Time to focus on the burden of Vitamin D deficiency on pregnant women of BAME origin in the UK

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Introduction

Vitamin D deficiency has been recognised as a common global health issue for several decades. A significant proportion of the world's population is either vitamin D deficient or insufficient (vit D level <25 nmol/L or between 25-30nmol/L respectively) mainly due to inadequate exposure to natural ultra-violet B (UVB) radiation from sunlight and a relatively low supply of foods rich in vitamin D.

In the UK, approximately 50 percent of all pregnant and breastfeeding women, including teenagers and young women, are at risk for vitamin D deficiency[1]. The pregnant women of BAME (Black and Asian Minority Ethnic) group disproportionately are at greater risk of vitamin D deficiency compared with Caucasian women[2]. These women are 'at risk' for a number of adverse pregnancy outcomes including pre-eclampsia, gestational diabetes, preterm birth and small for gestational age (SGA) babies and babies born with impaired bone growth or in severe cases rickets (congenital or infantile) and the development of childhood allergy[3, 4, 5]. Recent Cochrane review provided further evidence of an association between vitamin D deficiency and adverse pregnancy outcomes[6]. The RCOG Scientific Impact Paper No. 43 has discussed the role of vitamin D supplementation in pregnancy[3]. In the UK, Public health guidance has aimed to identify and prevent vitamin D deficiency in 'at risk' populations and has recommended vitamin D supplementation for these high-risk groups[1,7]. The latest UKOSS interim report has suggested that pregnant women of BAME origin are at increased risk of COVID-19 infection, raising the possibility of an association between vitamin D deficiency and severity of COVID-19 in these groups[8]. The research evidence from the USA also has raised the possibility of a link between vitamin D deficiency and the severity of COVID-19 suggesting the potential role of vitamin D in the prevention and treatment of at 'high risk' pregnant women with COVID -19[9].

Prevalence of vitamin D deficiency

It is estimated that in the UK, the prevalence of vitamin D deficiency in all adults is around 14.5%. This may be as high as 94% in otherwise healthy south Asian adults (male and female) [3]. A recent study in the UK has shown that over 25% of females are vitamin D deficient10.

In the UK, vitamin D deficiency is 3 times more common in the winter and spring compared to the summer and autumn due to inadequate exposure to sunshine when UVB level is low[3,11]. The DOH in the UK has recognised that a significant proportion of people in the UK probably are either vitamin D deficient or insufficient due to relatively low levels of sunshine and British diets being deficient in vitamin D. The prevalence of vitamin D deficiency is high in pregnant and lactating women of South Asia, Middle East, Africa and Caribbean ethnic origin living in countries located at latitudes higher than 35 including the United Kingdom where a high prevalence of vitamin D deficiency (vitamin D levels less than 25 nmol/L) has been reported among pregnant women of BAME groups with approximately 50% of Indian Asian women, 64 % middle eastern women, 58% Africa-Caribbean compared to 13% of Caucasian pregnant women[12]. A significant difference in the vitamin D levels between Asian and Caucasians groups has been reported during different seasons during the winter; 54% Asian pregnant women compared to 3.3% of Caucasian pregnant women were vitamin D deficient. During the summer, 38% of the Asians were still vitamin D deficient.

A high prevalence of vitamin D deficiency has been reported among pregnant women of BAME origin of lower socio-economic class. Obesity in pregnant women of BAME group has also been associated with vitamin D deficiency. In one study, over 60 percent women with a BMI over 30 were found to be vitamin D deficient compared to 36 percent of women with BMI less than 25[13].

Causes of vitamin D deficiency

Vitamin D deficiency is a multifactorial condition where the levels of vitamin D are determined by a combination of factors which influence vitamin D synthesis in the skin, such as latitude, skin pigmentation, dietary intake, food fortification and use of supplements in addition to various disease and genetics. The main source of vitamin D (sometimes called 'Sunshine' vitamin) in adults is formed in the skin. Exposure to solar ultraviolet B radiation at wave length 280-315nm facilitates synthesis of vitamin D on exposed skin between mid-October till April, in the UK. It is estimated that half an hour of sunlight exposure delivers 50 000 IU of vitamin D in non-pigmented skin. Dietary intake of vitamin D makes a relatively small contribution to overall vitamin D needs. Individual risk is increased mainly by a diet with insufficient vitamin D in association with inadequate sun exposure, cultural and religious and lifestyle factors, skin pigmentation, individual variations in increased vitamin D metabolism.

