

Pyridoxine toxicity from over-the-counter supplements

Miranda Sherley

CASE 1

A man aged in his late 60s, with multiple sclerosis (MS) and migraine, reported increasing burning bilateral, symmetrical paraesthesia in his feet over several months. He had put this down to MS, but his symptoms had otherwise been stable over a period of years, and MRI showed no new central nervous system lesions. Vitamin B12, lead and blood sugar levels were all normal. His vitamin B6 level was elevated at 2610 nmol/L pyridoxal-5-phosphate (normal range 20–190 nmol/L). On review, he reported taking ‘BLACKMORES EXECUTIVE B STRESS FORMULA’ (Blackmores Ltd, Melbourne, Vic, Australia), one tablet daily, since the time of his MS diagnosis roughly 25 years ago. This contains 20.6 mg pyridoxine equivalent per tablet; 12-fold the recommended daily intake (RDI) for a man of his age per tablet.¹ His symptoms were improving one year after cessation of this supplement, and his vitamin B6 levels had normalised.

CASE 2

A woman aged in her early 70s with Hashimoto hypothyroidism, urogenital changes of menopause, osteoarthritis, osteopaenia and mitral valve prolapse presented with restlessness and numbness in the feet, progressing over months to bilateral burning paraesthesia and hyperalgesia of the legs extending up the anterior thigh to the hip. Vitamin B12, lead and blood sugar levels were normal. Her vitamin B6 level was found to be 850 nmol/L (normal range 29–190 nmol/L). On review of her supplements, she reported taking ‘SUPER B 50’ (Australian Naturalcare

Products Pty Ltd, Sydney, NSW). She recounted being told this would be helpful for her mood at a time when she felt under stress, and she had been taking it for over one year. This formulation contains 41.1 mg pyridoxine equivalent; 27.4-fold the RDI of vitamin B6 for a woman of her age per tablet.¹ The supplement was stopped, her vitamin B6 levels declined, and her symptoms were almost resolved by 4.5 months.

QUESTION 1

What is the recommended daily intake of vitamin B6?

QUESTION 2

What are the symptoms of vitamin B6 deficiency and vitamin B6 toxicity?

QUESTION 3

What sorts of supplements can lead to vitamin B6 toxicity?

QUESTION 4

How much vitamin B6 is in products available in Australian pharmacies?

ANSWER 1

Vitamin B6 is used to describe pyridoxine, pyridoxamine, pyridoxal and their phosphorylated derivatives.¹ Australian RDI for vitamin B6 (pyridoxine equivalent) ranges from 0.1 mg/day for children aged 0–6 years to 1.7 mg/day for men aged over 50 years, and as high as 1.9 mg/day during pregnancy and 2.0 mg/day during breastfeeding (Table 1).

The Australian recommendation for the upper daily limit of vitamin B6 for age

Table 1. National Health and Medical Research Council-recommended intake of vitamin B6 (pyridoxine equivalent)¹

Group	EAR (mg/day)	RDI (mg/day)	UL (mg/day)
Boys and girls aged 1–3 years	0.4	0.5	15
Boys and girls aged 4–8 years	0.5	0.6	20
Boys and girls aged 9–13 years	0.8	1.0	30
Boys aged 14–18 years	1.1	1.3	40
Girls aged 14–18 years	1.0	1.2	40
Men and women aged 19–50 years	1.1	1.3	50
Men aged 51+ years	1.4	1.7	50
Women aged 51+ years	1.3	1.5	50
Pregnant and aged 14–18 years	1.6	1.9	40
Pregnant and aged 19–50 years	1.6	1.9	50
Lactating and aged 14–18 years	1.7	2.0	40
Lactating and aged 19–50 years	1.7	2.0	50

EAR, estimated average requirement; RDI, recommended daily intake; UL, upper limit.

19+ years is 50 mg/day, based primarily on studies from the 1980s.¹ Data from that time period primarily relate to very high doses that might have skewed the analysis.² The 2023 recommendation regarding recommended upper limits from the European Food Safety Authority Panel on Nutrition, Novel Foods and Food Allergens is substantially lower at 12 mg/day for adults.²

ANSWER 2

Vitamin B6 is found in a wide range of food types including meats, cereals, vegetables and fruits, and it has high bioavailability, so deficiency is considered rare.¹ There is a lack of agreement regarding what cut-offs indicate a deficiency state.¹ Symptoms of vitamin B6 deficiency can include seborrhoeic dermatitis, convulsions, microcytic anaemia, depression and confusion.¹

Signs and symptoms of toxicity include paraesthesia, hyperaesthesia, weakness, atrophy, reduced reflexes, fasciculation, numbness and pain.^{1,3} The Therapeutic Goods Administration (TGA) requires all vitamin B6-containing listed medications with a recommended daily dose >10 mg to include a paraesthesia warning.

