South Australian Perinatal Practice Guideline

Vitamin D in Pregnancy

Note:

This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this statewide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient's medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

Note: The words woman/women/mother/she/her have been used throughout this guideline as most pregnant and birthing people identify with their birth sex. However, for the purpose of this guideline, these terms include people who do not identify as women or mothers, including those with a non-binary identity. All clinicians should ask the pregnant person what their preferred term is and ensure this is communicated to the healthcare team.

The term Aboriginal is used respectively in this document as an all-encompassing term for Aboriginal and Torres Strait Islander people and culture.

Australian Aboriginal Culture is the oldest living culture in the world yet Aboriginal people continue to experience the poorest health outcomes when compared to non-Aboriginal Australians. In South Australia, Aboriginal women are 2–5 times more likely to die in childbirth and their babies are 2–3 times more likely to be of low birth weight. The accumulative effects of stress, low socio-economic status, exposure to violence, historical trauma, culturally unsafe and discriminatory health services, and health systems are all major contributors to the disparities in Aboriginal maternal and birthing outcomes. Despite these unacceptable statistics, the birth of an Aboriginal baby is a celebration of life and an important cultural event bringing family together in celebration, obligation, and responsibility. The diversity between Aboriginal cultures, language and practices differ greatly and so it is imperative that perinatal services prepare to respectfully manage Aboriginal protocol and provide a culturally positive health care experience for Aboriginal people to ensure the best maternal, neonatal and child health outcomes.

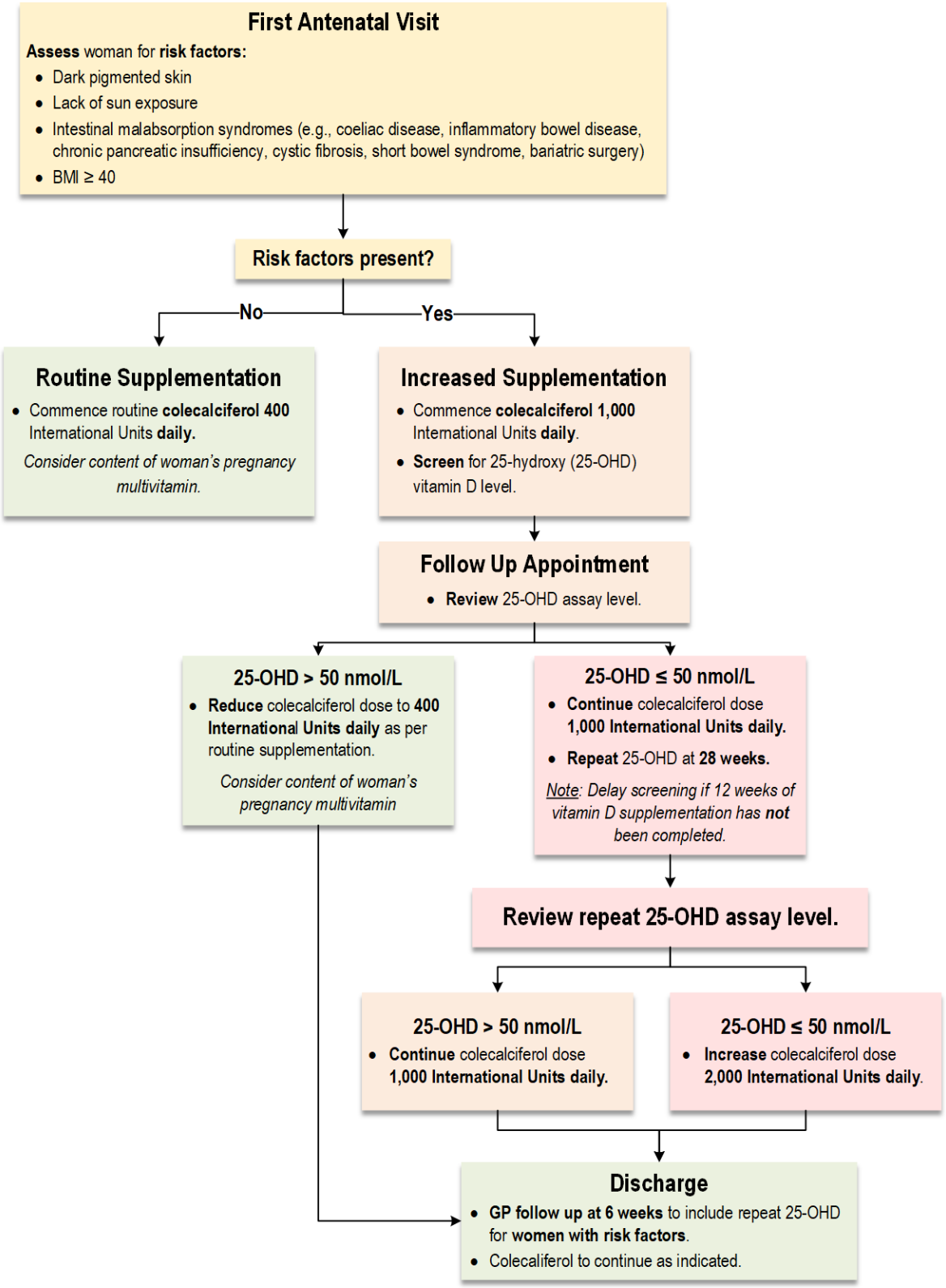
Explanation of the Aboriginal artwork: The Aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the Aboriginal culture. The horseshoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horseshoe shape depicts a pregnant woman. The smaller horseshoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.