Insufficient exposure to sunlight: In the UK, the most common cause of vitamin D deficiency is insufficient exposure to sunlight. The amount of vitamin D synthesized in the skin is dependent on skin exposure to solar UVB radiation[11]. Because the UK is located at latitude of above 35 degrees, solar UVB radiation is low due to the reduced level of sunshine it receives during the winter months (November and February). During this time, the angle of the sun is so oblique that latitudes greater than 35-degrees receive almost no ultraviolet rays capable of stimulating vitamin D3 synthesis. This leads to the UK population being at greater risk of vitamin D deficiency. Even during the summer months (between March and October), when solar UVB levels are highest during the middle of the day (between 11am and 3pm), effective UV radiation (60%) level is still insufficient as reduced by cloudy weather. Vitamin D deficiency is 3 times more common during the winter than the summer months. Cultural habit of dressing and heavy sunscreen use can significantly reduce skin expose to sunlight increasing the risk of vitamin D deficiency[11].

Diminished efficiency of cutaneous synthesis of vitamin D: The efficiency of cutaneous synthesis of vitamin D can be affected by the presence of excess melanin pigment which absorbs a proportion of the UVB radiation needed for cutaneous synthesis. In women of BAME origin, high levels of epidermal melanin compete with 7-dehydroxy cholesterol for UVB photons in insufficient sunlight. This reduces the efficiency of vitamin D synthesis[14] and cholecalciferol production significantly by approximately 90%12. The Scientific Advisory Committee on Nutrition in the report 'Vitamin D and Health' has identified BAME origin people with darker skin to be at higher risk of vitamin D deficiency[11].

Inadequate dietary and supplements: Reduced dietary intake of foods containing vitamin D such as oily fish, eggs, red meat, mushrooms (natural D2), fortified fat spread, fortified foods and breakfast cereals can lead to deficiency. The Western diet and poor eating habits are also largely to blame for the deficiency leading to decline of vitamin D status.

Impaired absorption of vitamin D: Intestinal malabsorption syndromes such as coeliac disease, cystic fibrosis and Crohn's disease can impair the absorption of dietary vitamin D leading to decreased bio-availability of vitamin D. Altered vitamin D metabolism caused by increased 25 OHD, 24 hydroxylase activity may cause low 25-OH D3 concentration in BAME (Asian) people.

Impaired activation of Vitamin D: Chronic renal disease or renal failure impairs the production of 1,25-dihydroxyvitamin D. Liver disease can also impair the activation of vitamin D.

Obesity (BMI>30): Fat soluble vitamin D has the potential readily to be stored in the adipose tissue compartment of the body leading to a reduced level of bio-available vitamin D.

Drug interactions: Drugs that reduce fat absorption e.g. Oristat can lead to decreased bioavailability of vitamin D. A number of antiepileptic drugs (Carbamazepine, Phenobarbital, and Phenytoin), Cholestyramine, Rifampicin, Corticosteroid and active antiretroviral treatment (HAART) can actively destroy vitamin D by activating catabolism of 25, OHD and 1,25 OH2D.

Genetic: A genetic influence to vitamin D deficiency has been suggested, however its true role is unclear at this time.

Diagnosis of vitamin D deficiency

Diagnosis of vitamin D deficiency can be achieved by a blood test to assess the levels of serum 25-hydroxyvitamin D. 25-hydroxyvitamin D (25-OHD), the specific metabolite of two distinct forms of vitamin D, vitamin D2 (Ergocalciferol) and D3 (Cholecalciferol), is the circulating vitamin D in the body and is measured to determine vitamin D status. The measures of blood levels, which reflect both dietary intake as well as synthesis from exposure to the sun, are considered to be an accurate representation of the vitamin D status of an individual. Although there is no international consensus on the threshold serum 25-hydroxyvitamin D (25-OHD) concentration used to define vitamin D deficiency in adults, the Institute of Medicine (IOM) in the UK in agreement with the ROS, proposed the following threshold in respect to the bone health[15]:

Deficient: .....25-OHD levels less than 30 nmol/L
.....(DOH, UK: less than 25nmol/L),
Insufficient (inadequate): .....30-50 nmol/L
Sufficient:.....Over 50 nmol/L

These thresholds, which are suitable to define vitamin D deficiency in general population in the UK, have identified 27% of the population with insufficient or deficient levels of Vitamin D, 74% with levels below the optimum levels of wellbeing. On average, women have a slightly lower level than men at 68 nmol/L. When interpreting 25-OHD concentrations in dark-skinned people living in the UK, it is important to consider the seasonal variations in vitamin D synthesis, as the winter season is associated with lower serum 25-OHD concentration and an individual classified as deficient in one month may not be deficient year-round and vice-versa[16].

