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Evidence Package

Vitamin B12

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Table 6a: Executive Summary of Therapeutic Indications

Indication identifier	System targeted	Therapeutic indication	Required dosage	Specific/ Non-specific
COBALAMIN1	General health or body parts	<ul style="list-style-type: none"> • Maintain/support general health and wellbeing • Maintain/support healthy growth and development 	2.4 mcg	Non-specific
COBALAMIN2	Cardiovascular system	<ul style="list-style-type: none"> • Aid/assist healthy red blood cell production • Maintain/support red blood cell health • Maintain/support blood health • Maintain/support cardiovascular system health • Maintain/support healthy cardiovascular system function • Helps decrease/reduce homocysteine levels in healthy individuals. 	2.4 mcg	Non-specific
COBALAMIN3	Nervous system	<ul style="list-style-type: none"> • Maintain/support nervous system health • Maintain/support nervous system function 	2.4 mcg	Non-specific

COBALAMIN4	Nutrition	<ul style="list-style-type: none"> • Helps prevent dietary Vitamin B₁₂ deficiency • Maintain/support Vitamin B₁₂ levels in the body • Vitamin B₁₂ aids/assists/helps metabolism of proteins, carbohydrates and fats • Aid/assist/helps protein synthesis in the body 	2.4 mcg	Non-specific
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Table 6b: Evidence Summary for Scientific Indications

INDICATION 1						
Indication	Evidence reference details	Ingredient	Dosage	Patient population	Summary of findings	Balance of evidence
		Plant/animal part and preparation	Daily dosage, frequency & method	Subject, characteristics, health condition, ages, gender, ethnicity	Include enough information to demonstrate relevance and study outcomes. Any justifications from table 4d of Checklist 4 should be included here.	'Primary supporting', 'Secondary supporting'
<ul style="list-style-type: none"> Maintain/support general health and wellbeing Maintain/support healthy growth and development 	Health Canada Monographs, Health Canada, 2023	Vitamin B ₁₂	0.14 – 1000mcg	NA	<ul style="list-style-type: none"> Helps to form red blood cells. Helps to maintain/support immune function/the immune system. Helps in the normal function of the immune system. Helps in energy metabolism in the body. Helps to maintain healthy metabolism. Helps to prevent vitamin B₁₂ deficiency. Helps to prevent vitamin B₁₂ deficiency. Helps to maintain the body's ability to metabolize nutrients. 	Primary supporting

