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VITAMIN D SUPPLEMENTATION PRACTICES IN PREGNANCY AND DURING INFANCY AND OTHER BEHAVIORS RELATED TO VITAMIN D STATUS AMONG A SAMPLE OF MUSLIM WOMEN IN IRELAND AND SAUDI ARABIA

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ABSTRACT

Objectives (background): Requirement for Vitamin D is high at particular stages of the lifecycle especially during pregnancy and infancy. Severe vitamin D deficiency during pregnancy may increase the risk of rickets in childhood. While policies exist in Ireland regarding supplementation of Vitamin D in either pregnancy or infancy, no policy recommendation exists in Saudi Arabia. The main aim of this study was to identify attitudes towards Vitamin D supplementation as well as its prevalence in pregnancy and infancy among Muslim mothers living in Ireland and in Saudi Arabia. Methods: A quantitative cross-sectional survey consisting of 121 Muslim mothers living in Saudi Arabia and 77 Muslim women living in Ireland. Recruitment of mothers took place in three hospitals in Makkah (Saudi Arabia Al-Noor Hospital, Hera'a Hospital and Maternity and Children's Hospital) and a religious Centre in Ireland between June and September 2012. Results: Only 28.6% of the Irish and 7.4% of the Saudi mothers had taken vitamin D supplements during their pregnancy. While 62.3% of the Muslim mothers in Ireland and 37.2% in Saudi Arabia were aware of the recommendation to give a daily vitamin D supplements to their infants until they were one year of age just 49.4% living in Ireland and 13.2% from Saudi Arabia did so. While a majority of mothers living in Ireland and Saudi Arabia were spending > 30 minutes a day outside, clothing that completely cover the body was worn by the entire sample, sunscreen was used by 44.2% in Ireland and 53.7% in Saudi Arabia. Conclusion: Poor vitamin D supplementation practices are evident among Muslim mothers and infants both in Ireland and Saudi Arabia. To improve this situation, mothers should be educated about the importance of vitamin D during pregnancy and infancy.

Keywords: Vitamin D, Supplementation, Pregnancy, Infancy, Muslim, Culture

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Contribution/ Originality

This study contributes to the existing literature by investigating the supplementation practices of vitamin D during pregnancy and infancy among Muslim women in two countries with differing guidelines regarding Vitamin D supplementation as well as different latitudes, climatic conditions and cultures. This study is unique in this respect.

1. INTRODUCTION

While vitamin D deficiency has traditionally been associated with poor musculoskeletal health namely rickets and osteomalacia, research in the last decade has suggested that vitamin D is crucial for optimal growth, development and health at all stages throughout the life cycle [1, 2]. Extensive research has implicated Vitamin D deficiency to numerous major chronic diseases [3] including several types of cancer [4] coronary heart disease, [5] and type 2 diabetes [6]. A considerable body of research [7-9] suggests that vitamin D deficiency during pregnancy and infancy have negative implications for the health of both mother and child. According to Dratva, et al. [10], prevention of vitamin D deficiency in infancy may decrease the risk of developing rickets in childhood and osteoporosis later in adulthood.

While studies have identified a lack of sun exposure as the main cause of vitamin D deficiency [1, 11] this does not preclude the existence of Vitamin D deficiency in hot sunny countries. Indeed, even in sunny climates such as in Saudi Arabia or other the Middle Eastern countries, a high prevalence of vitamin D deficiency has been found [12-15]. Indeed, there is evidence that the prevalence of rickets and vitamin D deficiency is greater in the Middle East than in many Western countries, with a large meta-analysis concluding that 20–80% suffer from vitamin D deficiency [12]. Saudi Arabia has plentiful sunshine; therefore, the marked low levels of $25(OH)_2D_3$ might be attributed to genetic predisposition [16], veiled clothing [17], long time spent indoors by pregnant Muslim women [12], which altogether reduce the length of exposure to the sunlight. Prolonged breastfeeding in the absence of vitamin D supplementation has also been identified as a risk factor for vitamin D deficiency [13].

