:<br>Maintain current UL recommendations<br><br>Adapt current UL to additional new age groupings | | OPTION 2:<br>Decrease the UL | | |
|---|---|---|---|---|
| All (males & females) | UL | | UL (Males) | UL (Females) |
| NRV age groupings: | | NRV age groupings: | | |
| 1 to under 4 years | 15 mg/day | 1 to under 4 years | 4.5 mg/day | 4.0 mg/day |
| 4 to under 9 years | 20 mg/day | 4 to under 9 years | 6.5 mg/day | 6.5 mg/day |
| 9 to under 14 years | 30 mg/day | 9 to under 14 years | 10.0 mg/day | 10.0 mg/day |
| 14 to under 18 years | 40 mg/day | 14 to under 18 years | 14.0 mg/day | 12.5 mg/day |
| Age groupings by school-age: | | Age groupings by school-age: | | |
| 12 to under 24 months | 15 mg/day | 12 to under 24 months | 4.0 mg/day | 3.5 mg/day |
| 2 to under 5 years | 15 mg/day | 2 to under 5 years | 5.0 mg/day | 5.0 mg/day |
| 5 to under 12 years | 25 mg/day | 5 to under 12 years | 8.0 mg/day | 8.0 mg/day |
| 12 to under 18 years | 35 mg/day | 12 to under 18 years | 13.0 mg/day | 12.0 mg/day |

## *Health evidence profile and supporting information*

| OPTION 1:<br>Maintain current UL recommendations<br><br>Adapt current UL to additional new age groupings | OPTION 2:<br>Decrease the UL |
|---|---|
| In the absence of evidence in children and adolescents, current recommendations have been extrapolated from the adult UL, based on metabolic body weight.<br><br>There remains insufficient evidence to inform derivation of ULs for children and adolescents. | As there was no data to support the derivation ULs for children, and there is no evidence to indicate that children may be more susceptible to vitamin B6 toxicity than adults, the ULs for adults were extrapolated to children based on metabolic body weight using the following formula:<br><br>$UL_{adult}$ x $(Weight_{child}/Weight_{adult})^{0.75} = UL_{child}$<br><br>Reference weights used were based on 2022 ideal weight data from the Australian Bureau of Statistics, as per the current NRVs Methodological Framework (NHMRC 2026). Calculated values were rounded to the nearest 0.5 mg/day to arrive at final values.<br><br>*For further information on the evidence supporting the Adult UL, see the Adult Evidence-to-Decision table* |

## *Vitamin B6 exposure in Australia and New Zealand*

### *Australia*

Vitamin B6 intake dietary intake data (excluding supplements) for children in Australia (2023) is presented in Table 7 below. This data relates to dietary intake, excluding supplements.

At the time of writing there was no information available from the 2023 ABS National Nutrition and Physical Activity Survey on the main food sources of vitamin B6, or vitamin B6 supplement use in children in Australia.

Among children aged 2–17 years, the proportion of males and females that took any supplement were similar (19.2% and 18.0%). Children aged 12–17 years (15.0%) were less likely to take a supplement than any other age group.

**Table 7.** **Vitamin B6 dietary intake in Australian children (general population), National Nutrition and Physical Activity Survey: Usual Nutrient Intakes (2023)**

| Age groups (years) | Sex | Mean Intake (mg/day) | % less than EAR | 95th percentile intake (mg/day) |
|---|---|---|---|---|
| **2-4** | Males | 0.8 | 2.3# | 1.2 |
| | Females | 0.7 | 4.2# | 1.1 |
| **5-11** | Males | 1.0 | 5.3 | 1.5 |
| | Females | 0.9 | 9.1 | 1.4 |
| **12-17** | Males | 1.5 | 19.1 | 2.7 |
| | Females | 1.0 | 42.9 | 1.8 |

**Source:** https://www.abs.gov.au/statistics/health/food-and-nutrition/usual-nutrient-intakes/latest-release

**Abbreviations:** EAR, estimated average requirement.

# proportion has a high margin of error and should be used with caution

### *New Zealand*

Table 8 below outlines Vitamin B6 intake levels for Children in New Zealand from the 2002 New Zealand National Children's Nutrition Survey. Dietary supplements (13%), Fruit (11%), Potatoes, kumara & taro (10%) and Breakfast cereals (9%) provided the most vitamin B6 to the diets of New Zealand children aged 5-14 years (Ministry of Health, 2003).