	<p>GlobinMed, Global Information Hub on Integrated Medicine, 2021</p>	Vitamin B ₁₂	RDI 4mcg	NA	<p>Biochemical Pathways Primarily functions as a methyl donor, transferring methyl groups in the following:</p> <p>a) Vitamin B₁₂ demethylates methyltetrahydrofolate to generate tetrahydrofolate, necessary in the synthesis of DNA. This means B₁₂ plays a role in the replication of the genetic code and is a growth factor in all cells of the body.</p> <p>b) Methylcobalamin transfers a methyl group onto homocysteine, which facilitates the conversion of homocysteine to methionine.</p> <p>Hydrogen Carrier Functions as a hydrogen carrier in hydrogen transfer reactions.</p> <p>Nervous System Required for the synthesis of myelin, the insulation around nerves. It plays a major role in the functioning and maintenance of the nervous system.</p> <p>Red Blood Cells Necessary for the maturation of red blood cells.</p> <p>Metabolism</p>	<p>Primary supporting</p>
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					<p>Involved in various aspects of protein, fat, and carbohydrate metabolism.</p> <p>Atherosclerosis Homocysteine concentrations, when elevated, are a risk factor for atherosclerotic disease. Vitamin B12 is necessary for the metabolism of homocysteine.</p>	
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	U.S. Department of Health and Human Services. (2024). Retrieved from National Institute of Health Office of Dietary Supplements website	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Vitamin B12 is required for proper red blood cell formation, neurological function, and DNA synthesis. Vitamin B12 functions as a cofactor for methionine synthase and L-methylmalonyl-CoA mutase. Methionine synthase catalyses the conversion of homocysteine to methionine. Methionine is required for the formation of S-adenosylmethionine, a universal methyl donor for almost 100 different substrates, including DNA, RNA, hormones, proteins, and lipids. L-methylmalonyl-CoA mutase converts L-methylmalonyl-CoA to succinyl-CoA in the degradation of propionate, an essential biochemical reaction in fat and protein metabolism. Succinyl-CoA is also required for haemoglobin synthesis.</p> <p>Deficiency Typically, vitamin B12 deficiency is treated with vitamin B12 injections, since this method bypasses potential barriers to absorption. However, high doses of oral vitamin B12 may also be effective.</p> <p>Vitamin B12 and Health</p>	Primary supporting
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					<p>Cardiovascular disease Elevated homocysteine levels have also been identified as an independent risk factor for cardiovascular disease. In the presence of insufficient vitamin B12, homocysteine levels can rise due to inadequate function of methionine synthase.</p>	
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	<p>Braun, L., & Cohen, M. (2015). Vitamin B₁₂. In <i>Herbs & Natural Supplements. An evidence-based guide</i> (4th ed., pp. 1091-1101). Chatswood, NSW: Elsevier Australia.</p>	<p>Vitamin B₁₂</p>	<p>RDI 2.4mcg</p>	<p>NA</p>	<p>Main Actions</p> <p>Important cofactor Vitamin B₁₂ is essential for the normal function of all cells. It affects cell growth and replication, the metabolism of carbohydrates, lipids and protein and is involved in fatty acid and nucleic acid synthesis. It is also involved in the production of red blood cells in bone marrow, and activates folacin coenzymes for red blood cell production.</p> <p>Homocysteine reduction Methylcobalamin aids in the conversion of homocysteine to methionine by the action of methionine synthase, transferring a methyl group from methylfolate (folic acid). After conversion from homocysteine, methionine is then converted to S-adenosyl-L-methionine (SAME), important for methylation reactions and protein synthesis.</p> <p>Nervous system Vitamin B₁₂ is involved in the synthesis of protein structures in the myelin sheath and nerve cells. As methylation is required for the production of myelin basic</p>	<p>Primary supporting</p>
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					<p>protein, a reduction in B₁₂ and SAME will result in demyelination of peripheral nerves and the spinal column (subacute combined degeneration).</p> <p>Antioxidant capacity Recent studies have identified that vitamin B₁₂ and its cobalamin-based derivatives are powerful antioxidants at pharmacological concentrations.</p> <p>Clinical Use Deficiency: treatment and prevention Traditionally, vitamin B₁₂ supplementation has been used to treat deficiency or prevent it in conditions such as pernicious anaemia and atrophic gastritis, but special consideration should be given to the elderly, who are at high risk.</p> <p>Hyperhomocysteinaemia Vitamin B₁₂ alone may not be sufficient to normalise elevated homocysteine levels. As a result, vitamin B₁₂ is often recommended in combination with folic acid and vitamin B₆ in conditions for which</p>	
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					homocysteine is implicated as a possible causative factor.	
	Gaby, A. (2017). Vitamin B ₁₂ . In <i>Nutritional Medicine</i> (2nd ed., pp. 94-100). Concord, NH: Fritz Perlberg Publishing.	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Biochemistry Vitamin B₁₂ plays a role in DNA synthesis, red blood cell formation, homocysteine metabolism, and synthesis of S-adenosylmethionine. It is involved in the functioning of the nervous system and immune system.</p> <p>Clinical indications Vitamin B₁₂ may be useful for preventing and/or treating numerous conditions, including Hyperhomocysteinemia</p>	Primary supporting