Consequences of maternal vitamin D deficiency

During pregnancy 25-OH vitamin D diffuses across the placenta to support the needs of the growing foetus who relies entirely on the vitamin D stores of the mother with maternal vitamin D deficiency increasing the risk of neonatal vitamin D deficiency[13]. It has been suggested that vitamin D affects transcription and function of the genes responsible for trophoblast invasion and angiogenesis, two factors critical for placental development. Vitamin D deficiency may predispose to abnormal trophoblast invasion, reduced placental perfusion, an increased inflammatory response and subsequent cascade of events resulting in various negative pregnancy outcomes[5]. In combination with its immunomodulatory and anti-inflammatory properties, vitamin D may play a role in the prevention of preterm birth and small for gestational age neonates.

The RCOG UK published Scientific Impact Paper (No.43) on vitamin D in pregnancy[3, 17] has provided evidence of association between vitamin D deficiency and adverse maternal and neonatal outcomes, which has been shown in Table 1.

Some of the adverse consequences of vitamin D deficiency for the mother and the offspring are manifested early in pregnancy. Even less profound vitamin D deficiency may lead to suboptimal bone size and density after birth without overt rachitic features, with the potential for developing osteoporosis and fracture in later life. A study has shown reduced neonatal cross-sectional bone area and bone mineral content in offspring of mothers with vitamin D levels <30 nmol/L) in late pregnancy.

The association between vitamin D deficiency and maternal impaired glucose intolerance and gestational diabetes mellitus (GDM) caused by increased insulin resistance and reduced insulin secretion has been suggested. However, whether vitamin D deficiency is a risk factor for gestational diabetes itself or if vitamin D supplementation can prevent GDM yet remains unknown.

Table 1: Consequences of maternal vitamin D deficiency

Maternal
Early onset severe Pre-eclampsia – 5-fold increased risk
Gestational impaired glucose tolerance and Gestational Diabetes (GD)
Primary caesarean Section rates – 4-fold increased risk
Bacterial vaginosis
Joint-limb griddle pain,
Proximal myopathy, myalgia
Depression, irritability and fatigue

Neonatal
Small for Gestational Age baby (SGA) – 2.4-fold increased risk
Neonatal/Infantile Seizures (one in ten infants) – 2-fold increased risk
Impaired linear growth and bone development and delayed walking
Infantile rickets
Dental enamel hypoplasia
Congenital cataract
Cardiomyopathy
Respiratory Syncytial virus bronchiolitis and respiratory infections
Childhood allergy, wheeze & asthma

Management of vitamin D deficiency: Supplementation and treatment in pregnancy

In view of the evidence that vitamin D deficiency is associated with a wide range of adverse health outcomes for the mother and her offspring, there are compelling reasons for supporting intervention strategies in terms of vitamin D supplementation and treatment of vitamin D deficiency. The aims of vitamin D supplementation and treatment are for the following reasons:

1. Avoid (or reverse) the consequences of vitamin D deficiency
2. Vitamin D deficiency is detected it can be reversed in a timely manner
3. Maternal vitamin D levels are replenished by the 3rd trimester to prevent the development of negative outcomes particularly infantile rickets

The latest DOH, UK guidance makes recommendations in relation to routine supplementation in pregnancy and breastfeeding but does not address the issue of correction of vitamin D deficiency in these situations[18]. For routine supplementation, the current DOH guidance recommends all pregnant women should receive vitamin D supplements either 400 IU daily from the first trimester or 1000 IU daily during the 3rd trimester which has shown to produce normal 2-hydroxyvitamin D concentration in mothers and infants at term. For pregnant women at high-risk of deficiency (BAME group or obese), a higher supplemental dose (of at least 1000 IU per day) is recommended.

