Deanship of Graduated Studies

Al-Quds University

"Pregnant Women Awareness of Vitamin D Deficiency in Eight Private Clinics in Ramallah District, Palestine."

Khaled Tareq Herzallah

M.Sc. Thesis

Jerusalem-Palestine

1435/2014

"Pregnant Women Awareness of Vitamin D Deficiency in Eight Private Clinics in Ramallah District, Palestine."

Prepared by:

Khaled Tareq Herzallah

B.Sc.: Medical Laboratory-Arab American University-Jenin

Supervisor: Dr. Asma Imam, Ph.D.

Jerusalem-Palestine

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Health/School of Public Health in Health Management and Policies.

Al-Quds University

1435/2014

Deanship of Graduate Studies

Al-Quds University

School of Public health

Thesis approval

"Pregnant Women Awareness of Vitamin D Deficiency in Eight Private Clinics in Ramallah District, Palestine."

Prepared by: **Khaled T. Herzallah**

Registration number: 20912052

Supervisor: **Dr. Asma Imam, Ph.D.**

Master thesis submitted and accepted, Date: 14th May, 2014

The names and signatures of the examining committee members are as follows:

1- Head of committee :**Dr. Asma Imam, Ph.D.** Signature .....

2- Internal Examiner: **Dr. Hazem Agha, Ph.D.** Signature.

3- External Examiner: **Dr. Basma Damiri, Ph.D** Signature

Jerusalem-Palestine

1434/2014

Dedication

I dedicate this dissertation to my beloved parents; Seham and Tariq. May GOD let them rest in mercy and peace.

To my darling wife; Mai,

To my cherished daughters; Noor and Misk,

To my well-regarded sisters and brothers, and

To those who treasured Palestine as a home land.

Khaled Tareq Herzallah

Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Singed:

Khaled Tareq Herzallah

Date: 14/05/2014

يرفع الله الذين ءامنوا منكم والذين
أوتوا العلم درجت

سورة المجادلة الآية 11

Acknowledgments

Thank you GOD for the opportunity to learn…

First and foremost, I would like to offer all the praises and glory to our God Almighty. His inspiring words and steadfast love and mercy are lamps and lights to my path that guide me from the conception until the giving of birth to this study.

To complete a research like this, several minds are essential, but God sent people who have been very helpful and instrumental in the accomplishment of this study. I am forever grateful to those people who have supported and encouraged me along the way.

I would like to express my sincere gratitude to my supervisor, Dr. Asma Imam for her faith in me, her unwavering support, wisdom, and great guidance throughout this study.
I would like to express my heartfelt appreciation to my teachers in the Public Health program at Al-Quds University for teaching me Public Health. Thank them for making me better in different ways.

Several colleagues made special contributions to this work and the researcher gratefully acknowledges their assistance. To all my colleagues in the health profession. My sincere gratitude goes to people who lent a helping hand to me in data collection. I would like also to thank all participants in this study, thank you a lot for the precious time you gave me.

My full love goes to all my sisters and brothers for their support, love and permanent caring, their encouragement was my motivation.

Finally, I must gratefully acknowledge the help and support of my gorgeous wife, Mai, whom I owe my deepest gratitude for caring, patience and inspiring; you were a pillar of strength and comfort, also my children, Noor and Misk, who have encouraged me to write, study, even though it has resulted in them undertaking additional family responsibilities.

Abstract

Background: Vitamin D deficiency (VDD) is a significant problem for a growing proportion in Palestine. Maternal vitamin D deficiency is associated with numerous adverse health conditions. However, most women of childbearing age are vitamin D deficient. It is very important that there should be a concern about scientific and public awareness of vitamin D deficiency's role in pregnants' health status.

Methodology: The aim of this study was to assess the level of awareness of vitamin D deficiency among pregnant women in order to identify groups most in need of education and improve their healthcare in eight private clinics in Ramallah district, Palestine. A convenient sample of four hundred and sixty (n=460) pregnants dwelling in Ramallah area were recruited during the period from September 2013 to December 2013 yielding 98.3% response rate.