	<p>Gropper, S., Smith, J., & Carr, T. (2018). Water soluble vitamins: Vitamin B₁₂. In <i>Advanced Nutrition and Human Metabolism</i> (7th ed., pp. 351-358). Boston: Cengage Learning.</p>	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Functions and Mechanisms of Action Two enzymatic reactions requiring vitamin B12 have been recognized in humans. One of these reactions requires methylcobalamin as a coenzyme for methionine synthase, and the other relies on adenosylcobalamin as a coenzyme for L-methylmalonyl-CoA mutase. These reactions facilitate nutrient metabolism and energy production, as well as indirectly (via interactions with folate) the synthesis of purines and pyridimidines for use in nucleic acids.</p> <p>Two reactions are responsible for converting homocysteine to methionine. One does not require vitamin B12. The other reaction requires methylcobalamin as a coenzyme for methionine synthase (also called homocysteine methyltransferase).</p>	Primary supporting
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	Therapeutic Research Center. (2024). Vitamin B ₁₂ . Retrieved from Natural Medicines website	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Orally, vitamin B12 is used for preventing and treating vitamin B12 deficiency. It is also used orally for treating hyperhomocysteinemia,</p> <p>Effectiveness</p> <p>Administering vitamin B12 orally, intramuscularly, or intranasally is effective for preventing and treating vitamin B12 deficiency. It is commonly believed that only intramuscular vitamin B12 is effective for treating vitamin B12 deficiency. However, clinical research shows that oral therapy is as effective as intramuscular administration.</p> <p>Older adults who take oral vitamin B12 supplements in doses of 25-37.5 mcg daily are more likely to have normal vitamin B12 levels than those who do not take supplements.</p> <p>Taking vitamin B12 orally in combination with folic acid, and sometimes with pyridoxine (vitamin B6), can reduce serum concentrations of homocysteine.</p>	Primary supporting
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	Association of Naturopathic Practitioners. (2020). Vitamin B ₁₂ . Retrieved from: Herb Drug Nutrient.	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Vitamin B12 is essential for the synthesis of fatty acids in myelin, normal blood cells and in the synthesis of DNA with folate.</p> <p>Deoxyadenosylcobalamin is essential for the conversion of L-methylmalonyl-CoA to succinyl-CoA which plays a part in energy production from lipids and proteins and in haemoglobin synthesis.</p> <p>Methylcobalamin and the folate-dependent enzyme, methionine synthase is essential for the metabolism of homocysteine to methionine and may thereby reduce the risk of cardiovascular disease.</p> <p>Vitamin B12 may reduce homocysteine.</p>	Primary supporting
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INDICATION 2						
Indication	Evidence reference details	Ingredient	Dosage	Patient population	Summary of findings	Balance of evidence
		Plant/animal part and preparation	Daily dosage, frequency & method	Subject, characteristics, health condition, ages, gender, ethnicity	Include enough information to demonstrate relevance and study outcomes. Any justifications from table 4d of Checklist 4 should be included here.	'Primary supporting', 'Secondary supporting'
<ul style="list-style-type: none"> Aid/assist healthy red blood cell production Maintain/support red blood cell health 	Health Canada Monographs, Health Canada, 2023	Vitamin B ₁₂	0.14 – 1000mcg	NA	<ul style="list-style-type: none"> Helps to form red blood cells. Helps in energy metabolism in the body. Helps to maintain healthy metabolism. Helps to prevent vitamin B₁₂ deficiency and to form red blood cells. 	Primary supporting