Purpose and Scope of PPG

This guideline aims to assist clinicians in the management of women and their newborns who are at risk of, or are found to have, vitamin D insufficiency/deficiency in pregnancy.

Government of South Australia
SA Health

Flowchart 1| Management of Vitamin D Status in Pregnancy



Vitamin D in Pregnancy PPG v5.0 (17/03/2025)

Table of Contents

Summary of Practice Recommendations

Routine screening for vitamin D deficiency in pregnant women is **not** recommended.

Screening for vitamin D deficiency should **only** be considered for women with risk factors (i.e., dark skin, new migrants, women with limited sun exposure (e.g., veil women), BMI > 40).

If levels are below 50 nmol/L, additional supplementation is recommended.

All pregnant women are recommended to take a multivitamin that contains a daily dose of 400 International Units of vitamin D.

Women identified with risk factors for vitamin D deficiency or those with a 25-OHD level < 50 nmol/L are recommended to take 1000 International Units of colecalciferol daily.

All pregnant women should be given information on safe sun exposure and be provided with education on dietary sources of vitamin D in the antenatal period.

Vitamin D supplementation of both breast milk and formula fed babies **with risk factors** is recommended at 400 International Units per day for the first 6–12 months of life.

All women with risk factors and those with identified vitamin D deficiency require a follow-up letter to their GP with a recommendation for a repeat 25-OHD assay at 6 weeks. Vitamin D should be resumed if indicated.

Abbreviations

>	Greater than
≥	Equal to or greater than
<	Less than
≤	Equal to or less than
25-OHD	25-hydroxy vitamin D
AI	Adequate intake
g	Gram(s)
Microg	Microgram(s)
nmol/L	Nanomoles per litre
UV	Ultraviolet
UVB	Ultraviolet B

Definitions

Osteomalacia	A metabolic bone disorder in adults, “softening of the bones”, characterised by insufficient mineralisation of bone tissue; typically, through prolonged deficiency of vitamin D or calcium.
Rickets	A condition that affects bone development in children, causing poor growth, soft bones and a leading cause of bone deformities.
Shared decision making	Shared decision making involves discussion and collaboration between a consumer and their healthcare providers. It is about bringing together the consumer's values, goals, and preferences with the best available evidence about benefits, risks and uncertainties of screening, investigations, and treatment, to reach the most appropriate healthcare decisions for that person.

