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Importance of Vitamin D in the antenatal period for maternal wellbeing

Abstract

Vitamin D deficiency is widely recognised as a major public health issue around the world; and is essential for optimal development and strengthening of the musculoskeletal system including the prevention of conditions such as osteoporosis, osteopenia and rickets. The association between Vitamin D and childhood rickets has led to the fortification of food sources and consequently the eradication of the rickets disease. Vitamin D levels are of particular importance for pregnant women especially for the development of the bone and muscle development of the fetus. In the last decade there has been a substantial increase in the incidence of Vitamin D deficiency and the re-emergence of the childhood rickets disease. It is vital that Vitamin D levels are at optimal levels during pregnancy as maternal calcium demands increase significantly to meet the demands of the developing fetus, especially in the third trimester.

Keywords: Vitamin D, Pregnancy, Antenatal, Maternal; Well-being

Introduction

The best source of Vitamin D is exposure to natural sunlight, and 90% of Vitamin D is derived from sunlight with 10% derived from food and plant sources (Cannell, 2019; Paxton et al., 2013). Approximately 1 in 5 people have low vitamin D levels (defined as serum levels below 25 nmol/L) in the United Kingdom (UK). Recent statistics reveal that Vitamin D deficiency affects the population as follows: 19% aged 4-10 years old, 37% 11-18 years old, 29% 19-64 years old, and 27% for people aged 65 years and older (NDNS, 2019). There is sufficient research to support a correlation between certain risk factors and Vitamin D deficiency; including lack of exposure to sunlight, darker skin pigmentation, increased body mass index and certain ethnic groups which involves the wearing of cultural garments (Fallon, Lanham-New, Williams, & Ray, 2020; Paxton et al., 2013).

Vitamin D screening and supplementation during pregnancy has generated significant interest in the last decade and is currently a topic of ongoing debate. According to current guidelines by The Royal College of Obstetricians and Gynaecologists (2014) antenatal screening for Vitamin D levels is not advised universally and only recommended for women at high risk of Vitamin D deficiency. The guidelines further recommend against routine Vitamin D supplementation; and state that supplementation should be reserved for pregnant women who are found to have Vitamin D serum levels below 50nmol (Royal College of Obstetricians and Gynaecologists, 2014). However there is ongoing dispute regarding Vitamin D screening in pregnancy and routine Vitamin D supplementation (De Laine, Matthews, & Grivell, 2013; Roth et al., 2017); with an argument for universal Vitamin D serum screening, as opposed to the argument that Vitamin D supplementation should be recommended for all pregnant women (Davies-Tuck et al., 2015).

Discussion

Vitamin D is an essential fat-soluble vitamin which plays an important role in the absorption of calcium and phosphorus; which are vital for optimal bone and muscle health (Hasanpour Dehkordi, 2018). In addition to the well-established muscle and skeletal benefits of vitamin D, there is emerging evidence to support that Vitamin D is effective in reducing the risk of illness such as diabetes and cardiovascular heart disease; as well as enhancing immune function and protecting against certain forms of cancers (Wimalawansa, 2018a, 2018b).

Vitamin D comprises of two active forms; Vitamin D2 and D3. Vitamin D2 otherwise known as ergocalciferol is derived from natural plant and food sources; whereas Vitamin D3 known as cholecalciferol is synthesised from exposure to ultraviolet light B radiation (De-Regil, Palacios, Lombardo, & Peña-Rosas, 2016). Both active forms of Vitamin D are metabolised by the liver to produce 25 hydroxy Vitamin D (25 (OH) D) which is then converted by the kidneys into calcitriol (De-Regil et al., 2016). The majority of Vitamin D is synthesised from exposure to sunlight; with approximately 10% of Vitamin D requirements derived from food sources such as oily fish, fortified dairy products, fortified breakfast cereals and eggs (Fischer, 2020).