<ul style="list-style-type: none"> • Maintain/support blood health • Maintain/support cardiovascular system health • Maintain/support healthy cardiovascular system function • Helps decrease/reduce homocysteine levels in healthy individuals. 	<p>GlobinMed, Global Information Hub on Integrated Medicine, 2021</p>	<p>Vitamin B₁₂</p>	<p>RDI 4mcg</p>	<p>NA</p>	<p>Biochemical Pathways Primarily functions as a methyl donor, transferring methyl groups in the following:</p> <p>a) Vitamin B₁₂ demethylates methyltetrahydrofolate to generate tetrahydrofolate, necessary in the synthesis of DNA. This means B₁₂ plays a role in the replication of the genetic code and is a growth factor in all cells of the body.</p> <p>b) Methylcobalamin transfers a methyl group onto homocysteine, which facilitates the conversion of homocysteine to methionine.</p> <p>Nervous System Required for the synthesis of myelin, the insulation around nerves. It plays a major role in the functioning and maintenance of the nervous system.</p> <p>Red Blood Cells Necessary for the maturation of red blood cells.</p> <p>Atherosclerosis Homocysteine concentrations, when elevated, are a risk factor for atherosclerotic disease. Vitamin</p>	<p>Primary supporting</p>
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					B12 is necessary for the metabolism of homocysteine.	
	U.S. Department of Health and Human Services. (2024). Retrieved from National Institute of Health Office of Dietary Supplements website	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Vitamin B12 is required for proper red blood cell formation, neurological function, and DNA synthesis.</p> <p>Vitamin B12 functions as a cofactor for methionine synthase and L-methylmalonyl-CoA mutase. Methionine synthase catalyses the conversion of homocysteine to methionine, which is required for the formation of S-adenosylmethionine, a universal methyl donor for almost 100 different substrates, including DNA, RNA, hormones, proteins, and lipids. Succinyl-CoA is also required for haemoglobin synthesis.</p> <p>Vitamin B12 and Health Cardiovascular disease Elevated homocysteine levels have also been identified as an independent risk factor for cardiovascular disease. In the presence of insufficient vitamin B12, homocysteine levels can rise due to inadequate function of methionine synthase.</p>	Primary supporting

	<p>Braun, L., & Cohen, M. (2015). Vitamin B₁₂. In <i>Herbs & Natural Supplements. An evidence-based guide</i> (4th ed., pp. 1091-1101). Chatswood, NSW: Elsevier Australia.</p>	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Main Actions</p> <p>Important cofactor Vitamin B₁₂ is essential for the normal function of all cells. It affects cell growth and replication. It is also involved in the production of red blood cells in bone marrow, and activates folacin coenzymes for red blood cell production.</p> <p>Homocysteine reduction Methylcobalamin aids in the conversion of homocysteine to methionine by the action of methionine synthase, transferring a methyl group from methylfolate (folic acid). After conversion from homocysteine, methionine is then converted to S-adenosyl-L-methionine (S-AdoMet), important for methylation reactions and protein synthesis.</p> <p>Clinical Use Hyperhomocysteinaemia Vitamin B₁₂ alone may not be sufficient to normalise elevated homocysteine levels. As a result, vitamin B₁₂ is often recommended in combination with folic acid and</p>	Primary supporting
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					vitamin B ₆ in conditions for which homocysteine is implicated as a possible causative factor.	
	Gaby, A. (2017). Vitamin B ₁₂ . In <i>Nutritional Medicine</i> (2nd ed., pp. 94-100). Concord, NH: Fritz Perlberg Publishing.	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Biochemistry Vitamin B₁₂ plays a role in red blood cell formation, homocysteine metabolism.</p> <p>Clinical indications Vitamin B₁₂ may be useful for preventing and/or treating numerous conditions, including Hyperhomocysteinemia</p>	Primary supporting