Literature Review

Current evidence on the associations between vitamin D status during pregnancy and perinatal outcomes are inconsistent. There is a lack of large, robust randomised controlled trials to demonstrate a clear benefit of routine vitamin D supplementation in pregnancy beyond the levels found in most pregnancy multivitamins.

Several small cohort and observational studies have demonstrated that vitamin D deficiency is associated with poor bone health, cancer, heart disease, hypertension, immune system dysfunction, and an increased risks of adverse obstetric outcomes such as preterm birth, preeclampsia, gestational diabetes, and emergency caesarean.[1-4] However these findings are complicated by several confounding factors, including differences in ethnicity, geographical location (spanning both developed and developing countries), the time of year studies were conducted (influencing sun exposure), latitude, baseline health, BMIs of participants, and variability in the assays or thresholds used to define vitamin D deficiency.

A meta-analysis that included 43 trials, with data from over 8400 women, found that while routine supplementation did increase the maternal 25(OH)D serum concentrations, it was not associated with reduced risk of preeclampsia or hypertension.[5] Vitamin D supplementation did however, have a small impact in increasing mean birth weight of neonates, reducing the risk of small-for-gestational-age babies, and lowering the incidence of childhood wheeze.[5] A recent systematic review, on the other hand, found that routine vitamin D supplementation did not improve maternal obstetric outcomes (i.e., preeclampsia, caesarean section) or neonatal outcomes (i.e., gestational age, birth length).[6]

The UK MAVIDOS trial, found no changes to whole body bone mineral content in the neonates at two weeks of age following maternal vitamin D supplementation.[7] However, follow-up at four years of age demonstrated a positive effect on skeletal development, with children showing greater bone mass.[8]

More recently, a Cochrane Review emphasises the crucial role vitamin D plays in maternal health and fetal development, particularly in bone health, immune function, and cell growth.[9] Although strong associations exist between vitamin D deficiency and adverse outcomes such as gestational diabetes, pre-eclampsia, low birth weight, and poor fetal development, the evidence is insufficient to establish causality.[9] Further high-quality randomised controlled trials are needed to refine recommendations for vitamin D supplementation during pregnancy.[9]

Introduction

Vitamin D plays a critical role in musculoskeletal health, with adequate levels needed to prevent and cure nutritional rickets and osteomalacia. It is pivotal in regulating the absorption and metabolism of calcium and phosphate. The predominant source of vitamin D is the synthesis that occurs in the skin through ultraviolet exposure (90%), with dietary intake contributing a lesser amount (10%), primarily from sources such as dairy products, eggs, and fish.[10]

There are two major forms of vitamin D: vitamin D2, found in plants and vitamin D3, produced in the skin. Both vitamin D2 and D3 must go through a process known as enzymatic hydroxylation in the liver and kidneys before they can be utilised by the body.[11]

Vitamin D3 is derived from the synthesis of 7-dehydrocholesterole (found in abundance in the skin), with exposure to Ultra Violet B (UVB) radiation from the sun.[12] It is then metabolised by the liver to produce 25-hydroxyvitamin D ($25(OH)_2D$), a metabolically inactive form. $25(OH)_2D$ is then converted to 1,25-dihydroxyvitamin D ($1,25(OH)_2D$), a metabolically active form, in the kidneys which can then be used by the body.[11, 12] Conversion of 25(OH)D to 1,25(OH)D is done under the influence of parathyroid hormone, phosphate, and calcium levels in the body. $1,25(OH)_2D$ increases the absorption of calcium in the gut, increases bone resorption, while decreasing the excretion of calcium and phosphate through the kidneys.

Dark skin tones have lower levels of vitamin D when compared to lighter skin tones, due to the higher levels of melanin pigment present in dark skins.[13] Melanin pigments absorb UVB radiation, therefore protecting the underlying skin from damage; in turn reducing the amount of UVB available for the synthesis of 7-dehydrocholesterole.[13]

Vitamin D deficiency, i.e., $25(OH)_2D$ levels below 50 nmol/L, can cause a plethora of complications in both adults and children including hypocalcaemia, nutritional rickets, muscle weakness, seizures, and tetany.[4, 14-16]

Sources of Vitamin D

Sun Exposure

Exposure to sunlight remains the predominant method through which the majority of Vitamin D is obtained for most adults in Australia and New Zealand.[17] However, due to the risk of skin malignancies, caution must be taken with prolonged sun exposure.