Median intakes of vitamin B6 for all subgroups of children were above the RNIs (Reference Nutrient Intakes) that range from 0.9 mg (4–6 years) to 1.2 mg (11–14 years), comparison to NHMRC 2006 values were not possible as this data predates them. As vitamin B6 is involved in protein metabolism, recommended intakes were based on protein intake. The UK Dietary Reference Value (UK Department of Health, 1991) calculations were based on protein providing 14.7 percent of the EAR for energy. On this basis the vitamin B6 intake of New Zealand children appeared satisfactory (Ministry of Health, 2003).

**Table 8.** **Vitamin B6 intake in New Zealand children (general population), 2002 National Children's Nutrition Survey**

| Age groups (years) | Sex | Mean Intake (mg/day) | % less than EAR | 90th Percentile intake (mg/day) |
|---|---|---|---|---|
| **5-6** | Males | 1.2 | 0 | 1.6 |
| | Females | 1.1 | 0 | 1.5 |
| **7-10** | Males | 1.4 | 0 | 2.1 |
| | Females | 1.2 | 0 | 1.4 |
| **11-14** | Males | 1.6 | 0 | 2.4 |
| | Females | 1.3 | 0 | 1.7 |

**Source:** https://www.health.govt.nz/system/files/2011-11/nzfoodnzchildren.pdf

**Abbreviations:** EAR, estimated average requirement.

Overall, dietary vitamin B6 intake remains well below the UL in both Australia and New Zealand for children in all population groups. However, the usual intake data does not include vitamin B6 from dietary supplements for children in Australia. This is an important limitation because high-dose supplemental vitamin B6, rather than intake from foods and fortified beverages, is the main exposure source relevant to peripheral neuropathy risk (SLR, 2006).

### *Populations more likely to have excess Vitamin B6 intake*

In Australia, around 1 in 10 children aged 2 to 17 were reported to consume a vitamin or mineral supplement (ABS, 2025). While this data is not specific to vitamin B6, it highlights that supplement use is prevalent among children, in particular among younger children, with vitamin or mineral supplement use dropping to around 5% in 12-17 year olds (ABS, 2025).

In children, a population that may be more likely to have excess vitamin B6 intake is any children who may be prescribed vitamin B6 supplements, as sometimes happens for children with neurodevelopmental disorders (Sato, 2018). There is guidance for health professionals when prescribing high dose vitamin B6 (Schellack et al., 2025). However, there are concerns when parents or carers provide high dose or multiple supplements to children without health professional oversight.

## *Benchmarking against comparable international jurisdictions*

**Table 9.** **Overview of existing Tolerable Upper Intake Levels (ULs) for vitamin B6, in mg/day**

| Population group | SCF (2000) | IOM (1998) | NHMRC (2006) | EFSA (2023) |
|---|---|---|---|---|
| **Infants** | | | | |
| 4–6 months | *nd* | *nd* | *nd* | 2.2[(d)] |
| 7–11 months | *nd* | *nd* | *nd* | 2.5[(d)] |
| **Children and adolescents** | | | | |
| 1–3 years | 5[(b)] | 30[(a)] | 15[(a)] | 3.2[(d)] |
| 4–6 years | 7[(b)] | - | - | 4.5[(d)] |
| 4–8 years | - | 40[(a)] | 20[(a)] | - |
| 7–10 years | 10[(b)] | - | - | 6.1[(d)] |
| 9–13 years | - | 60[(a)] | 30[(a)] | - |
| 11–14 years | 15[(b)] | - | - | 8.6[(d)] |
| 14–18 years | - | 80[(a),(c)] | 40[(a),(c)] | - |
| 15–17 years | 20[(b)] | - | - | 10.7[(d)] |

***Abbreviations:*** *nd: not defined; IOM: Institute of Medicine; NHMRC: National Health and Medical Research Council; Australia and New Zealand; SCF: Scientific Committee on Food.*

*(a) Extrapolated from the UL for adults on a body size basis and growth considerations (for NHMRC only).*

*(b) Extrapolated from the UL for adults on a body weight basis.*

*(c) Including pregnant and lactating women.*

*(d) Extrapolated from the UL for adults using allometric scaling ($bw^{0.75}$) with reference body weights*