	<p>Gropper, S., Smith, J., & Carr, T. (2018). Water soluble vitamins: Vitamin B₁₂. In <i>Advanced Nutrition and Human Metabolism</i> (7th ed., pp. 351-358). Boston: Cengage Learning.</p>	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Functions and Mechanisms of Action Two enzymatic reactions requiring vitamin B12 have been recognized in humans. One of these reactions requires methylcobalamin as a coenzyme for methionine synthase, and the other relies on adenosylcobalamin as a coenzyme for L-methylmalonyl-CoA mutase. These reactions facilitate nutrient metabolism and energy production.</p> <p>Two reactions are responsible for converting homocysteine to methionine. One does not require vitamin B12. The other reaction requires methylcobalamin as a coenzyme for methionine synthase (also called homocysteine methyltransferase).</p>	Primary supporting
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	Therapeutic Research Center. (2024). Vitamin B ₁₂ . Retrieved from Natural Medicines website	Vitamin B ₁₂	RDA 2.4mcg	NA	Orally, vitamin B12 is also used orally for treating hyperhomocysteinemia, Effectiveness Taking vitamin B12 orally in combination with folic acid, and sometimes with pyridoxine (vitamin B6), can reduce serum concentrations of homocysteine.	Primary supporting
	Association of Naturopathic Practitioners. (2020). Vitamin B ₁₂ . Retrieved from: Herb Drug Nutrient.	Vitamin B ₁₂	RDI 2.4mcg	NA	Vitamin B12 is essential for the synthesis of fatty acids in normal blood cells. Deoxyadenosylcobalamin is essential for the conversion of L-methylmalonyl-CoA to succinyl-CoA which plays a part in energy production from lipids and proteins and in haemoglobin synthesis. Vitamin B12 may reduce homocysteine. Methylcobalamin and the folate-dependent enzyme, methionine synthase is essential for the metabolism of homocysteine to methionine and may thereby reduce the risk of cardiovascular disease.	Primary supporting

INDICATION 3						
Indication	Evidence reference details	Ingredient	Dosage	Patient population	Summary of findings	Balance of evidence
		Plant/animal part and preparation	Daily dosage, frequency & method	Subject, characteristics, health condition, ages, gender, ethnicity	Include enough information to demonstrate relevance and study outcomes. Any justifications from table 4d of Checklist 4 should be included here.	'Primary supporting', 'Secondary supporting'

<ul style="list-style-type: none"> • Maintain/support nervous system health • Maintain/support nervous system function 	Health Canada Monographs, Health Canada, 2023	Vitamin B ₁₂	0.14 – 1000mcg	NA	<ul style="list-style-type: none"> • Helps in energy metabolism in the body. • Helps to maintain healthy metabolism. 	Primary supporting
	GlobinMed, Global Information Hub on Integrated Medicine, 2021	Vitamin B ₁₂	RDI 4mcg	NA	<p>Biochemical Pathways Vitamin B₁₂ demethylates methyltetrahydrofolate to generate tetrahydrofolate, necessary in the synthesis of DNA. This means B₁₂ plays a role in the replication of the genetic code and is a growth factor in all cells of the body.</p> <p>Nervous System Required for the synthesis of myelin, the insulation around nerves. It plays a major role in the functioning and maintenance of the nervous system.</p>	Primary supporting

	U.S. Department of Health and Human Services. (2024). Retrieved from National Institute of Health Office of Dietary Supplements website	Vitamin B ₁₂	RDA 2.4mcg	NA	<p>Vitamin B12 is required for proper neurological function.</p> <p>Vitamin B12 functions as a cofactor for methionine synthase and L-methylmalonyl-CoA mutase. Methionine synthase catalyses the conversion of homocysteine to methionine. Methionine is required for the formation of S-adenosylmethionine, a universal methyl donor for almost 100 different substrates, including DNA, RNA, hormones, proteins, and lipids. L-methylmalonyl-CoA mutase converts L-methylmalonyl-CoA to succinyl-CoA in the degradation of propionate, an essential biochemical reaction in fat and protein metabolism.</p>	Primary supporting
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	<p>Braun, L., & Cohen, M. (2015). Vitamin B₁₂. In <i>Herbs & Natural Supplements. An evidence-based guide</i> (4th ed., pp. 1091-1101). Chatswood, NSW: Elsevier Australia.</p>	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Main Actions</p> <p>Important cofactor Vitamin B₁₂ is essential for the normal function of all cells. It affects cell growth and replication, the metabolism of carbohydrates, lipids and protein and is involved in fatty acid and nucleic acid synthesis.</p> <p>Nervous system Vitamin B₁₂ is involved in the synthesis of protein structures in the myelin sheath and nerve cells. As methylation is required for the production of myelin basic protein, a reduction in B₁₂ and SAME will result in demyelination of peripheral nerves and the spinal column (subacute combined degeneration).</p>	Primary supporting
	<p>Gaby, A. (2017). Vitamin B₁₂. In <i>Nutritional Medicine</i> (2nd ed., pp. 94-100). Concord, NH: Fritz Perlberg Publishing.</p>	Vitamin B ₁₂	RDI 2.4mcg	NA	<p>Biochemistry Vitamin B₁₂ is involved in the functioning of the nervous system and immune system.</p>	Primary supporting