- The duration required to achieve an effective dose of ultraviolet radiation for vitamin D synthesis varies depending on skin type, the extent of skin exposure, and factors affecting UV radiation intensity, such as geographic location, season, and time of day.[17]
- Outdoor sun exposure can provide an adequate dose of vitamin D, provided the exposure occurs between 8 a.m. and 5 p.m. and sufficient skin is exposed.[17]
  - For most individuals, less than 10 minutes outdoors with 35% of their body surface area exposed is adequate.[17]
- For many individuals, adequate levels of vitamin D synthesis can be readily achieved through incidental sun exposure.[17]

***Note**: Awareness of the UV index and recommended sun protection times is essential for guiding safe sun exposure practices. Vitamin D synthesis in the skin is not a continuous process. Prolonged outdoor exposure elevates the risk of skin cancer without providing additional benefits for vitamin D production.*

Dietary Sources

Approximately 10% of vitamin D needs will be met from food sources alone, as part of a well-balanced diet.[18] The most common food sources of vitamin D include:

- Oily fish (e.g., salmon, tuna, herring, mackerel and sardines)
- Lean red meat
- Milk
- Eggs
- Fortified margarines

***Note**: Food sources alone are not adequate in obtaining sufficient vitamin D levels.[17]*

Supplementation

- Expert consensus recommends routine Vitamin D supplementation of 400 International Units per day (or 10 microg per day) of 25(OH)D during pregnancy and lactation.
- Exclusively breastfed infants should be supplemented with 400 International Units per day (or 10 microg per day)[19]

Vitamin D Level Classifications

Definitions of vitamin D sufficiency differ, but in Australia, levels below 50 nmol/L are typically regarded as suboptimal.[20]

Vitamin D status can be defined based on the below levels of $25(OH)_2D$:[21]

Sufficiency > 50 nmol/L
Insufficiency 30–50 nmol/L[20]
Deficiency < 30 nmol/L

Risk Factors for Vitamin D Deficiency

Risk factors for Vitamin D deficiency have been established in the literature.[9, 23]

- Dark pigmented skin.
- Lack of sun exposure (for cultural, medical, occupational, seasonal or residential reasons)
- Intestinal malabsorption syndromes (e.g., coeliac disease, inflammatory bowel disease, chronic pancreatic insufficiency, cystic fibrosis, short bowel syndrome, bariatric surgery).
- BMI > 40.

Screening for Vitamin D Deficiency

- Routine screening for vitamin D deficiency in pregnancy is **not** recommended in the absence of risk factors.[16, 20, 23]
  - Universal screening increases healthcare costs compared to universal vitamin D supplementation.
- Consider vitamin D screening levels in those with risk factors.
- If risk factors are present, request blood 25-hydroxy vitamin D (25-OHD) level.
  - If testing is performed, additional supplementation to be recommended for vitamin D levels < 50 nmol/L.[23]
  - If vitamin D levels < 50 nmol/L, repeat blood 25-hydroxy vitamin D (25-OHD) level at 28 weeks gestation.
  - Serum 25OH-D is the best marker for clinical assessment of an individual's vitamin D status, as it has a longer half-life than $1,25(OH)_2D$; 2–3 weeks compared to 4–6 hours, respectively.[12, 24, 23]
  - Serum 25OH-D levels should **not** be retested earlier than 3 months following commencement of supplementation with vitamin D or change in dose.[23]

Vitamin D Supplementation

Inconsistencies in national and international recommendations for supplementation and optimal doses has been identified. Expert consensus recommends the following:

- **All** pregnant women are recommended to take 400 International Units per day of colecalciferol while pregnant and breast feeding
  - For example: 0.2 ml Ostelin Vitamin D Liquid® (1,000 International Units/0.5 ml) or, half tablet of OsteVit-D® (equivalent to 500 International Units) (which may be purchased from a community pharmacy without a prescription).[25, 26]
  - This should be continued throughout pregnancy and lactation.