Results: The study results indicated that most of the respondents (76.1%) ranged between 20-30 years old, 47.2% living in villages while 52.6% were in their first parity. More than 81% of subjects were veiled, whilst more than half subjects (43.7%) were qualified with a bachelor degree. Moreover, 60.7% attained a range of 1500-3000 NIS whereas 58.7% had a gravidity range 2-4 pregnancies. Of the participants, 95.8% never been told that they have had vitamin D deficiency, 4.2% had diabetes mellitus, 3.5% had osteomalacia, 3.3% had the disease of osteoporosis. None of the respondents suffered from renal failure or skin cancer while 6.5% of the respondents suffered from depression. Moreover, 46.3% of the pregnants were drinking milk daily, 76% of the respondents did not have fish oil pills, while 83.7% indicated that enriched food is available to them and 80.7% reported they were exposed to sun, whilst 40% were practicing exercises daily. About 78.5% had never heard of vitamin D deficiency while 85.8% believed that vitamin D was important for their health, however, 79.6% denied being asked by the physician to do a lab test for the VD, out of them, 80.5% reported not having any lab test in the last six months, which, in turn might explain answers about low lab test results. Approximately 22.2% stated taking vitamin D (VD) supplements which were prescribed by their physician, of those who were fully committed in taking VD tablets were low in number (40.8%). About 76.6% were unaware about the lifestyle and nutrition associated with VDD whilst 82.1% were not aware about the symptoms with vitamin D deficiency. Subjects displayed unawareness of VDD's reasons when findings highlighted (72.2%) of the respondents. Nearly 83.3% of the survey subjects revealed considerable ignorance and confusion about their knowledge and awareness towards the diseases of VDD. There was a significant correlation between education and unawareness of VDD. Also, there were significant relationships between diseases, reasons and symptoms associated with VDD and awareness of VDD. Pregnants were asked about their judgments and practices

involving inference to lessen VDD; most of which is increasing intake of foods fortified with VD (96.1%) followed by visiting and checking with physicians (93.7%). Grossly, 78.5% of the participants were unaware about VDD. Participants also revealed specific sources of information for their knowledge of VD; mostly named: media including newspapers, magazines and community networks, physicians, family members/friends and schools/further education.

Conclusion and recommendations: This study provides evidence that vitamin VDD unawareness is prevalent among pregnant women in the study sample. Improving knowledge and public health education to tackle modifiable preconceptions and behaviour may be an effective first step toward increasing awareness about VDD, as well as concerted collaboration is required amongst the health care providers and others such as community members to promote the awareness and bridge this gap. Finally, public health and health promotion campaigns should encompass education as an effective approach in addressing VDD through community networks.

Keywords

Vitamin D; vitamin D deficiency; pregnant women; sun exposure; awareness; education; 25-hydroxyvitamin D; 1,25-dihydroxyvitamin D; safety; nutrition; ultraviolet radiation; osteomalacia; osteoporosis; supplementation; knowledge.

ملخص الدراسة

الخلفية: يلعب فيتامين "د" دورا أساسيا في الصحة العامة لجسم الإنسان بشكل عام. إن نقص فيتامين "د" قد يؤدي إلى مشاكل صحية خطيرة في المجتمع الفلسطيني المتنامي وبالذات عند النساء الحوامل حيث يكون هذا الفيتامين ناقصا عندهن في الغالب. من المهم جدا أن يكون هناك اهتمام حول التوعية لنقص فيتامين "د" في صحة الإنسان.

منهجية البحث: تهدف هذه الدراسة إلى قياس وعي النساء الحوامل لنقص فيتامين "د" في الجسم في 8 عيادات خاصة في منطقة رام الله, فلسطين. تم اخذ عينة متوافقة مكونة من 460 من السيدات الحوامل القاطنات في منطقة رام الله خلال الفترة ما بين أيلول إلى كانون أول 2013 بمعدل استجابة 98.3%.