	Association of Naturopathic Practitioners. (2020). Vitamin B ₁₂ . Retrieved from: Herb Drug Nutrient.	Vitamin B ₁₂	RDI 2.4mcg	NA	Vitamin B12 is essential for the synthesis of fatty acids in myelin.	Primary supporting
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INDICATION 4						
Indication	Evidence reference details	Ingredient	Dosage	Patient population	Summary of findings	Balance of evidence
		Plant/animal part and preparation	Daily dosage, frequency & method	Subject, characteristics, health condition, ages, gender, ethnicity	Include enough information to demonstrate relevance and study outcomes. Any justifications from table 4d of Checklist 4 should be included here.	'Primary supporting', 'Secondary supporting'
<ul style="list-style-type: none"> Helps prevent dietary Vitamin B₁₂ 	Health Canada Monographs, Health Canada, 2023	Vitamin B ₁₂	0.14 – 1000mcg	NA	<ul style="list-style-type: none"> Helps in energy metabolism in the body. Helps to maintain healthy metabolism. Helps to prevent vitamin B₁₂ deficiency. Helps to maintain the body's ability to metabolize nutrients. 	Primary supporting

<ul style="list-style-type: none"> deficiency • Maintain/support Vitamin B₁₂ levels in the body • Vitamin B₁₂ aids/assists/helps metabolism 	<p>GlobinMed, Global Information Hub on Integrated Medicine, 2021</p>	<p>Vitamin B₁₂</p>	<p>RDI 4mcg</p>	<p>NA</p>	<p>Biochemical Pathways Primarily functions as a methyl donor, transferring methyl groups in the following: Vitamin B₁₂ demethylates methyltetrahydrofolate to generate tetrahydrofolate, necessary in the synthesis of DNA. This means B₁₂ plays a role in the replication of the genetic code and is a growth factor in all cells of the body. Hydrogen Carrier Functions as a hydrogen carrier in hydrogen transfer reactions. Metabolism Involved in various aspects of protein, fat, and carbohydrate metabolism.</p>	<p>Primary supporting</p>
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<p>m of proteins, carbohydrates and fats</p> <ul style="list-style-type: none"> • Aid/assist/helps protein synthesis in the body 	<p>U.S. Department of Health and Human Services. (2024). Retrieved from National Institute of Health Office of Dietary Supplements website</p>	<p>Vitamin B₁₂</p>	<p>RDA 2.4mcg</p>	<p>NA</p>	<p>Vitamin B12 functions as a cofactor for methionine synthase and L-methylmalonyl-CoA mutase. Methionine synthase catalyses the conversion of homocysteine to methionine. Methionine is required for the formation of S-adenosylmethionine, a universal methyl donor for almost 100 different substrates, including DNA, RNA, hormones, proteins, and lipids. L-methylmalonyl-CoA mutase converts L-methylmalonyl-CoA to succinyl-CoA in the degradation of propionate, an essential biochemical reaction in fat and protein metabolism.</p> <p>Deficiency Typically, vitamin B12 deficiency is treated with vitamin B12 injections, since this method bypasses potential barriers to absorption. However, high doses of oral vitamin B12 may also be effective.</p>	<p>Primary supporting</p>