***Note**: This could be as part of a combined pregnancy multivitamin (See Table 1).*

- Women identified with risk factors for vitamin D deficiency or those with a 25-OHD level < 50 nmol/L are recommended to take 1000 International Units per day of colecalciferol daily.
  - If repeat 25OHD level at 28 weeks gestation is ≤ 50 nmol/L, supplementation dose should be increased 2,000 International Units per day.[9]

***Note**: Daily, lower-dose supplementation is recommended over non-daily, higher doses, however less frequent dosing may be more accessible for some individuals and may increase adherence.[16]In such cases, a maximum dose of 4000 International Units is accepted based on the risk of hypercalcaemia, hypercalciuria and suppressed parathyroid functions at higher doses.[9, 27]*

Important: Vitamin D supplementation > 250 microg/day or 10,000 International Units can lead to hypercalcaemia and is associated with suppressed parathyroid function and hypercalciuria.

Table 1: Vitamin D content in common multivitamin brands

Multivitamin Brand	Cholecalciferol D3
Ostelin Vitamin D3®	1000 International Units (25 microg)
Blackmores Pregnancy and Breastfeeding Gold®	500 International Units (12.5 microg)
Swiss Ultinatal Pre Conception & Pregnancy®	500 International Units (12.5 microg)
Elevit®	200 International Units (5 microg)
Natalis®	200 International Units (5 microg)

Discharge Considerations

All women with risk factors and those with identified vitamin D deficiency in pregnancy require a follow-up letter to their GP which includes a recommendation for repeat 25-OHD assay at 6 weeks postpartum. Vitamin D should be resumed where indicated.

***Note**: Women who are breastfeeding should continue supplementation.*

Neonatal Management

Universal supplementation of infants with vitamin D is recommended in global consensus guidelines, particularly for infants and children who may be at higher risk due to limited sun exposure or those with darker skin pigmentation.[25, 28] However, Australian and New Zealand guidelines recommend targeted supplementation of infants with risk factors.[26] Further studies are required to confirm whether universal supplementation will reduce the risk of nutritional rickets in Australia and New Zealand.

The following considerations are the basis for recommendations for neonatal supplementation, taking into account published recommendations and an approach to protocol implementation that optimises adherence and minimises harm. See Appendix 3 for information for parents.

- In the absence of maternal risk factors, babies do not need routine vitamin D supplementation.
- Supplementation of both breast milk and formula fed babies **with risk factors** increases the simplicity of the protocol and may reduce a maternal perception that breast milk is inadequate.
  - Daily vitamin D intake from breastmilk and formula is unlikely to meet the recommended adequate intake (AI) (400 International Units, assuming minimal sun exposure);
- Sunlight exposure in babies needs to balance risks of skin damage with the benefit of vitamin D synthesis and no firm recommendations can be made.

Vitamin D supplementation in neonates is indicated for the following:

- Prevention of vitamin D deficiency in babies with risk factors
- Prevention of rickets and osteomalacia
  - Preterm neonates < 34 weeks gestation or weighing < 2000 grams.
  - Term or late preterm neonates (34^{+0} – 36^{+6} weeks) born to mothers who:
    - had vitamin D levels ≤ 50 nmol/L at booking or 28 weeks (whichever is later)
    - had little or no antenatal care
    - are veiled, darker skinned or newly arrived refugee (even if vitamin D > 50 nmol/L and receiving routine supplementation during pregnancy).
- Prevention of vitamin D deficiency with cholestasis or fat malabsorption
- Treatment of documented vitamin D deficiency, and vitamin D deficient osteomalacia or rickets
  - For term infants, refer to *Vitamin D Deficiency in Children* SA Paediatric Clinical Practice Guideline in the A-to-Z listing found at www.sahealth.sa.gov.au/paediatric.
- See *Colecalciferol* SA Neonatal Medication Guideline for dosing recommendations in the A-to-Z listing found at www.sahealth.sa.gov.au/neonatal.