النتائج: شخصت الدراسة أن معظم المشاركات (76.1%) ما بين 30-20 عاما و 47.2% يسكن في القرى وأن 52.6% في حملهن الأول وأكثر من 81% يضعن غطاء فوق رؤوسهن وحوالي 43.7% يحملن شهادة البكالوريوس و 60.7% يتراوح دخلهن ما بين NIS 3000-1500 وحوالي 60% لهن من الأولاد من 2-4. هناك حوالي 95.8% لم يتواجد عندهن نقص فيتامين "د" من قبل و 4.3% كن مصابات بالسكري وحوالي 3.3% يعانين من هشاشة العظام بينما 6.5% عندهن حالة من اليأس. أكثر من 46% من المشاركات في الدراسة يتناولن الحليب يوميا ولكن الغالبية منهن (76%) لا يتناولن حبوب زيت السمك و 83.7% أخبرن بأنه لا يتوافر لديهن الأغذية الغنية بفيتامين "د" وأن 80.7% قد عرضن أجسادهن للشمس بينما تمارس التمارين الرياضية منهن ما نسبته 40% وكذلك فإن 78.5% لم يسمعن بنقص فيتامين "د" من قبل معتقدات في نفس الوقت بأن فيتامين "د" ضروري جدا لصحتهن. حوالي 79.6% صرحن بأن طبيبهن لم يطلب منهن عمل فحص للتأكد من نقص الفيتامين وأن 80.7% ممن طلب منهن عمل الفحص لم يقمن بعمله خلال الستة أشهر الماضية مما يفسر بشكل ما سبب انخفاض نتيجة الفحص. ما يقارب من 22.2% صرحن بأنهن يتناولن مكملات فيتامين "د" الموصوف لهن من قبل الطبيب التزم منهن ما يقارب 41% بهذه المكملات. كشفت النساء الحوامل عن نسبة عدم وعي لا بأس بها (76.6%) عند سؤالهن عن مدى معرفتهن بنمط الحياة والتغذية المرتبط بنقص فيتامين "د". حوالي 82.1% لم يكن عندهن الوعي الكامل بأعراض نقص فيتامين "د", بينما كانت نسبة عدم الوعي 72.2% بالنسبة لأسباب المرض, وأما بالنسبة للأمراض المسببة له فقد كانت نسبة عدم الوعي 83.3%. عندما سئلت الحوامل عن كيفية التقليل من نقص فيتامين "د", فإن الغالبية أجبن بالأغذية الغنية بفيتامين "د" (96.1%) يتبعها زيارة الطبيب (93.7%). تبين وجود علاقة قوية ايجابية بين معرفة الحوامل بأعراض المرض, وأسبابه, والأمراض المصاحبة له وكذلك نمط الحياة والتغذية وبين وعي النساء الحوامل لنقص فيتامين "د" في الجسم. وبالإجمال فإن نسبة عدم وجود وعي كاف عن نقص فيتامين "د" عند المشاركات في الدراسة قد وصل إلى نسبة لا يستهان بها (78.5%). أشارت المشاركات في الدراسة إلى بعض المصادر للحصول على المعلومات عن نقص فيتامين "د" مثل الإعلام ويشتمل على الصحف والمجلات وشبكات التواصل الاجتماعي والأطباء وأفراد العائلة والأصدقاء والمدارس وحملات التوعية والتثقيف الصحي.

الاستنتاجات والتوصيات: تستنتج هذه الدراسة دليلا قويا على قلة الوعي تجاه نقص فيتامين " د" بين النساء الحوامل في منطقة رام الله; فلسطين. وعليه وبناء على ذلك فإن تحسين المعرفة والتثقيف الصحي يعتبران الخطوة الأولى للتغلب على هذا النقص وزيادة الوعي وكذلك التعاون بين أفراد المجتمع لتعزيز الوعي وجسر هذه الفجوة. وأخيرا فإن حملات التعزيز الصحي من

شـــأنـها أن تكـــون أســـلوبـا فـعـــالا فـــي التـغـلـب عـلـى نـقـص فـيـتـامـيـن "د" مـن خـلال شـــبـكات الـتـواصـل الاجـتـمـــاعـــي وغـيـــرهـا.