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	<p>Braun, L., & Cohen, M. (2015). Vitamin B₁₂. In <i>Herbs & Natural Supplements. An evidence-based guide</i> (4th ed., pp. 1091-1101). Chatswood, NSW: Elsevier Australia.</p>	<p>Vitamin B₁₂</p>	<p>RDI 2.4mcg</p>	<p>NA</p>	<p>Main Actions</p> <p>Important cofactor Vitamin B₁₂ is essential for the normal function of all cells. It affects cell growth and replication, the metabolism of carbohydrates, lipids and protein and is involved in fatty acid and nucleic acid synthesis.</p> <p>Antioxidant capacity Recent studies have identified that vitamin B₁₂ and its cobalamin-based derivatives are powerful antioxidants at pharmacological concentrations.</p> <p>Clinical Use Deficiency: treatment and prevention Traditionally, vitamin B₁₂ supplementation has been used to treat deficiency or prevent it in conditions such as pernicious anaemia and atrophic gastritis, but special consideration should be given to the elderly, who are at high risk.</p>	<p>Primary supporting</p>
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	Gaby, A. (2017). Vitamin B ₁₂ . In <i>Nutritional Medicine</i> (2nd ed., pp. 94-100). Concord, NH: Fritz Perlberg Publishing.	Vitamin B ₁₂	RDI 2.4mcg	NA	Biochemistry Vitamin B ₁₂ plays a role in DNA synthesis, red blood cell formation, homocysteine metabolism, and synthesis of S-adenosylmethionine. It is involved in the functioning of the nervous system and immune system.	Primary supporting
	Gropper, S., Smith, J., & Carr, T. (2018). Water soluble vitamins: Vitamin B ₁₂ . In <i>Advanced Nutrition and Human Metabolism</i> (7th ed., pp. 351-358). Boston: Cengage Learning.	Vitamin B ₁₂	RDA 2.4mcg	NA	Functions and Mechanisms of Action Two enzymatic reactions requiring vitamin B12 have been recognized in humans. One of these reactions requires methylcobalamin as a coenzyme for methionine synthase, and the other relies on adenosylcobalamin as a coenzyme for L-methylmalonyl-CoA mutase. These reactions facilitate nutrient metabolism and energy production, as well as indirectly (via interactions with folate) the synthesis of purines and pyrimidines for use in nucleic acids. Two reactions are responsible for converting homocysteine to methionine. One does not require vitamin B12. The other reaction requires methylcobalamin as a coenzyme for methionine synthase (also called homocysteine methyltransferase).	Primary supporting

	Therapeutic Research Center. (2024). Vitamin B ₁₂ . Retrieved from Natural Medicines website	Vitamin B ₁₂	RDA 2.4mcg	NA	Orally, vitamin B12 is used for preventing and treating vitamin B12 deficiency. Effectiveness Administering vitamin B12 orally, intramuscularly, or intranasally is effective for preventing and treating vitamin B12 deficiency. It is commonly believed that only intramuscular vitamin B12 is effective for treating vitamin B12 deficiency. However, clinical research shows that oral therapy is as effective as intramuscular administration. Older adults who take oral vitamin B12 supplements in doses of 25-37.5 mcg daily are more likely to have normal vitamin B12 levels than those who do not take supplements.	Primary supporting
	Association of Naturopathic Practitioners. (2020). Vitamin B ₁₂ . Retrieved from: Herb Drug Nutrient.	Vitamin B ₁₂	RDI 2.4mcg	NA	Vitamin B12 is essential for the synthesis of fatty acids in myelin, normal blood cells and in the synthesis of DNA with folate. Deoxyadenosylcobalamin is essential for the conversion of L-methylmalonyl-CoA to succinyl-CoA which plays a part in energy production from lipids and proteins and in haemoglobin synthesis.	Primary supporting