Though vitamin D is produced by the human body due to exposure to sunlight, it can also be obtained by consuming foods such as fatty fish, egg yolks, liver, fish-liver oil and mushrooms. Researchers such as De-Regil, et al. [9] and Prentice [7] have suggested vitamin D supplementation during pregnancy and infancy as a safe way of improving outcomes among these groups of individuals [1]. In spite of food fortification policies in many countries [18] as well as recommendations for vitamin D supplementation of groups that are at risk, Vitamin D deficiency and infantile rickets are still major public health issues for many developed and developing nations [13]. In the current literature information is lacking about the supplementation practices among Muslim pregnant women who are at high–risk of hypovitaminosis D due to a combination of inadequate exposure to sunlight, frequent pregnancies and breast feeding.

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In addressing the need to establish how vitamin D levels can be increased during pregnancy and infancy [9] this study aims to establish the prevalence of vitamin D supplementation practices during pregnancy and infancy among a sample of Muslim mothers in Ireland and Saudi Arabia as well as the prevalence of other behaviors that influence Vitamin D status.

2. METHODS

Ethical approval was obtained from the Dublin Institute of Technology Ethics Committee for the study (January 2012). In addition, permission was received from Al-Noor, Hera'a and Maternity and Children Hospitals in Makkah, Saudi Arabia. Prior to taking part in the study, all participants signed an informed consent statement. Only study subjects who agreed to give their consent and who met the selection criteria were recruited for the study and no financial incentive was offered since their participation was voluntary in nature.

2.1. The Sample and Recruitment

Convenience sampling was used to identify the study participants. The study sites comprised of four sites one in Ireland: the Islamic Cultural Centre of Ireland (ICCI), Clonskeagh, Dublin 14, and three sites in Makkah, Saudi Arabia Al-Noor Hospital, Hera'a Hospital and Maternity and Children's Hospital. These hospitals were chosen because the hospitals have public health clinics that serve the target population and also the researcher, a dietitian knew clinicians in each of these hospitals. Muslim women attending the Islamic Cultural Centre of Ireland or one of these three hospitals in Saudi Arabia were invited to participate in the present study provided that they met the inclusion criteria. These included: being over 18 years of age, of being a mother and having an infant between 6 months and three years of age. All Muslim mothers who attend the places mentioned above were invited to participate in the present study, seventy seven Muslim mothers living in Ireland and one hundred and twenty one Muslim mothers living in Saudi Arabia agreed to take apart in this study.

This provided an adequate convenience sample that, while not nationally representative of Saudi women in Saudi Arabia is reflective of an urban sample which serves as a comparative group to Muslim women living in Ireland. Recruitment took place between June and September 2012.

2.2. Study Design

The design for this study was a quantitative cross-sectional design. A cross-sectional study design was employed to provide a snapshot of the behaviors and attitudes of Muslim mothers towards Vitamin D supplementation and to describe the behaviors as they currently are and therefore match well with a descriptive design whose purpose is to describe the phenomenon exactly as it is and does not require the researcher to manipulate variables that constitute the phenomenon [19]. Descriptive research seeks to accurately portray the characteristics of

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situations, events, people or groups [20]. A descriptive approach was used to collect data on the behaviors and attitudes of Muslim mothers towards vitamin D supplementation.

2.3. The Survey Instrument

For this research an interviewer-assisted face-to-face questionnaire to gather the necessary data was used. The questionnaire was divided into four sections, the first section provided information about the mother's health during pregnancy, aspects of her diet related to Vitamin D intakes as well as Vitamin D supplementation practices during pregnancy and the first year of life of her infant. which included (mother's health status during pregnancy, information on their supplementation during pregnancy and their diet, information on the child and whether the child had received vitamin D supplementation), the second section provided information on their practices such as sun exposure which includes (time spending outside, clothing practice, sunscreen use and tanning), the third section provided information on breastfeeding practices which includes (feeding method, weaning age and the first foods that were introduced to the baby), the last section provided information on mothers socio economic status which included (age, and education level, employment, marital status, nationality and gender of their baby).