Resources

SAPPGs Web-based App:
Practice Guidelines (sahealth.sa.gov.au)

Medicines Information: (sahealthlibrary.sa.gov.au)
https://sahealthlibrary.sa.gov.au/friendly.php?s=SAPharmacy

SA Health Pregnancy:
Pregnancy | SA Health

Australian Government Pregnancy, Birth and Baby: (www.pregnancybirthbaby.org.au)
Pregnancy, Birth and Baby | Pregnancy Birth and Baby (pregnancybirthbaby.org.au)

Pathology Tests Explained: (https://pathologytestsexplained.org.au/)
Pathology Tests Explained

Cancer Council
https://cancer.org.au/cancer-information/causes-and-prevention/sun-safety
https://cancer.org.au/cancer-information/causes-and-prevention/sun-safety/vitamin-d

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Fact Sheet

Routine Vitamin D Supplementation in Pregnancy

About Vitamin D

Vitamin D is needed to keep bones healthy and strong.

- Most (90%) vitamin D comes from exposing your skin to the sun. A balance of sun exposure and sun protection is needed to make enough Vitamin D.
- Some (10%) vitamin D comes from food such as oily fish, meat, milk, and eggs.

What happens if you do not have enough vitamin D?

Many people with low vitamin D do not have symptoms. Vitamin D deficiency can cause:

- Rickets (soft bones) in children
- Muscle cramps
- Seizures (fits) due to low calcium

Low vitamin D may be linked to other health problems such as: a higher risk of bowel cancer, heart disease, problems with immunity (how the body fights infections) and autoimmune diseases (e.g. diabetes).

Vitamin D Supplementation

Routine supplementation with Vitamin D (400 units/day) is recommended for all pregnant women.

This can be achieved by a vitamin D supplement which may be purchased from a community pharmacy without a prescription. For example:

- 0.2 ml Ostelin Vitamin D Liquid® (1,000 units/0.5 ml) or
- half tablet of OsteVit-D® (equivalent to 500 units)

If you are already taking a pregnancy multivitamin be aware that the vitamin D dose varies so you may need additional vitamin D supplementation. For more information, please discuss this with your pregnancy healthcare provider.

The vitamin D content of commonly used pregnancy multivitamins is as follows:

- Blackmores Pregnancy & Breastfeeding Gold
  - 500 units per capsule = 1000 units/day (i.e. 2 tabs)
- Elevit Pregnancy Multivitamin
  - 200 units per tablet = 200 units/day
- Swisse Pregnancy + Ultivite
  - 600 units per capsule = 600 units/day

Resources

1. Well for Life: https://betterhealth.vic.gov.au/health/HealthyLiving/vitamin-d
2. NHMRC Nutrient Reference Values for Australia and NZ Vitamin D: https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/vitamin-d

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For more information, please speak to your midwife or doctor.

Vitamin D Supplementation in Pregnancy Fact Sheet

Maternal, Neonatal and Gynaecology Strategic Executive Leadership Committee
South Australian Perinatal Practice Guidelines
SA Health

www.sahealth.sa.gov.au

Fact Sheet

Vitamin D Insufficiency/Deficiency in Pregnancy

About Vitamin D

Vitamin D is needed to keep bones healthy and strong.

- Most (90%) vitamin D comes from exposing your skin to the sun. A balance of sun exposure and sun protection is needed to make enough Vitamin D.
- Some (10%) vitamin D comes from food such as oily fish, meat, milk, and eggs.

What happens if you do not have enough vitamin D?

Many people with low vitamin D do not have symptoms. Vitamin D deficiency can cause:

- Rickets (soft bones) in children
- Muscle cramps
- Seizures (fits) due to low calcium

Low vitamin D may be linked to other health problems such as: a higher risk of bowel cancer, heart disease, problems with immunity (how the body fights infections) and autoimmune diseases (e.g. diabetes).