كلمات رئيسية للبحث:

فيـتـامـيـن "د", نقـص فـيـتـامـيـن "د", نساء حوامل, التعرض لأشعة الشمس, الوعي والتثقيف الصحي, سلامة, تغذية, فوق بنفسجي, لين العظام, هشاشة العظام, مكملات و معرفة.

List of Contents:

List of Tables:

List of Figures:

Acronyms and Abbreviations:

Abbreviation	Abbreviations Expansion
25-OH-D	25-Hydroxyvitamin
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
e.g.	For example
Ibid	Same reference
i.e.	That is
IU	International Unit
Mg	Micrograms
mL	Milliliters
Ng	Nanogram
No	Number
SPF	Sun Protection Factor
UV	Ultra Violet
VD	Vitamin D
VDD	Vitamin D Deficiency
WHO	World Health Organization

Conversion for vitamin D:
[Source] 40 IU=1µ
[Serum] 2.5 nmol/L = 1ng/mL

Chapter One: Introduction

1.1 Introduction

This chapter includes a brief discussion about vitamin D (VD) and its sources, function, mechanism of action and indication of VD testing. Besides that, causes of vitamin D deficiency (VDD), prevention and treatment, assessing of VDD, and prevalence of low VD during pregnancy are also discussed. Moreover, clinical manifestations of VDD such as nutritional rickets, osteomalacia, muscle weakness and pain are presented. Also, risk factors of VDD, justification and significance of the study, problem statement, aim and general objectives, hypotheses and questions of the study and summary of the study are presented.

1.2 What is vitamin D?

Vitamins are organic compounds needed in small quantities for the operation of normal body metabolism and cannot be produced by the body's own cells. Vitamin D is not actually a vitamin; it is a fat-soluble steroid hormone formed from dehydrocholesterol by the action of ultraviolet (UV) light on the basal layers of the skin. It is then hydroxylated once to form hydroxyvitamin D3 and then a second time to form dehydroxyvitamin D_3 which is generally regarded as the active form of the vitamin (Lieberman and Bruning, 1990).

Vitamin D is one of the vitamins in human body that is converted to hormone within the body. Researchers have shown, for example, that vitamin D_3 is one of the primary biological regulators of calcium homeostasis. Vitamin D_3's important biological effects occur only as a consequence of its metabolism into a family of a daughter metabolites including the key kidney-produced metabolite 1α,25 (25-dehydroxyvitamin D3[1α,25(OH)2D3]. Researchers consider $1\alpha,25(OH)_2D_3$ to be a steroid hormone and believe that it functions the same way as other steroid hormones by interacting with its cognate vitamin D receptor (VDR) (Feldman et al., 2005). It is also essential for balance of the calcium in human body and important for maintenance of the bone and muscle in the body as well. Therefore, maternal vitamin D deficiency (VDD) is more threat for the bone of infants like: rickets, muscle weakness, heart failure, hypocalcaemia convulsions and fetal brain development (Halicioglu et al., 2011). Very few foods naturally contain vitamin D and foods that

are fortified with vitamin D are often inadequate to satisfy either a child's or an adult's vitamin D requirement. Besides rickets in children, VDD will precipitate and exacerbate osteopenia, osteoporosis and fractures in adults. It has been associated with increased risk of common cancers, autoimmune diseases, hypertension and infectious diseases (Chen, Chimeh, Lu et al., 2007).

Table 1.1: New recommended daily amounts of calcium and vitamin D.

Life Stage Group	**Calcium Recommended Dietary Allowance (mg/day)**	**Vitamin D Recommended Dietary Allowance (IU/day)**
Infants 0 to 6 months	*	**
Infants 6 to 12 months	*	**
1 - 3 years old	700	**
4 - 8 years old	1,000	600
9 - 13 years old	1,300	600
14 - 18 years old	1,300	600
19 - 30 years old	1,000	600
31 - 50 years old	1,000	600
51 - 70 years old	1,000	600
51 - 70 year old females	1,200	600
71+ years old	1,200	800
14 - 18 years old, pregnant/lactating	1,300	600
19 - 50 years old, pregnant/lactating	1,000	600

**For infants, adequate intake is 200 mg/day for 0 to 6 months of age and 260 mg/day for 6 to 12 months of age.*
***For infants, adequate intake is 400 IU/day for 0 to 6 months of age and 400 IU/day for 6 to 12 months of age.*
(Source: Institute of Medicine, 2010).