The instrument was translated into Arabic the language most locals can read and understand in this area. A pilot study was undertaken before the commencement of field work to check for reliability and quality of the instrument. Any errors, inconsistencies and any changes needed in the questionnaire were made as appropriate. The feedback from the pilot study helped in coming up with a more refined standardized instrument so that the questions were clear and concise. In order to complete the questionnaire the researcher conducted a face to face interview with the selected subjects and the data was entered directly into the iPad software survey (Quick Tap Survey) from iPad Apple store www.quicktapsurvey.com . The 'Quick Tap Survey' data was automatically stored in an excel spreadsheet. The use of the iPad software helped in reducing human error and was a convenient back-up mechanism.

2.4. Data Analysis

Data was analyzed using the Statistical package for the Social Sciences - Predictive analytics Software and Solutions (SPSS version17). Descriptive statistics of categorical variables was conducted to determine the general trend and to provide a summary of data collected and these results were presented in the form of frequencies (percentages), proportions, means and SD as appropriate. Cross-tabulations and Chi-square statistical tests were performed to determine associations between categorical variables in the two study sites. Where associations were being evaluated between two dichotomous variables then Yate's continuity correction was applied. The level of statistical significance was fixed at ($p< 0.05$).

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3. RESULTS

3.1. Sample Characteristics

The social and demographic characteristics of the sample of Muslim mothers from both Ireland and Saudi Arabia are described in Table 1. No differences were found in age, education level attained between mothers from both regions. A significantly higher proportion of Muslim mothers in Ireland were students (42%) compared to Muslim mothers in Saudi Arabia (2%) (P<0.001). While 17% reported having gestational diabetes among Saudi Muslim mothers 12% of Muslim mothers in Ireland had gestational diabetes during pregnancy.

3.2. Factors Influencing Vitamin D Status

3.2.1. Dietary Factors

Some of the main dietary sources of vitamin D include dairy foods (fortified) and fatty fish. The main dairy food consumed among this sample of Saudi Muslim mothers was yoghurt (68.6%) while it was fresh milk for Muslim women in Ireland. Such dairy products (milk, cheese and were consumed daily by 87% of the Saudi sample and 95% of the Irish sample (data not shown). Data were also collected from mothers from Ireland (n=53) and Saudi Arabia (n=78) regarding the frequency of their consumption of oily fish – one of the best sources of dietary Vitamin D (Table 2). Just 18.8% of Muslim mothers in Ireland and 37% of Muslim mothers in Saudi Arabia were consuming oily fish more than once per week. (Table 2).

3.2.2. Exposure to Sunlight

An important contributor to vitamin D status is exposure to sunlight. The differences in factors concerning the status of mothers' exposure to sunlight are outlined in Table 3. While a majority of mothers from Ireland (40.2%) and Saudi Arabia (37.2%) reported spending more than 30 minutes a day outside a considerable proportion of mothers in Saudi (29.8%) spent no time outside at all. Furthermore, almost (44%) of the Irish Muslim mothers spent 15 minutes or less outside per day. This was a considerably lower proportion of mothers compared to Saudi mothers where (59.5%) were spending just 15 minutes or less outside (p=0.01).

Almost all mothers in both countries wore clothing on their hair and bodies while approximately 25% in both countries tended to wear sunglasses outside. The self-reported reaction of exposed skin to sunlight was also not deemed significant (p=0.61) with 67.5% of mothers in Ireland and 69.4% of Saudi mothers reporting that they tan easily (Table 3).

3.3. Supplementation during Pregnancy and Infancy

While 80.5% of Muslim mothers in Ireland took a supplement during pregnancy just 36.4% of Saudi mothers did so (P<0.001) (Table 4). Significant differences were also seen in supplements of folic acid, iron, calcium and vitamin D (P<0.001). Indeed Muslim mothers in Ireland were four

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times more likely to take a vitamin D supplement during pregnancy compared to Saudi mothers with only 7.4% of them taking a Vitamin D supplement during their pregnancy (P<0.001).

While a majority of mothers from Ireland (62%) and Saudi Arabia (37.2%) know about the recommendation of giving infants vitamin D drops (data not shown), just 49.4 % from Ireland and 13.2% from Saudi gave their infant vitamin D supplements (P<0.001) (Table 4).