Addressing the need for recognition and management of vitamin D deficiency in pregnancy, NICE, in the UK, recommends that all pregnant and breastfeeding women should be informed about the importance of vitamin D supplementation and treatment and advices that all pregnant women should be advised to take 10 micrograms (400 IU) of vitamin D supplements daily and women belonging to the 'high risk' categories should be considered for a higher dose of vitamin D supplementation (Table 2).

It has been recommended that specialist advice should be sought if vitamin D deficiency is severe with vitamin D levels less than 25 nmol/L7. For this group of women in the 3rd trimester of pregnancy a more vigorous replacement therapy for rapid correction may be required. In severe cases it may be rational to use doses higher than 4000 IU per day (but not more than 10,000IU per day) for up to 11 weeks to provide a cumulative dose of around 150,000 or 300,000 IU in pregnancies that are in the 2nd or 3rd trimester. It might also be reasonable to use a weekly dose of 20,000 IU per week if compliance is a problem with daily use. It has been suggested that 'at risk' women who have a delayed diagnosis of vitamin D deficiency (after 12 weeks gestation) would require more vigorous replacement therapy with the loading doses. In cases where compliance is a problem, a single high dose of vitamin D 100 000-200 000 IU given during the 6th or 7th month gestation may be preferred to

achieve best efficacy and compliance. Research evidence suggests that supplemental doses of 4000 IU cholecalciferol a day is considered safe and more effective compared to the lower doses[19]. Some advocate that women at risk of preeclampsia are advised to take at least 800 IU a day combined with calcium. Because of lack of safety or outcome data in the first trimester, the correction should not begin until the 2nd trimester.

Box 1: The Royal College of Obstetricians and Gynaecologists UK recommendation for Vitamin D supplementation[3].

1. In general, vitamin D 10mcgs (400 IU) a day recommended for all pregnant women according to national guidance1,3. This should be available through the 'Healthy Start' Programme for eligible families. Daily vitamin supplementation with oral Cholecalciferol (Fultium-D3) or ergocalciferol is safe in pregnancy.
2. High risk women (women with increased skin pigmentation, reduced exposure to sunlight, or those who are socially excluded, housebound or remain covered, at risk of preeclampsia or obese with BMI >30 are advised to take at least 1000 IU per day throughout the pregnancy.
3. Treatment: for women who are deficient (serum 25-OUD level <25nmol/L) in vitamin D: treat for 4-6 weeks, either with cholecalciferol 20,000IU in a week or ergocalciferol 10,000IU twice a week, followed by standard supplementation is appropriate. For women who require short-term repletion, 20,000 IU weekly appears to be effective and safe treatment of vitamin D deficiency. A daily dose is likely to be appropriate to maintain subsequent repletion (1000 IU daily). Any higher dosage is not recommended in pregnancy.

Monitoring of vitamin D level: Vitamin D is safe in pregnancy and dosing regimens as recommended in the national guideline in pregnancy are unlikely to cause any toxicity. Accordingly, routine monitoring of vitamin D levels is not necessary in pregnancy and breastfeeding unless there is history of vitamin D deficiency, poor adherence is suspected or a loading regime has been completed for vitamin D deficiency. However, if treated for deficiency with doses over 2000IU per day, should have serum calcium levels checked a month after starting the treatment and 3 months later in order to avoid toxicity. Some advocate that women at moderate or high risk of vitamin D deficiency should be offered blood vitamin D level quantified with their booking blood test and adequately replaced. Measurement of vitamin D in symptomatic woman as part of their treatment continues to be applicable. This includes women with a low calcium concentration, bone pain, gastrointestinal disease, alcohol abuse, a previous child with rickets and those receiving drugs which reduce vitamin D level.

Dietary Supplements: Women receiving vitamin D supplements should also be advised to take a diet rich in vitamin D as vitamin D is not present naturally in sufficient amounts in most foods to meet recommended daily allowance of vitamin D need. In USA and Scandinavian countries, the mean serum levels of vitamin D in the population by food fortification have successfully been increased and appear to have been effective in reducing the prevalence of vitamin D deficiency.