Throughout pregnancy, maternal serum concentrations of 25 hydroxyvitamin D correlate with dietary vitamin D intake. Maternal serum concentrations of 1.25-dihydroxyvitamin D, the hormonal circulating and active form of vitamin D, are elevated during pregnancy. 1.25-dihydoxyvitamin D is synthesized mainly by the decidual cells of the placenta and allows for increased calcium absorption. The fetus is exclusively dependent on the mother for its supply of 25 (OH) D which is believed to cross easily the placenta. Vitamin D deficiency during pregnancy affects the fetus and the newborn; birth weight is decreased, bone mineralization is impaired and

neonatal hypocalcaemia is frequent. In countries where dairy products are not routinely supplemented with vitamin D, maternal vitamin D supplementation during pregnancy is necessary (Salle et al., 2002).

This study offers an update on vitamin D function and the global scale and implications of vitamin D deficiency and relates to pregnancy and infancy. It also addresses a combined strategy to prevent vitamin D deficiency during pregnancy (Dawodu and Wagner, 2012).

1.3 Sources of vitamin D

Vitamin D deficiency is one of the health problems and unexpectedly has a high prevalence in sunny countries, e.g. Middle East (Salek, 2008). Vitamin D deficiency (VDD) is one of the problems that are increasingly reported as a public health in many parts of the world (Dawodu and Wagner, 2012).

The major source of vitamin D is exposure to sunlight (Chen and Holick, 2008). Sunlight converts a compound in the skin called cholecalciferol to a vitamin D precursor called vitamin D_3. The compound produced enters the bloodstream and travels to the liver and kidney for processing. After leaving the kidney, vitamin D is active and ready to use (Halicioglu et al., 2011).

1.3.1 Sunlight:

Ultraviolet-B radiation (UVB; wavelengths of 290 to 315 nanometers) stimulates the production of vitamin D_3 in the epidermis of the skin (Norman, 2001). Sunlight exposure can supply most people with their entire vitamin D requirement. Children and young adults who use a short period outside two or three times a week will generally synthesize all the vitamin D they need to avoid deficiency. A study reported that serum vitamin D concentrations following exposure to 1 minimal erythemal dose of simulated sunlight (the amount required to cause a slight pinkness of the skin) was equivalent to ingesting approximately 20,000 IU[1] of vitamin D_2 (Holick, 2002). Individuals with dark-colored skin synthesize markedly less vitamin D on exposure to

[1]International Units (IU) are an old terminology used to state the potency of vitamins A, D and E before vitamins were manufactured in a pure enough form to be measured by weight.
One IU of Vitamin A = 0.3 micrograms.
One IU of Vitamin D = 0.025 micrograms.
One IU of Vitamin E = 0.67 micrograms.

sunlight than those with light-colored skin (Holick, 2004). Additionally, the elderly have diminished capacity to synthesize vitamin D from sunlight exposure and frequently use sunscreen or protective clothing in order to prevent skin cancer and sun damage. The function of sunscreen with sun protection factor (SPF) of 8 reduces production of vitamin D by 95%. According to Dr. Michael Holick, as little as 5-10 minutes of sun exposure on arms and legs or face and arms three times weekly between 11:00 am and 2:00 pm during the spring, summer, and fall at 42 degrees latitude should provide a light-skinned individual with adequate vitamin D and allow for storage of any excess for use during the winter with minimal risk of skin damage (Holick, 2003).

1.3.2 Food sources:

In nature, vitamin D is found in very few foods. Foods attaching vitamin D include some fatty fish (mackerel, salmon and sardines), fish liver oils, and eggs from hens that have been fed vitamin D. In the United States (U.S.), milk and infant formula are fortified with vitamin D so that they contain 400 IU (10 mg) per quart. Nevertheless, other dairy products, such as cheese and yogurt, are not always fortified with vitamin D. Some cereals and breads are also fortified with vitamin D. Lately, orange juice fortified with vitamin D has been made available in the U.S. Accurate estimates of average dietary intakes of vitamin D are difficult because of the high variability of the vitamin D content of fortified foods (Food and Nutrition Board, Institute of Medicine, 1999). Vitamin D contents of some vitamin D-rich foods are listed in Table (1.2) below in both international units (IU) and micrograms (mg).