Table 5 illustrates the main sources of information regarding vitamin D supplementation to infants up to one year of age among those who were currently or had supplemented their baby with vitamin D drops. The main source of information on vitamin D was provided by doctors with 46.8% of mothers in Ireland and 29.8% of Saudi mothers getting information on recommendations to supplement their infant with vitamin D to one year of age. Other important sources of information were the television for mothers in Ireland (13%) and the Internet for both countries (9.1% and 7.4% for mothers in Ireland and Saudi respectively).

3.4. Knowledge about Vitamin D and its Health Benefits

Three quarters of the mothers in this study either agreed or totally agreed that providing a vitamin D supplement to children prevented rickets while just over 20% did not know (Table 6). No difference was seen between Muslim mothers in Ireland and Saudi in their knowledge about vitamin D giving protection against rickets (p=0.38). A similar proportion were in agreement with the statement regarding the ability of Vitamin D to increase muscle strength, while a higher proportion (89.2%) either agreed or agreed totally that taking vitamin D makes bones healthy. The relationship between Vitamin D and other chronic diseases found considerably lower levels of agreement and a high level of mothers responding "Don't know" (Table 6).

4. DISCUSSION

This study set out to examine vitamin D supplementation practices in a sample of Muslim mothers living in Ireland and in Saudi Arabia. It examined supplementation during pregnancy as well as infancy (first year of life). In order to be able to assess how important this supplementation of vitamin D in these life stages is, it was necessary to explore other behaviors that influence vitamin D status such as dietary intakes and exposure to sunshine.

In Saudi Arabia, the prevalence of vitamin D insufficiency is very high, with females having an average of 9.9ng/ml, which is in the range of vitamin D insufficiency of 10-20ng/ml [21]. Although Saudi Arabia has high levels of sunshine, such low levels of $25(OH)_2D_3$ could be attributed to genetic predisposition [16], the use of veiled clothing [17] and the long periods of time spent indoors by pregnant Muslim women [12]. In Ireland studies have revealed that poor vitamin D status amongst pregnant women is a significant problem [22].

The sample was made up of Muslim mothers living in Ireland and Saudi Arabia. The recruitment procedure differed between locations due to the fact that in Ireland, Muslims are a small minority population while in Saudi Arabia they the majority. Thus, in Ireland recruitment

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was through the ICCI in Clonskeagh which serves as not only a place of worship but also offering many services including marriage services facilitation, translation services of books, marriage certificates etc from English into other languages. In Saudi Arabia recruitment was through a number of hospitals which are representative of different socio-economic levels located in Makkah. In both locations convenience sampling was used for recruitment. The snowball method was also employed. Snowball sampling is a method typically used in studies when subjects are hard to locate. The samples differed primarily by education level with higher educational attainment seen among the mothers in Ireland (74% versus 63.6% of Saudi mothers). The majority of the Muslim mothers in Ireland was housewives or students (96.1%) compared to mothers in Saudi Arabia where most of them were also housewives or employed (97.5%). The higher proportion of students among the sample in Ireland is to be expected as that represents one of their main reasons for leaving their country and coming to Ireland. As the snow-ball method of sampling was used in this study this can make it difficult to assess the degree to which the final sample was representative of the population they are supposed to represent. Since this study was conducted for comparative purposes, such convenience sampling is considered appropriate for such an analysis.

A low intake of vitamin D rich foods in places where sunlight is minimal or is not a source that is availed of can result in increased vitamin D deficiencies [11]. Pregnant and lactating mothers are advised to consume diets with rich sources of vitamin D twice per week, which was consistent with the findings from this study. This sample of mothers in Saudi Arabia was found to be consuming diets high in powdered milk, yoghurt, and to a lesser extent oily fish while fresh milk and cheese were the main dairy products consumed among the mothers in Ireland. But because the natural diet is not a great source of vitamin D the options of fortification and supplementation are critically important. Indeed, in the US and Canada fortification provides the main source of Vitamin D, for example in Canada milk is fortified by law with 35–40 IU/100 mL and infant formula 40–100 IU/100 kcal in the United States and 40–80 IU/100 kcal in Canada [23]. In Ireland increasing levels of fortification of dairy products such as Super milk produced by Avonmore are a direct response to the low levels observed in so many sub-groups in the Irish population. In Saudi Arabia vitamin D fortified foods are dairy products such as milk, buttermilk and yoghurt. In Saudi Arabia and Ireland commonly consumed foods fortified with vitamin D include dairy products (milk and yoghurt) as well as bread [24]. More recently, cereals and formula milk have been fortified. As rice qualifies as a staple food in Saudi Arabia perhaps it could be added to the list of fortified foods [25]. In a recent study of married couples in Saudi Arabia, milk intake was found to be statistically significant positive independent predictors of vitamin D level, adjusted for factors as age, sun exposure, clothing, skin color [26]. The recent fortification of milk in Sweden and Finland with Vitamin D has resulted in a decline in the level of Vitamin D insufficiency.