**Notes:**

- EVM (2003): UK Expert Group on Vitamins and Minerals and WHO/FAO (2004): World Health Organization/Food and Agriculture Organization did not derive values for children
- Values will be adjusted using a weighted average calculation, to align with the proposed age groupings

## *Balance of effects (benefits and harms)*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| There is no evidence to suggest that the current ULs for children are not protective of most individuals in the general population of Australia and New Zealand.<br><br>There is no evidence to suggest that peripheral neuropathy is a public health concern for children in Australia or New Zealand.<br><br>*As values for children are extrapolated from adult values, see the balance of effects for adults.* | There is no evidence to suggest that peripheral neuropathy is a public health concern for children in Australia or New Zealand. This could be because children may be less likely to consume products containing high levels of vitamin B6, and less like to consume multiple vitamin B6 containing supplements or supplemented food products.<br><br>Among Australian children aged 2–17 years 19.2% males and 18.0% females took a supplement (ABS, 2025).<br><br>Decreasing the level is more protective of the population, and more consistent with recent international values.<br><br>*As values for children are extrapolated from adult values, see the balance of effects for adults.* |

Additional considerations: *Committee input not captured in research evidence (note: there may be insufficient evidence to comment)*

- *none discussed*

## *Certainty of the evidence*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| *As values for children are extrapolated from adult values, see the certainty of the evidence statement for adults* | *As values for children are extrapolated from adult values, see the certainty of the evidence statement for adults* |

Additional considerations: *Committee input not captured in research evidence (note: there may be insufficient evidence to comment)*

- *none discussed*

## *Values and preferences (consumers, communities)*

*See discussion in adult table above.*

## *Feasibility*

Among Australian children aged 2–17 years, the proportion of males and females that took a supplement were similar (19.2% and 18.0%) (ABS, 2025).

The Australian and New Zealand food modelling data presented in Table 10 below shows modelled intake for children and adolescents is well below the revised ULs for children and adolescents.

**Table 10.** Comparison of modelled child and adolescent selenium intakes with proposed ULs

| Modelled Vitamin B6 Intake (Foundation Diet, mg/day) | | | Comparison with Proposed ULs (mg/day) | | | | |
|---|---|---|---|---|---|---|---|
| | | | | RETAINED 2006 UL | DECREASED 2026 UL | | % Modelled Intake Exceeding UL |
| Age Group | Male | Female | Applicable UL Age Group/s | All | Male | Female | |
| 13-23 months | 0.84 | 0.88 | 13-23 months | 15 | 4.5 | 4.0 | 0 |
| 2 – 3 years | 0.98 | 1.02 | 2-4 years | | | | |
| 4 – 8 years | 1.55 | 1.61 | 2-4/5-11 years | 20 | 6.5 | 6.5 | 0 |
| 9 – 11 years | 1.78 | 1.87 | 5-11 years | 30 | 10.0 | 10.0 | 0 |
| 12 – 13 years | 1.97 | 1.98 | 12-17 years | | | | |
| 14 – 18 years | 1.84 | 1.73 | 12-17 years | 40 | 14.0 | 12.5 | 0 |
| Pregnant, 14 – 18 years | *na* | 2.05 | Pregnant, 12-17 years | 40 | *na* | 12.5 | 0 |
| Lactating, 14 – 18 years | *na* | 2.0 | Lactating, 12-17 years | 40 | *na* | 12.5 | 0 |
| - | - | - | PROPOSED ADULT ULs | 50 | 14 | 14 | *na* |

## *Resource impacts*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| *See discussion in adult table above.* | *See discussion in adult table above.* |

## *Other factors (health equity impacts)*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| *See discussion in adult table above.* | *See discussion in adult table above.* |

## *Other factors (sustainability)*

| OPTION 1:<br>Maintain current UL recommendations | OPTION 2:<br>Decrease the UL |
|---|---|
| *See discussion in adult table above.* | *See discussion in adult table above.* |

## *DECISION*

**Option 2** was selected: a recommendation to decrease the UL, extrapolating from an adult UL of 14 mg/day.

As the ULs for children will be extrapolated from the adult UL, see adult decision section above for justification of recommendation.

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