Table 1.2: Vitamin D contents of some vitamin D-rich foods in both international units (IU) and micrograms (mg).

Food	Serving	Vitamin D (IU)	Vitamin D (mg)
Pink salmon, canned	3 ounces	530	13.3
Sardines, canned	3 ounces	231	5.8
Mackerel, canned	3 ounces	213	5.3
Quaker Nutrition for Women Instant Oatmeal	1 packet	154	3.9
Cow's milk, fortified with vitamin D	8 ounces	98	2.5
Soy milk, fortified with vitamin D	8 ounces	100	2.5
Orange juice, fortified with vitamin D	8 ounces	100	2.5
Cereal, fortified	1 serving (usually 1 cup)	40-50	1.0-1.3
Egg yolk	1 large	21	0.53

Food and Nutrition Board, Institute of Medicine (1999).

1.3.3 Supplements:

The majority of vitamin D supplements available without a prescription contain cholecalciferol (vitamin D_3). Multivitamin supplements generally provide 400 IU (10 mg) of vitamin D. Solitary constituent vitamin D supplements may provide 400 to 2,000 IU of vitamin D but 400 IU is the most frequently existing dosage. A number of calcium supplements may also provide vitamin D.

1.4 Function

1.4.1 Activation of vitamin D:

Vitamin D must be metabolized to its biologically active forms because it is biologically inactive. It enters the circulation and is transported to the liver after it is consumed in the diet or synthesized in the epidermis of skin. It is hydroxylated in the liver to form 25-hydroxyvitamin D (calcidiol; 25-hydroxyvitamin D, the major circulating form of vitamin D). Increased exposure to sunlight or increased dietary intake of vitamin D increases serum levels of 25-hydroxyvitamin D, making the serum 25-hydroxyvitamin D concentration a useful indicator of vitamin D nutritional status. In the kidney, the 25-hydroxyvitamin D_3-1-hydroxylase enzyme catalyzes a second hydroxylation of 25-hydroxyvitamin D, resulting in the formation of 1,25-dihydroxyvitamin D (calcitriol, 1alpha, 25-dihydroxyvitamin D), the most powerful

form of vitamin D. Most of the physiological effects of vitamin D in the body are related to the activity of 1,25-dihydroxyvitamin (Holick, 2003).

The diverse forms of vitamin D are illustrated below:

- Vitamin D_2 (ergocalciferol) present in plants.
- Vitamin D_3 (cholecalciferol) present in the skin of animals.
- Vitamin $D_3 \rightarrow$25 (OH)D (calcidiol) in the liver$\rightarrow$1.25$(OH)_2$D (calcitriol) in the kidneys.

1.4.2 Mechanisms of action of vitamin D:

Vitamin D is metabolized in the liver to 25(OH)D, and after that in the kidneys to 1,25$(OH)_2$D (DeLuca, 2004). It is also recognized that many other tissues in the body, including macrophages, brain, colon, prostate, breast and others, have the enzymatic equipment to nearby create 1,25$(OH)_2$D (Bikle, 2005). The 1,25$(OH)_2$D formed by the kidneys goes into the flow and moves to its chief target tissues the intestine and bone, where it interacts with its vitamin D receptor to improve intestinal calcium absorption and mobilize osteoclastic activity (Holick and Garabedian, 2006). The local production of 1,25$(OH)_2$D in non-calciumregulating tissues such as the colon, prostate, and breast is thought to be for the purpose of regulating up to 200 genes, which help to control cell expansion and cellular demarcation and may be responsible for decreasing the risk of the cells being transformed into a malignant state (Nagpal et al., 2005).