ANSWER 3

Vitamin B6 toxicity has been reported in people taking daily pyridoxine supplementation at a range of doses,²⁻⁵ a single large dose supplementation with pyridoxine,⁶ daily mixed B-group vitamin supplements⁷ and daily multivitamin supplements,⁸⁻¹⁰ as well as in the newborn of a person taking vitamin supplements during pregnancy and breastfeeding.¹¹ Elevated plasma levels of pyridoxine have also been reported in the context of regular intake of energy drinks and multivitamins.¹²

A 2024 survey of vitamin B6-containing products available from Chemist Warehouse¹³ found that over one-quarter of products identified were named in a way that implied that they were supplements for non-B vitamins and minerals, and another quarter indicated that they were to be taken for specified health conditions.

ANSWER 4

Vitamin B6 doses in products available in Australia vary widely (a searchable index of all listed medications registered with the TGA is available at <https://compliance.health.gov.au/artg>). Doses in products available for

online purchase from Chemist Warehouse in July 2024 ranged from 0.3 to 263 mg daily.¹³ Doses exceeding the current Australian recommended pyridoxine equivalent upper daily limit (UDL)¹ and European UDL are found in B-group vitamins, multivitamins, non-B vitamins/minerals, health products and sports supplements (Tables 2 and 3). Patients taking multiple vitamins, supplements and sports products, or taking supplements for prolonged periods, might also be at risk of toxicity.

Key points

- Excessive pyridoxine causes neurological injury.
- Over-the-counter vitamins and supplements contain vitamin B6 levels sufficient to cause toxicity when taken as directed.
- Vitamins and supplements not labelled as B vitamins can contain high levels of vitamin B6.

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Table 2. Supplements for specified health conditions with daily vitamin B6 dose over 12 mg pyridoxine equivalent^A

Health condition specified	Product (Sponsor details)	Vitamin B6 content at maximum recommended daily dose as pyridoxine equivalent (mg)
Mental function	Nature's Own Mind, Memory & Energy (Sanofi-Aventis Healthcare Pty Ltd, Brisbane, Qld, Australia)	41.2
	Swisse Ultiboost Memory + Focus (Swisse Wellness Pty Ltd, Melbourne, Vic, Australia)	41.1
	Brain Booster Ginkgo Biloba 6000 mg (Nature's Care Manufacture Pty Limited, Sydney, NSW, Australia)	32.9
Hair, skin and nails	Skin & Nails (McPherson's Consumer Products Pty Ltd, Sydney, NSW, Australia)	50.0
	JSHealth Skin + Digestion (JSHealth Vitamins Pty Ltd, Sydney, NSW, Australia)	20.0
	Thompson's Skin, Hair & Nails (Homart Wellness Aust Pty Ltd, Sydney, NSW, Australia)	16.5
Mood/Stress	Swisse Ultiboost Mood (Swisse Wellness Pty Ltd, Melbourne, Vic, Australia)	41.1
	Thompson's Mood Support (Homart Wellness Aust Pty Ltd, Sydney, NSW, Australia)	40.0
	Mood Support (McPherson's Consumer Products Pty Ltd, Sydney, NSW, Australia)	20.0

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Table 2. Supplements for specified health conditions with daily vitamin B6 dose over 12 mg pyridoxine equivalent^A (cont'd)