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Supplementation of micronutrients amongst pregnant women in Saudi Arabia was low in the present study with only 36.4% taking supplements. This is consistent with the finding presented by Azhar [27] which indicated that only 29.7% of the women in Makkah, Saudi Arabia used supplements. In public hospitals in Saudi Arabia, gynecologists prescribe folic acid for the mother for the first three months of pregnancy [27]. The differences seen in supplementation practices during pregnancy between Saudi Arabia and other countries such as the US and in Europe probably reflects differences in culture as well as recommendations from health professionals.

In Ireland, only 49.4% of the mothers gave their infants vitamin drops in spite of 62.3% of them having heard of the recommendation to supplement. While this was a considerably higher percentage compared to Tarrant, et al. [28] where in her study of 450 mother –infant pairs they found that 4.4% of infants had received vitamin D drops. The increase might be explained by virtue of the fact that Tarrant's study was conducted between 2004 and 2006 before the publication of FSAI recommendation on vitamin D supplementation to infants up to the age of 1year. In addition, while the sample in Tarrant's study was predominantly made up of Irish nationals with a very small number of Muslims, in this study it was comprised of 100% Muslims. Health professionals may be more aware of the increased risk of vitamin D inadequacy in this group and so more likely to provide them with specific advice to give their babies vitamin D drops. Living in temperate climates like Ireland contributed to increased cases of vitamin D deficient diseases amongst infants. Food Safety Authority of Ireland [29] asserts that infants aged 0-12 months should be given 5µg per day. Thus, the advice given during birth and antenatal clinics played an important role in informing women on the importance of giving their infants vitamin drops. The recommendations coming from healthcare services are also another factor that encouraged women to give infants vitamin D drops as found in this study.

Vitamin D supplementation among Saudi Arabian mothers during pregnancy was low at only 7.4%. This percentage revealing that the vast majority are not supplementing with vitamin D during pregnancy is consistent with the findings reported by Elidrissy, et al. [30], which indicated extremely low levels of serum $25(OH)_2D_3$ among the sample of mothers in that study. In Saudi Arabia there are no country specific guidelines or recommendations for Saudi Arabian women to take vitamin D supplements during pregnancy. This is a public health issue that seriously needs to be addressed. Vitamin D supplementation to infants up to 1 year of age was also found to be low with only 13.2% of women giving their infants vitamin drops. Due to limited information on the importance of such vitamin drops and a lack of advice coming from doctors, 62.8% of Saudi women did not know about the importance of vitamin D drops for their infants. This greatly increases the infant's vulnerability to vitamin D deficiency.

While exposure of skin to sunlight is one of the main ways for the body to obtain Vitamin D, excessive exposure to sunlight increases the risk for skin damage and cancer thus meriting the requirement for sunscreen [31]. Application of sunscreen, while it protects the skin from damage of sun burn greatly reduces skin synthesis of vitamin D. In this study sunscreen usage was not

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common among the mothers in this study. However almost all of these Muslim mothers were almost completely covered up and therefore they are less inclined to apply sunscreen. This may reflect the fact that it is not customary for them to do so or the fact that they may not be out for long in the sun and consequently do not feel that they will burn. Indeed, in a recent qualitative study among female students in Saudi Arabia, a major barrier to the prevention of vitamin D deficiency in that country was the climate [25]. Effecting behavioural change to increase their UV exposure may pose a difficult challenge given the cultural norms in that country.