Table 2: Pregnant women at risk group in the UK (NICE 2014)

1. All pregnant women and breastfeeding women, especially teenagers and young women.
2. People who have low or no exposure to sun, for example, people who cover their skin for cultural reasons, or for health reasons (skin photosensitivity or history of skin cancer) or those who are housebound, confined indoors for long periods or who are immobile.
3. People who have darker skin because their bodies are not able to make as much vitamin D. For example, South Asian, Middle-Eastern African and African-Caribbean ethnic origin.
4. Women with BMI over 30. Increased adiposity may affect bioavailability
5. Previous or Family history of vitamin D deficiency
6. People at increased risk of nutritional deficiency, for example vegans and those who do not eat fish or have a poor diet.
7. People with the following conditions: Multiple Sclerosis, Malabsorption syndrome or have had gastric bypass surgery.
8. People on certain drugs that impair vitamin D effect e.g. steroids, antacids, antiepileptics rifampicin, tacrolimus, anti-retroviral, cholestyramine, diuretics.

Discussion

In recent years, vitamin D deficiency status has been identified as a major health problem in a significant proportion of pregnant women of BAME origin who are greater risk of a wide range of adverse (consequences) maternal and neonatal outcomes compared to their Caucasian counterpart.

Emerging research data providing evidence on the potential effect of Vitamin D supplementation on pregnancy and neonatal outcomes, it is now accepted that interventional strategies in terms of vitamin D supplementation and treatment aiming to correct the deficiencies may have a significant short and long-term health benefits with no harmful effects in pregnant women[3]. The latest Cochrane review evaluating the effect of vitamin D supplementation in pregnancy, in relation to the risk of maternal adverse events, has provided evidence that supplementing pregnant women with vitamin D alone probably reduces the risk of preeclampsia, gestational diabetes, Low Birth Weight babies and the risk of severe postpartum haemorrhage[6]. The risk of preterm birth before 37 weeks gestation was not evident. The review has shown that although combined vitamin D and calcium supplements in pregnancy may reduce the risk of developing early onset severe pre-eclampsia, there was a potential harm through increased risk of preterm birth before 37 weeks. Despite this, the authors concluded that the benefits of combined supplementation outweigh the harms.

Accordingly, national guidelines focused on effective prevention strategies have been published that would ensure pregnant and lactating women who are at greater risk of vitamin D deficiency are vitamin D sufficient[3, 7]. The Cochrane review also has demonstrated that benefits of vitamin D supplementation outweighing the risks of the therapy may be helpful in informing any planned upgrades of existing UK guidelines and their local implementation by NHS Commissioning Groups[6]; and in the process may benefit the pregnant women of the BAME group who appear to be at higher risk of vitamin D deficiency.

Recently published UK Obstetric Surveillance System (UKOSS) interim report has shown that most of the pregnant women after being severely affected by COVID-19 admitted to hospital with COVID-19 (in the third trimester of pregnancy) particularly those who were at 28 weeks gestation or above belonged to BAME origin suggesting that pregnant women from BAME groups are particularly at increased risk of being severely unwell and have significant (27%) risk of preterm delivery[8]. The research evidence from the USA has suggested the potential association between vitamin D deficiency and the severity of COVID-19 among Black and Hispanic population groups[9]. However, currently no evidence of a direct link between vitamin D deficient pregnant women of BAME group and the severity of COVID-19 infection has been established. On the basis of this evidence, the authors have supported the use of vitamin D supplementation for the prevention and treatment of COVID-19 infection in pregnant women who are at risk vitamin D deficiency[9]. However, Advisory Statement published by NICE in the UK stated that there is no evidence to support the use of vitamin D supplements to specifically prevent or treat COVID-19 infection[2]. The authors suggested universal screening for vitamin D deficiency and further investigation of vitamin D supplementations in randomised control studies, which may lead to possible treatment or prevention of COVID-19 in pregnant women11.

Although, numerous studies have suggested that vitamin D favourably affects pregnancy and birth outcomes, there is no consensus on the optimal dose of vitamin D supplementation to maximise the prenatal and or postnatal maternal or infant benefits. There is an urgent need for further research to establish the potential benefits and optimal dosing of vitamin of vitamin D supplementation in pregnant women of BAME population. Controversies also surround the universal screening for vitamin D deficiency which offers an opportunity for early detection and interventions that would prevent or halt the progression of disease. However, at present there is no research evidence to support routine screening for vitamin D deficiency in all pregnant and breastfeeding women in terms of health benefit or cost effectiveness. As the test is expensive, offering routine screening may not be cost effective compared to offering universal vitamin D supplementation, especially when the treatment is regarded as being safe and it would be simple to supplement all pregnant women with vitamin D.

BOX 2: NICE guidelines[7] and specific recommendations.