Health condition specified	Product (Sponsor details)	Vitamin B6 content at maximum recommended daily dose as pyridoxine equivalent (mg)
Energy and wakefulness	Ultra Muscleeze Energy (FIT-BioCeuticals Pty Ltd, Sydney, NSW, Australia)	50.0
	Nature's Own Mind, Memory & Energy (Sanofi-Aventis Healthcare Pty Ltd, Brisbane, Qld, Australia)	41.2
	Caruso's GET UP & GO (Caruso's Natural Health Pty Ltd, Sydney, NSW, Australia)	37.0
	Centrum ENERGISE & GO (Haleon Australia Pty Ltd, Sydney, NSW, Australia)	25.2
Muscle cramps	Cramps Away (Caruso's Natural Health Pty Ltd, Sydney, NSW, Australia)	82.2
	Ultra Muscleeze P5P (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	68.4
	Ultra Muscleeze Energy (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	50.0
	Ultra Muscleeze (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	41.1
	Crampeze Leg Cramps & Spasms (LaCorium Health Australia Pty Ltd, Sydney, NSW, Australia)	32.8
PMS/Menopause	In-Flow Period & PMS Relief (Shakti Co Pty Ltd, Sydney, NSW, Australia)	26.3
	JSHealth Vitamins Hormone + PMS Support (JSHealth Vitamins Pty Ltd, Sydney, NSW, Australia)	24.7
Metabolism/Sugar	BLACKMORES SUGAR BALANCE (Blackmores Ltd, Melbourne, Vic, Australia)	19.74
	Sugar Balance Plus (Nature's Care Manufacture Pty Limited, Sydney, NSW, Australia)	19.68
	JSHealth Vitamins Metabolism+ (JSHealth Vitamins Pty Ltd, Sydney, NSW, Australia)	15
Gout	Gout Complex (FIT-BioCeuticals Pty Ltd, Sydney, NSW, Australia)	50
Digestion	JSHealth Skin + Digestion (JSHealth Vitamins Pty Ltd, Sydney, NSW, Australia)	20
Fluid	Fluid Away (Caruso's Natural Health Pty Ltd, Sydney, NSW, Australia)	25
Adrenals	Adrenoplex (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	17.2
Rejuvenation	Rejufort Heart & Cardiovascular Health (Pharmametics Products, A Division of Max Biocare Pty Ltd, Melbourne, Vic, Australia)	12.5
Migraine	Migraine Care (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	25

^AProducts identified from the Chemist Warehouse website in July 2024 by searching for vitamin B. Vitamin B6-containing products were defined as supplements for specific health conditions if the product name did not contain the terms B, multivitamin or another named vitamin or mineral, and did specify that they are to be used for one or more health conditions.¹³

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Table 3. Products naming specific vitamins/minerals/herbs/supplements or sold as sports supplements and not naming B vitamins or using the terms 'multi' or 'multivitamin' with a daily vitamin B6 dose over 12 mg pyridoxine equivalent^A

Category	Product (Sponsor details)	Vitamin B6 content at maximum recommended daily dose as pyridoxine equivalent (mg)
Sports supplement	Vital strength pre-workout shot (Vitalstrength, Ingleburn, NSW, Australia)	263.0
	FBX Energy & Burn (Carotino [Australia] Pty Ltd, Sydney, NSW, Australia)	25.0
Magnesium	EZZ Magnesium Plus (EZZ LIFE SCIENCE HOLDINGS LIMITED, Sydney, NSW, Australia)	100.0
	Cenovis Magnesium (Sanofi-Aventis Healthcare Pty Ltd T/A Sanofi Consumer Healthcare, Brisbane, Qld, Australia)	98.6
	ULTRA MAGNESIUM POWDER (RF Six Pty Ltd, Melbourne, Vic, Australia)	82.0
	Healthy Care Super Bio Magnesium Capsules (Nature's Care Manufacture Pty Limited, Sydney, NSW, Australia)	82.0
	Bioglan Active Magnesium Powder (Natural Bio Pty Limited, Sydney, NSW, Australia)	67.6
	BLACKMORES SUPER MAGNESIUM + (Blackmores Ltd, Melbourne, Vic, Australia)	50.0
	Super Magnesium Powder (Nature's Care Manufacture Pty Limited, Sydney, NSW, Australia)	42.6
	ETHICAL NUTRIENTS MEGA MAGNESIUM ENERGY (Metagenics [Aust] Pty Ltd, Brisbane, Qld, Australia)	41.2
	BLACKMORES BIO MAGNESIUM (Blackmores Ltd, Melbourne, Vic, Australia)	41.1
	GO Magnesium Powder Lemon Lime (The Better Health Company [Australia] Pty, Sydney, NSW, Australia)	41.1
	BLACKMORES RECOVERY MAGNESIUM POWDER (Blackmores Ltd, Melbourne, Vic, Australia)	41
	Wagner Super Bio Magnesium (RF Six Pty Ltd, Melbourne, Vic, Australia)	41
	ETHICAL NUTRIENTS MEGA MAGNESIUM; (Metagenics [Aust] Pty Ltd, Brisbane, Qld, Australia)	40.9
	Thompson's Organic Magnesium (Homart Wellness Aust Pty Ltd, Sydney, NSW, Australia)	24.7
	Wagner Vegan Magnesium Plus (RF Six Pty Ltd, Melbourne, Vic, Australia)	24.7
	Magnesium Advanced - Powder Watermelon (McPherson's Consumer Products Pty Ltd, Sydney, NSW, Australia)	20.6
Vitamin D	Blackmores vitamin D3 1000IU (Blackmores Ltd, Melbourne, VIC, Australia) ^B	50