The traditional long clothes (Abaya) covering them from head to toe that are worn by veiled women are preventing them from sun exposure and synthesis of vitamin D [25]. Findings from this study revealed that 100% of the mothers covered their bodies and this is primarily due to cultural and religious purposes [32]. This therefore, significantly reduces the amount of sun exposure among pregnant women and their infants and according to Holick Sunlight [33] Muslim women who cover their skin are often vitamin D deficient. Indeed, this assertion is supported by several other studies [34, 35]. This practice of covering their whole bodies for religious purposes precludes this behavior being targeted for change hence the need for supplementation and fortification of target foods.

A high proportion of mothers agreed or totally agreed about the importance of providing vitamin D supplements to ensure the prevention of rickets in children. In addition, the majority agreed or totally agreed that taking vitamin D supplements makes bone healthy and helps to increase muscle strength. These results suggest therefore that most of the mothers knew about the traditional health benefits of vitamin D for them and for their baby. However, the fact that so few reported taking supplements during pregnancy or providing them to their infants suggest the need for them to be further educated and to receiving support from their doctor to bring about the necessary behavioral change.

A particular strength of this study was the fact that the researcher was herself a Muslim mother as well as being a qualified dietitian who therefore not only had direct access with other Muslim mothers but also would have been more likely to elicit truthful responses from them. A limitation of this study was the retrospective nature of the survey on supplementation practices. Mother's recall of supplementation may be inaccurate due to mothers having to think back to when they were pregnant. Furthermore, there may be possible interviewer bias where mothers exaggerated this positive health behavior in an attempt to please the interviewer. However, regarding supplementation practices this would suggest that levels might even be lower than what is being reported in this study making it an even more serious public health issue.

Results from this study suggest that the risk for vitamin D deficiency is considerable given the pattern of behaviors regarding supplementation practices and behaviors around sun exposure. Muslim mothers in Saudi Arabia were found to get little sunlight exposure primarily due to cultural factors. Such behaviors lead to a high risk for diseases such as rickets. Unless behaviours around exposing skin (such as arms and legs) in public and spending more time outside can be

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changed then supplementation and fortification remain the more promising options for increasing Vitamin D uptake in women and their infants. Indeed, Holick [1] suggests that there is a vital need to develop suitable supplements for vitamin D in such regions so as to prevent vitamin D deficient diseases from increasing. Furthermore, developing a supplement that is specifically suitable for infants 0-12 months of age is also recommendation [36]. Such supplements for both mother and child should be accessible and cost friendly.

Research reveals that Muslim women are used to an indoor lifestyle and rarely go out in the sunshine [27]. These women need to become involved in more outdoor activities to increase their exposure to sunlight [27] especially during pregnancy [37]. In addition, there is a crucial need to educate pregnant Muslim women on the importance of vitamin D both for their own health and that of their infants. Health care providers need to inform women during their pregnancy to take vitamin D supplements for the sake of their fetus and if they are found to be Vitamin D deficient then they should supplement breast milk with vitamin D (5μg), especially during the wintertime when this deficiency is at its highest [38]. Furthermore, expectant mothers should receive recommendations from their doctors to give their infant a vitamin D supplement each day for the first year to reduce the risks of Vitamin D deficiency. In addition, advice should be provided to young Muslim women about the principal sources of Vitamin D (from sunlight) and fortified foods as well as recommendations on how to obtain Vitamin D from these sources which may then offer alternative routes to sufficient Vitamin D intakes to Vitamin D supplementation.

Appropriate communication about Vitamin D supplementation should be encouraged from health care providers. In Saudi Arabia there should be recommendations given by the Ministry of Health for vitamin D supplementation especially given that there is currently no public health policy for vitamin D in the Kingdom of Saudi Arabia [39]. Effective strategies to promote supplementation practices during pregnancy and infancy have not been widely explored and as a result, information about suitable supplementation practices is scarce. Another area that needs further research is a detailed assessment of vitamin D deficiency among Muslim women in Saudi Arabia as a result of socio-cultural and religious factors. Since Vitamin D status in Muslim mothers was not assessed directly in this study, additional research obtaining a direct measure of vitamin D status in these population sub-groups would be a useful follow-up to this work. This is borne out by a recent study highlighting significant hypovitaminosis D in older adolescent females in Saudi Arabia [39].