Risk factors for Vitamin D deficiency

There are several risk factors which have been linked to increased incidence of Vitamin D deficiency; many of the risk factors relate to reduced synthesis of Vitamin D from lack of exposure to sunlight. Risk factors for Vitamin D deficiency include women whom have limited exposure to sunlight for behavioural reasons including those working indoors, nightshift workers and those whom are predominately housebound (Aji, Erwinda, Yusrawati,

Malik, & Lipoeto, 2019). Moreover it is well documented that latitude and season have a significant influence on Vitamin D deficiency around the world; with a higher prevalence of Vitamin D deficiency in temperate zones in comparison to tropical zones; and during the winter months (Griffiths, 2020).

Many cultural factors influence Vitamin D levels, and it is widely accepted that women from ethnic backgrounds who have darker skin have a higher prevalence of Vitamin D deficiency (Richard, Rohrmann, & Quack Lötscher, 2017). Women with darker skin have increased melanin pigment in their skin which protects against ultraviolet light exposure and inhibits synthesis of Vitamin D; therefore women with darker skin require three to six times more exposure to sunlight to achieve optimal Vitamin D synthesis, in comparison to women with fairer skin (Mitchell et al., 2019).

Women with darker skin including those from South East Asia, Middle East and Africa are associated with higher prevalence of Vitamin D deficiency; of up to 80% (Davies-Tuck et al., 2015). Furthermore, women who don covering garments and veils as part of cultural or religious practices are also at significant increased risk of Vitamin D deficiency during pregnancy (Al-Yatama, AlOtaibi, Al-Bader, & Al-Shoumer, 2019). Significant evidence also supports that Vitamin D deficiency is higher amongst women from Indigenous backgrounds around the world including Native Americans; Native Canadians, Maori, Pacific Islanders and Australian Aboriginals (Malacova et al., 2019; Naqvi et al., 2017; O'Brien, Grivell, & Dodd, 2016; Porter, Wechsler, Hime, & Naschold, 2019).

There are many physical factors and health conditions that are associated with increased risk of Vitamin D deficiency. There is significant evidence to support a correlation between obesity and Vitamin D deficiency; synthesised Vitamin D being stored in adipose tissue and

reducing its bioavailability (Carrelli et al., 2017). In addition, certain conditions such as kidney disease, liver failure and intestinal malabsorption and medications (anti-retroviral and anti-epileptic), affect the synthesis and absorption of Vitamin D and are associated with increased risk of Vitamin D deficiency (Magro & Borg, 2017; Weinert & Silveiro, 2015). There is also evidence to suggest a link between lifestyle behaviours such as smoking, alcohol and inactivity to Vitamin D deficiency (Skaaby et al., 2016). Therefore, it is important that midwives have sound knowledge of the various risk factors associated with Vitamin D deficiency and ensure thorough screening of women during the antenatal period.

Current research and guidelines regarding Vitamin D in Pregnancy

There has been a significant increase in interest regarding Vitamin D in pregnancy, with a current lack of consensus around the world regarding Vitamin D screening and supplementation during pregnancy (Davies-Tuck et al., 2015). There is also much debate regarding optimal ranges for Vitamin D and what qualifies as Vitamin D deficiency. The currently available guidelines by the World Health Organisation (World Health Organisation, 2016) state that there is limited evidence to support routine supplementation of Vitamin D during pregnancy and in the prevention of maternal and fetal adverse effects. The guidelines by The Royal College of Obstetricians and Gynaecologists (2014) further support the argument that routine screening of Vitamin D levels of pregnant women is not recommended; based on the lack of perceived benefits and cost effectiveness, and recommend that women take 400iu (10mcg) of Vitamin D during pregnancy as part of their daily prenatal multivitamin supplement.

There are conflicting views and evidence regarding the recommendation of routine Vitamin D supplementation during pregnancy. There is evidence from randomised controlled trials

that argues that Vitamin D supplementation during pregnancy is safe and effective in achieving optimal Vitamin D levels and preventing against maternal and fetal adverse health effects (Divakar, Singh, Narayanan, & Divakar, 2018; Mir et al., 2016).