1. NHS service providers should increase access to vitamin supplements containing the recommended dose and the Department of Health to work with the manufacturers of vitamin D supplements to ensure that products contain the recommended daily amount of vitamin D for health.
2. The DOH should also be required to amend existing legislation to allow 'Healthy Start' vitamins to be more widely distributed and sold and encourage manufacturers to sell them direct to pharmacies.
3. Local authorities should ensure supplements containing the recommended amount of vitamin D are widely available for all at-risk groups in local settings such as pharmacies, GP reception areas and children's centres. As the deficiency is usually first identified in the primary care setting it is important for the clinicians to target interventions to prevent deterioration and to better adjust treatments and prevent complications. This may involve referral to a secondary care setting.

It would not be unreasonable to expect that the NHS healthcare providers should be responsive to the vitamin D supplementation policies intended to reduce the burden of vitamin D deficiency-related conditions in vulnerable populations. Healthcare professionals caring for pregnant women in primary and secondary care settings should be aware of the particular needs of pregnant women of the BAME group who are at greater risk of vitamin D deficiency. Assessment of vitamin D deficiency status is an important first step that would guide towards timely interventions and prevent or improve some of the negative outcomes, especially when vitamin D supplementation and treatment of vitamin D deficiency is safe.

Health education, a vital part of management, should be targeted towards 'at risk' pregnant BAME women in order to raise their awareness on the risks of vitamin D deficiency, benefits of interventions and the safety of supplements[20]. In addition to daily vitamin D supplements during winter months, women should be advised on lifestyle changes necessary to maintain optimum vitamin D levels. Factors recognised as a barrier to compliance with supplementation for example, language-barrier, religious/cultural issues, preparations containing gelatine, palatability, frequency of the supplementation, should be taken into account to improve compliance with vitamin D supplementation. It makes sense to prescribe vitamin D alone in order to improve compliance. This is limited by the availability of suitable agent; vitamin D cannot be prescribed at low doses without calcium. Formulations of Cholecalciferol without calcium are available (e,g. Fultium-D3) offers an advantage of having higher concentration of vitamin D3 over in 'Healthy Start' vitamin in each capsule/tablet and the composition is more religion friendly . Patient information leaflets and online information can further facilitate discussion with healthcare professionals regarding individualised pregnancy risk and which supplements will be most beneficial. It cannot be over emphasised that the impact of vitamin D deficiency on pregnant women of BAME origin is recognised, prevented and treated in order to avoid adverse consequences. The healthcare providers should focus on beneficial interventions to improve pregnancy outcomes and reduce the burden of healthcare costs.

Conclusion

Vitamin D deficiency (or insufficiency) in pregnant women particularly of BAME origin, believed to be more common than perceived, is largely preventable. As currently available scientific data provides sufficient evidence of an association between vitamin D deficiency and adverse maternal and neonatal outcomes and the beneficial effect of vitamin D supplementation and treatment; and its safety, the rationale for vitamin D supplementation in 'at risk' group of BAME origin becomes quiet compelling. Despite publications of numerous guidance and recommendations, vitamin D deficiency continues to adversely impact on the pregnant women of BAME origin. Therefore, if our ultimate goal is to reduce the burden of vitamin D deficiency on the pregnant women of BAME heritage, then healthcare providers in the UK should focus on implementing sustained preventable strategies for early recognition, timely interventions with vitamin D supplementation and treatment for these women. It is hoped that would help to minimise the negative impacts of Vitamin D deficiency on pregnancy and in the process lessen the financial burden on the already stretched NHS healthcare costs. In this context, RCOG the 'advocator of Women's Health worldwide' should ensure women specially BAME women are aware of the benefits of Vit D though education and 'empower' them with clear information on the needs for vitamin D supplementation in pregnancy, before and after.

Key Points

1. Pregnant women of BAME group are at greater risk of vitamin D deficiency compared with Caucasian women.
2. Causes of vitamin d deficiency are multifactorial but mainly due to inadequate exposure to natural sunlight and diet deficient in vitamin D.
3. Targeted management of vitamin D deficiency is crucial to avert some of the adverse effects of vitamin D deficiency in pregnancy.
4. Vitamin D supplementation is safe so long as follow the recommended doses.
5. Health Education targeted at the risk group in order to raise awareness of the beneficial role of vitamin D supplementation and improve compliance

Acknowledgement

I, on behalf of British International Doctors Association, would like to thank Ms Emma McBride, Hospital Account Specialist and Ms Emma Howarth, Senior Brand Manager of Thornton & Ross Pharmaceuticals STADA Group for supporting the publication of this article and for their review of my manuscript. ***Disclaimer:*** PKS personally did not receive any grants from any sources for writing this article.