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Table-1. Demographic characteristics of the mothers

Social and demographic characteristics	**Ireland (n=77) % (n)**	**Saudi Arabia (n=121) % (n)**	**Significance *P* value[1]***
Mothers age (years)			
<25	32.5 (25)	19.0 (23)	
26-35	58.4 (45)	66.1 (80)	
>35	9.1 (7)	14.8 (18)	0.13
Educational level			
Primary school	5.2 (4)	8.3 (10)	
Secondary school	20.8 (16)	28.1 (34)	
Higher education	74.0 (57)	63.6 (77)	0.30
Employment status			
House wife	54.5 (42)	46.3 (57)	
Employed	3.9 (3)	51.2 (62)	
Student	41.6 (32)	1.7 (2)	0.00
Marital status			
Married	97.4 (75)	85.1 (103)	
Divorced/separated	2.5 (2)	12.3 (15)	
Widowed	.0 (0)	2.4 (3)	0.37
First child			
Yes	44.2 (34)	28.1 (34)	0.03
Gender of baby			
Female/Male	36/41	50/71	0.54
Type of delivery			
Normal delivery	87.0 (67)	81.0 (98)	
Caesarean delivery	13.0 (10)	19.0 (23)	0.36
Clinical Conditions during pregnancy			
Gestational diabetes	15.6 (12)	14.0 (17)	0.92
Preeclampsia	5.2 (4)	3.3 (4)	0.77

[1]Pearson's chi-square test used to determine differences
*Significant $p<0.05$

Table-2. Consumption of oily fish. consumed by mothers in Ireland and Saudi Arabia

	Ireland (n=53) % (n)	**Saudi Arabia (n=78) % (n)**
More than three times a week	1.9 (1)	3.8 (3)
Three times a week	1.9 (1)	12.8 (10)
Twice a week	15.0 (8)	20.5 (16)
Once a week	64.2 (34)	61.5 (48)
Less than once a week	17.0 (9)	1.3 (1)

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Table-3. The status of mothers' exposure to sunlight

	Ireland (n=77) % (n)	Saudi Arabia (n=121) % (n)	Significance *P* value[1*]
Time spend outside per day (minutes/day)			
None	15.6 (12)	29.8 (36)	
Less than 5	6.5 (5)	9.1 (11)	
5-15	22.1 (17)	20.7 (25)	
15-30	15.6 (12)	3.3 (4)	
More than 30	40.3 (31)	37.2 (45)	0.01
The protection were used during outside[§]			
Covering arms and legs	100.0 (77)	100.0 (121)	
Covering hair	96.0 (74)	99.1 (120)	
Sunglasses	27.3 (21)	26.4 (32)	0.31
Sunscreen use			
Never	41.6 (32)	33.1 (40)	
Just summer	44.2 (34)	53.7 (65)	
Summer and winter	14.3 (11)	13.2 (16)	0.40
Exposed skin reaction[2]			
Burn then peel	24.7 (19)	19.8 (24)	
Tan easily	67.5 (52)	69.4 (84)	
Burn then tan	7.8 (6)	10.7 (13)	0.61

[1]Pearson's chi-square test used to determine differences
[*]Significant *P*<0.05
[2]Self-perceived
[§]Percentages do not add up to 100 because some mothers gave more than one answer

Table-4. Use of nutritional supplements during pregnancy

	Ireland (n=77) % (n)	Saudi Arabia(n=121) % (n)	Significance *P* value[1*]
Use supplements during pregnancy			
Yes	80.5 (62)	36.4 (44)	
No	19.5 (15)	63.6 (77)	<0.001
Supplements use			
Vitamins			
Folic acid	42.8 (33)	19.8 (24)	
Minerals			
Iron	49.3 (38)	25 (30)	
Calcium	35.1 (27)	12.3 (15)	
Zinc	.0 (0)	.8 (1)	
Pregnancy care**	23.4 (18)	.0 (0)	<0.001
Vitamin D supplements during pregnancy			
Yes	28.6 (22)	7.4 (9)	
No	71.4 (55)	92.6 (112)	<0.001
Cod liver oil or Omega-3 fatty supplements			
Yes	14.3 (11)	18.2 (22)	
No	85.7 (60)	81.8 (99)	0.60
			Continue