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Table 3. Products naming specific vitamins/minerals/herbs/supplements or sold as sports supplements and not naming B vitamins or using the terms 'multi' or 'multivitamin' with a daily vitamin B6 dose over 12 mg pyridoxine equivalent^A (cont'd)

Category	Product (Sponsor details)	Vitamin B6 content at maximum recommended daily dose as pyridoxine equivalent (mg)
Zinc	Zinc Advanced (McPherson's Consumer Products Pty Ltd, Sydney, NSW, Australia)	50
	BLACKMORES BIO ZINC TABLET (Blackmores Ltd, Melbourne, Vic, Australia)	41.1
	ULTIMATE ZINC SUSTAIN (RF Six Pty Ltd, Melbourne, Vic, Australia)	25.8
	Zinc Sustain (FIT-BioCeuticals Pty Ltd, Postal Address Blackmores Limited, Sydney, NSW, Australia)	24.8
	Swisse Ultiboost Zinc + (Swisse Wellness Pty Ltd, Melbourne, Vic, Australia)	24.7
	Bioglan Zinc Forte High Strength 40 mg (Natural Bio Pty Limited, Sydney, NSW, Australia)	20
	GO Zinc Complex 1-A-Day (The Better Health Company [Australia] Pty, Sydney, NSW, Australia)	16.5
	Cenovis Zinc Plus (Sanofi-Aventis Healthcare Pty Ltd T/A Sanofi Consumer Healthcare, Brisbane, Qld, Australia)	16.4
	ETHICAL NUTRIENTS MEGA ZINC 40MG (Metagenics [Aust] Pty Ltd, Brisbane, Qld, Australia)	16.4
Iron	Iron Advanced (McPherson's Consumer Products Pty Ltd, Sydney, NSW, Australia)	20.6
	GO Iron 1-A-Day (The Better Health Company [Australia] Pty, Sydney, NSW, Australia)	20.6
	Pure Vegan Iron + Energy Plus (Nature's Care Manufacture Pty Limited, Sydney, NSW, Australia)	20.6
	Iron Sustain (FIT-BioCeuticals Pty Ltd, Sydney, NSW, Australia)	15
Named herbs	BLACKMORES ASHWAGANDHA+ (Blackmores Ltd, Melbourne, Vic, Australia)	41.2
	De-Stress Ultra with Ashwagandha (Phytologic Holdings Pty Limited, Sydney, NSW, Australia)	41.1
	Nature's Own Mild Anxiety Ashwagandha (Sanofi-Aventis Healthcare Pty Ltd T/A Sanofi Consumer Healthcare, Brisbane, Qld, Australia)	41.1
	Horny Goat Weed For Her (Carotino [Australia] Pty Ltd, Sydney, NSW, Australia)	24.7
	Horny Goat Weed For Him (Carotino [Australia] Pty Ltd, Sydney, NSW, Australia)	24.7
	Caruso's St John's Wort (Caruso's Natural Health Pty Ltd, Sydney, NSW, Australia)	20.0
	Caruso's Garcinia 7500 (Caruso's Natural Health Pty Ltd, Sydney, NSW, Australia)	20.0
Other	BLACKMORES BIO ACE EXCELL (Blackmores Ltd, Melbourne, Vic, Australia)	41.2
	BLACKMORES ECHINACEA ACE + ZINC (Blackmores Ltd, Sydney, NSW, Australia)	32.1
	Methyl-Max (FIT-BioCeuticals Pty Ltd, Blackmores Limited, Sydney, NSW, Australia)	20.0

^AProducts identified from the Chemist Warehouse website in July 2024 by searching for vitamin B.¹³ Vitamin B6-containing products were defined as supplements for specific health conditions if the product name did not contain the terms B, multivitamin or another named vitamin or mineral, and did specify that they are to be used for one or more health conditions.¹³

^BThe current formulation of this product at the time of writing does not include any vitamin B6.

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