Impact of Vitamin D deficiency on maternal and fetal health

In recent years there has been a significant increase in research regarding Vitamin D in pregnancy and the associated maternal adverse effects. Vitamin D is well known for its effects in the body in regulation bone and muscle health however, there is also evidence to support that Vitamin D plays a role in increasing insulin sensitivity and responsiveness; thus improving the metabolism and transport of glucose (Tang et al., 2018). Therefore, there is mounting evidence to support that Vitamin D deficiency in pregnancy is associated with an increased risk of gestational diabetes (Shao et al., 2019).

Growing evidence suggests that low levels of maternal serum Vitamin D are associated with increased onset of anxiety and depressive disorders (Shah & Gurbani, 2019). A recent study (Aghajafari, Letourneau, Mahinpey, Cosic, & Giesbrecht, 2018) identified that low Vitamin D levels during the first 18 weeks of gestation was associated with increased risk of onset of mood disturbance and depressive symptoms in the antenatal and postnatal periods.

For the last century it has been well established that maternal Vitamin D deficiency has adverse effects on the growth and development of the fetus (Wagner & Hollis, 2018). One of the most well-known adverse effects associated with low maternal Vitamin D during pregnancy is the condition Vitamin D deficient rickets; which involves abnormal bone growth and growth plate mineralisation. There have also been some significant studies

linking Small for Gestational Age (SGA) neonates with maternal Vitamin D deficiency (Chen, Zhu, Wu, Li, & Tao, 2017; Wang, Xiao, Zhang, & Gao, 2018).

Vitamin D supplementation

In regard to Vitamin D supplementation, there is evidence to suggest that problems may arise due to patient compliance and adherence with supplementation therapy (Patil, Tripathi, & Shah, 2018), and this implies that noncompliance to supplementation therapy could be the cause of inadequate levels. It is suggested that many pregnant women may be incompliant with Vitamin D supplements due to concerns of side effects, optimal doses and the risk of overdose, and women have also cited factors such as frequency, taste and preparation of Vitamin D supplements may also contribute to nonadherence (Bonevski, Bryant, Lambert, Brozek, & Rock, 2013). In addition to noncompliance there are concerns regarding overdosing of Vitamin D supplements in pregnancy; leading to Vitamin D toxicity. Vitamin D toxicity is associated with symptoms such as weight loss, polyuria, arrhythmias and anorexia; and a worse-case scenario being multi organ failure (Sanders & Lamb, 2015).

Therefore, it is vital that midwives are aware of the potential issues with compliance of Vitamin D supplementation during pregnancy. Providing pregnant women with practical solutions and advice to enhance compliance to supplementation is essential, such as smart phone apps, daily alarms/reminders and combining supplementation with routine activities i.e. before or after brushing teeth. In addition, health professionals should ensure that women are provided with adequate education on the dosage of Vitamin D supplements as per national guidelines; to reduce the likelihood of Vitamin D overdose and toxicity.

Conclusion

Vitamin D deficiency is a significant public health concern worldwide. Vitamin D is of particular importance for women during pregnancy; for there is ample evidence to support that Vitamin D deficiency is associated with many significant maternal and fetal adverse effects. Risk factors associated with vitamin D deficiency include limited sun exposure, obesity, ethnicity and various medical conditions that disrupt synthesis of Vitamin D. Some of the maternal adverse effects include an increased risk of gestational diabetes, low birth weight, preterm birth, postnatal depression. Moreover, there is evidence that maternal Vitamin D deficiency is associated with adverse effects in the development of children which include rickets, asthma, diabetes, eczema and impaired brain development. It is vital that women maintain adequate levels of Vitamin D during pregnancy to ensure optimal maternal and fetal wellbeing.

Key Points:

- Vitamin D is of particular importance for women during pregnancy; there is evidence to support that Vitamin D deficiency is associated with many significant maternal and fetal adverse effects
- It is important that midwives can identify women at risk of Vitamin D deficiency and initiate required screening; and provide appropriate education
- It is vital that women maintain adequate levels of Vitamin D during pregnancy to ensure optimal maternal and fetal wellbeing

CPD Questions:

- What the prevalence of Vitamin D deficiency in pregnant women in the UK?
- Vitamin D deficiency is a growing epidemic in the UK, how can midwives provide an opportunity to provide health promotion on Vitamin D?
- What are the best sources of Vitamin D?

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