References:

1. Department of Health Chief Medical Officers, UK. Vitamin D - advice on supplements for at risk groups – letter from UK Chief Medical Officers. 2012 http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/dear colleagueletters/DH132509
2. NICE. COVID -19 rapid evidence summary: Vitamin D for CVID-19. Evidence Summary (ES 28) Published 29 June 2020. www.nice.org.uk/guidance/es28
3. RCOG. Vitamin D in pregnancy - Scientific Impact Paper No. 43. RCOG, London June 2014
4. European Food Safety Authority. 2016 (http://www.evidentlycochrane.net/glossary/safety/
5. Christensen HT, Falkenberg T, Lamont RF, et a. The impact of vitamin D on pregnancy: a systematic review. Acta Obstet Gynecol Scand 2012;91(12):1357-1367 doi: 10.111/aogs.12000 PMID: 2297137
6. Palacios C, Kostiuk LK and Pena-Rosas J. Vitamin D supplementations for women during-pregnancy. Cochrane Database of Systemic Reviews 2019. Issue 1 https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD008873.pub4/full
7. NICE (2014) Vitamin D supplement use in specific population groups. Updated January 2017. Public Health Guideline. nice.org.uk/guidance/ph56.2014
8. RCOG. Advice on pregnant women. COVID-19 virus infection and pregnancy from RCM/RCOG, UK version 3.4: 2020.10 August
9. Pugach I and Pugach S. Strong correlation between prevalence of severe vitamin D deficiency and population mortality rate from COVID 19 in Europe. medRxiu 2020. Doi:https://doi.org/10.1101/2020.06.24.20138644
10. Forth Vitamin Deficiency Status in UK. March 9, 2020
11. SACN 2016. http://bot.ly/29x9GowShaw NJ and Pal BR. Vitamin D deficiency in the UK Asian Families: activating a new concern. Arch Dis Child 2002;86:147-149
12. Yu CK, Sykes L, Sethi M, Teoh TG, Robinson S. Vitamin D deficiency and supplementation during pregnancy. Clin Endocrinol (Oxf) 2009;70:685-690
13. Bodnar LM and Simhan HN. Vitamin d may be a link to black-white disparities in adverse birth outcomes. Obstet Gynecol Survey 2010;65 (4): 273-284 doi:10.1097/OGX.0b013e3181dbc55b PMID:20403218
14. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, et al. Evaluation, treatment, and prevention of vitamin D deficiency: An Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2011;96(7):1911-1930 doi: 10.1210/jc. 2011-0385 PMID: 21646368
15. National Osteoporosis Society (NOS). Vitamin D and bone health: a practical clinical guideline for patient management. Bath: NOS 2018. www.nos.org.uk/page.aspx?pid=1074 & srcid= 299
16. March KM, Chen NN and Karakochuk CD et al. Maternal Vitamin D3 Supplementation at 50ng/dl protects against low serum 25-hydroyvitamin D in infants at 8wks of age: A randomised controlled trial of 3 doses of vitamin D beginning in gestation and continued in lactation. Am J Clin Nutr 2015:102:402 - 410
17. Aghajafar F et al. Association between maternal serum 25-hydroxyvitamin D levels and pregnancy and neonatal outcomes: Systematic and meta-analysis of observational studies. BMJ 2013;346: f1169
18. DOH. Specialist Pharmacy Service What oral vitamin d dosing regimens can be used to correct deficiency in pregnancy? DOH UK January 2019.
19. Hollis BW, Johnson D, Hulsey, Ebeling M, Wagner CL. Vitamin D supplementation during pregnancy: a Double-blind randomised clinical trial of safety and effectiveness. J Bone Miner Res 2011; 26:2341-57
20. Toher C, Lindsay K, Mckenna M, Kilbane M, Curran S, Harrington L et al. Relationship between vitamin D knowledge and 25 hydroxyvitamin D levels among pregnant women. J Hum Nutr Diet 2014 ;27[3];261-9 doi :10.1111/jhn.12150