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Vitamin D supplements for child in first 12 months			
Yes	49.4 (38)	13.2 (16)	
No	56.6 (39)	86.8 (105)	<0.001

[1] Pearson's chi-square test used to determine differences
*Significant $p<0.05$
**Contains (Vitamin D, Vitamin E, Vitamin C, Vitamin B1, Vitamin B2, Vitamin B3,Vitamin B6, Vitamin B12, Vitamin K, Folic acid, Iron, Selenium, Zink, Copper, Magnesium, Beta-carotene)

Table-5. Sources of information to give vitamin D supplements to the infant in the first 12 months among those who had given vitamin D supplement to their baby

	Mothers heard about the recommendations to give baby vitamin D drops in Ireland Yes (n=48) % (n)	**Mothers heard about the recommendations to give baby vitamin D drops in Saudi Arabia Yes (n=45) % (n)**
Health professional		
Doctor	46.8 (36)	29.8 (36)
Nurse	3.9 (3)	.8 (1)
Others		
Book/Magazine	5.2 (4)	3.3 (4)
T.V	13.0 (10)	6.6 (8)
Internet	9.1 (7)	7.4 (9)
Family and Friends		
Mother	5.2 (4)	9.1 (11)
Sister	2.6 (2)	5.8 (7)
Family	3.9 (3)	7.4 (9)
Relatives	7.8 (6)	9.9 (12)

Percentages do not add up to 100 because some mothers gave more than one answer

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Table-6. Muslim mothers' knowledge about the potential benefits of vitamin D

	Ireland (n=77) % (n)	Saudi Arabia (n=121) % (n)	Significance *P* value[1*]
Giving children vitamin D protects them against rickets			
Totally agree	28.6 (22)	34.7 (42)	
Agree	49.4 (38)	38.8 (47)	
Disagree	1.3 (1)	5.0 (6)	
Totally disagree	.0 (0)	.8 (1)	
Don't know	20.8 (16)	20.7 (25)	
			0.38
Taking vitamin D reduces cancer risk	6.5 (5)	13.2 (16)	
Totally agree	22.1 (17)	20.7 (25)	
Agree	5.2 (4)	11.6 (14)	
Disagree	3.9 (3)	2.5 (3)	
Totally disagree	62.3 (48)	52.1 (63)	
Don't know			0.25
Taking vitamin D may prevent heart disease			
Totally agree	3.9 (3)	10.7 (13)	
Agree	9.1 (7)	20.7 (25)	
Disagree	9.1 (7)	10.7 (13)	
Totally disagree	2.6 (2)	1.7 (2)	
Don't know	75.3 (58)	56.2 (68)	0.04
Taking vitamin D helps to increase muscle strength			
Totally agree	22.1 (17)	24.8 (30)	
Agree	42.9 (33)	47.9 (58)	
Disagree	2.6 (2)	5.0 (6)	
Totally disagree	1.3 (1)	1.7 (2)	
Don't know	31.2 (24)	20.7 (25)	0.52
Taking Vitamin D makes bones healthy	55.8 (43)	42.1 (51)	
Totally agree	35.1 (27)	47.1 (57)	
Agree	1.3 (1)	.8 (1)	
Disagree	.0 (0)	.0 (0)	
Totally disagree	7.8 (6)	9.9 (12)	
Don't know			0.28
Taking vitamin D reduces the risk of Multiple Sclerosis (MS)			
Totally agree	5.2 (4)	14.0 (17)	
Agree	7.8 (6)	12.4 (15)	
Disagree	1.3 (1)	6.6 (8)	
Totally disagree	.0 (0)	2.5 (3)	
Don't know	85.7 (66)	64.5 (78)	
			0.01

[1]Pearson's chi-square test used to determine differences *Significant $p<0.05$

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