Vitamin D Supplementation

Supplementation with vitamin D (1000 units) is recommended for women with risk factors or whose vitamin D level is known to be low.

This can be achieved by a vitamin D supplement which may be purchased from a community pharmacy without a prescription. For example:

- 0.5mL Ostelin Vitamin D Liquid® (1,000 units/0.5mL) or
- One tablet of OsteVit-D® (1,000 units) or
- One capsule of Ostelin Vitamin D (1,000 units)

You may be taking a pregnancy multivitamin already; however, the vitamin D dose varies so you may need additional supplementation. For more information, please discuss this with your pregnancy healthcare provider.

The vitamin D content of commonly used pregnancy multivitamins is as follows:

- Blackmores Pregnancy & Breastfeeding Gold
  - 500 units per capsule = 1000 units/day (i.e. 2 tablets)
- Elevit Pregnancy Multivitamin
  - 200 units per tablet = 200 units/day
- Swisse Pregnancy + Ultivite
  - 600 units per capsule = 600 units/day

Resources

1. Well for Life: https://betterhealth.vic.gov.au/health/HealthyLiving/vitamin-d
2. NHMRC Nutrient Reference Values for Australia and NZ Vitamin D: https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/vitamin-d

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For more information, please speak to your midwife or doctor.

Maternal, Neonatal and Gynaecology Strategic Executive Leadership Committee
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Fact Sheet

Vitamin D Deficiency in Babies

About Vitamin D

Vitamin D is needed to keep bones healthy and strong.

- Most (90%) vitamin D comes from exposing your skin to the sun. A balance of sun exposure and sun protection is needed to make enough Vitamin D.
- Some (10%) vitamin D comes from food such as oily fish, meat, milk, and eggs.

What happens if you do not have enough vitamin D?

Many people with low vitamin D do not have symptoms. Vitamin D deficiency can cause:

- Rickets (soft bones) in children
- Muscle cramps
- Seizures (fits) due to low calcium

Low vitamin D may be linked to other health problems such as: a higher risk of bowel cancer, heart disease, problems with immunity (how the body fights infections) and autoimmune diseases (e.g. diabetes).

Breast Feeding

Breast feeding is the best way to feed your baby. Breast feeding is important for your baby's health and well-being. You can continue to breast feed your baby if your vitamin D level is low.

Vitamin D Supplementation for Babies

All breastfed and formula fed babies born to mothers who have had persistently low vitamin D levels in pregnancy or who are at risk of vitamin D deficiency (e.g. due to darker skin colour, veiled), should be given a 400 units/day vitamin D supplement for the first 12 months of life.

The preparations used in SA hospitals are Ostelin Vitamin D Liquid® (1,000units/0.5mL) and Penta-vite Infant Drops®.

Ostelin Vitamin D Liquid (1,000 units/0.5 mL)

Ostelin Vitamin D Liquid® contains vitamin D. The dose is 0.2mL/day, and it is the preferred vitamin D liquid in term babies as it tastes better than Penta-vite Infant Drops®. You can buy a bottle of Ostelin Vitamin D Liquid® from your local chemist.

Penta-vite Infant Drops

Penta-vite Infant Drops® contain vitamins A, B1, B2, B3, B6, C and D. The dose is 0.45 mL/day. You can buy a bottle of Penta-vite Infant Drops® from your local chemist.

Further Information

Speak with your GP (General Practitioner) if you have any questions about your or your baby's Vitamin D levels.

Resources

1. Well for Life: https://betterhealth.vic.gov.au/health/HealthyLiving/vitamin-d
2. NHMRC Nutrient Reference Values for Australia and NZ Vitamin D: https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/vitamin-d

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For more information, please speak to your midwife or doctor.

Maternal, Neonatal and Gynaecology Strategic Executive Leadership Committee
South Australian Perinatal Practice Guidelines
SA Health

www.sahealth.sa.gov.au

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