The 1,25$(OH)_2D_3$ has been shown to inhibit cancer cell growth, induce cancer cell maturation, induce apoptosis, and decrease angiogenesis (Mantell et al., 2000). The 1,25$(OH)_2$D inhibits renin production in the kidney (Li, 2003) and has an immunomodulatory activity on monocytes and activated T and B lymphocytes (Mathieu and Adorini, 2002).

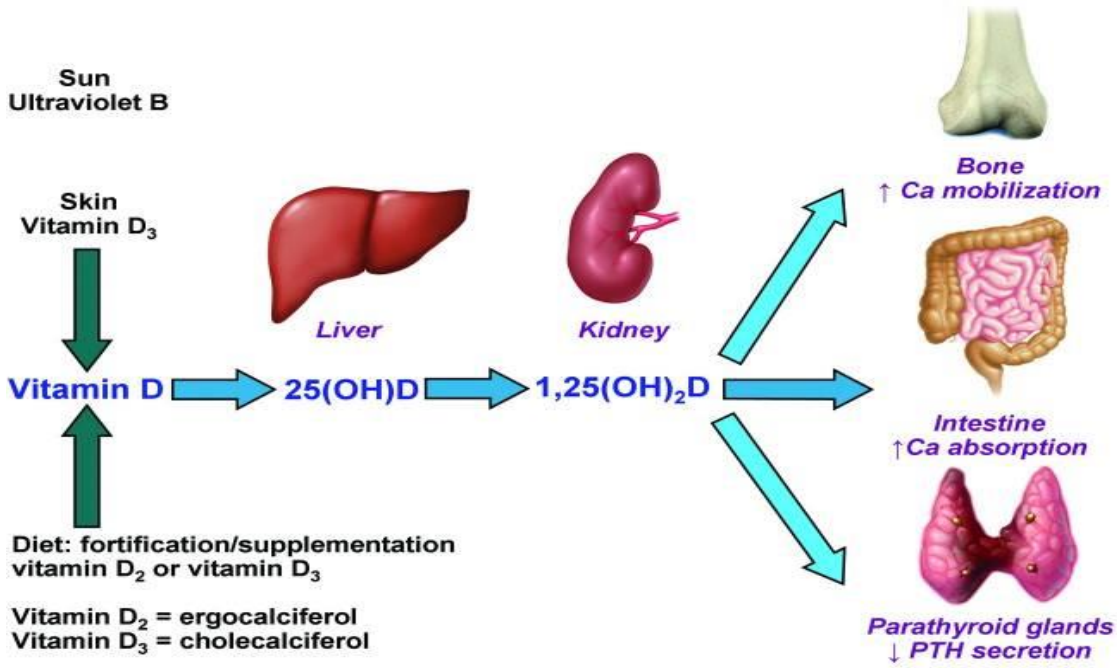


Figure1.1: Mechanisms of action of vitamin D.

Vitamin D metabolism: Ca = calcium; 1,25(OH)$_2$D = 1,25-dihydroxyvitamin D; 25(OH)D = 25-hydroxyvitamin D; PTH = parathyroid hormone.

Source: Mayo Foundation for Medical Education and Research, 2011.

1.4.3 Calcium balance:

Preservation of serum calcium levels within a fine variety is imperative for normal functioning of the nervous system in addition to bone growth and maintenance of bone density. Vitamin D is essential for the proficient consumption of calcium by the body (Holick, 2994). The parathyroid glands discern serum calcium levels and secrete parathyroid hormone (PTH) if calcium levels go down too low (Figure 1.2). The rise in PTH increases the activity of the 25-hydroxyvitamin D_3-1 hydroxylase enzyme in the kidney, resulting in increased production of 1,25-dihydroxyvitamin D. Increasing 1,25-dehydroxyvitamin D production results in changes in gene expression that standardize serum calcium by:

1. Increasing the intestinal absorption of dietary calcium,
2. Increasing the reabsorption of calcium filtered by the kidneys, and
3. Mobilizing calcium from bone when there is insufficient dietary calcium to maintain normal serum calcium levels. Parathyroid hormone and 1,25-dihydroxyvitamin D are required for these latter two effects (DeLuca, 2004).

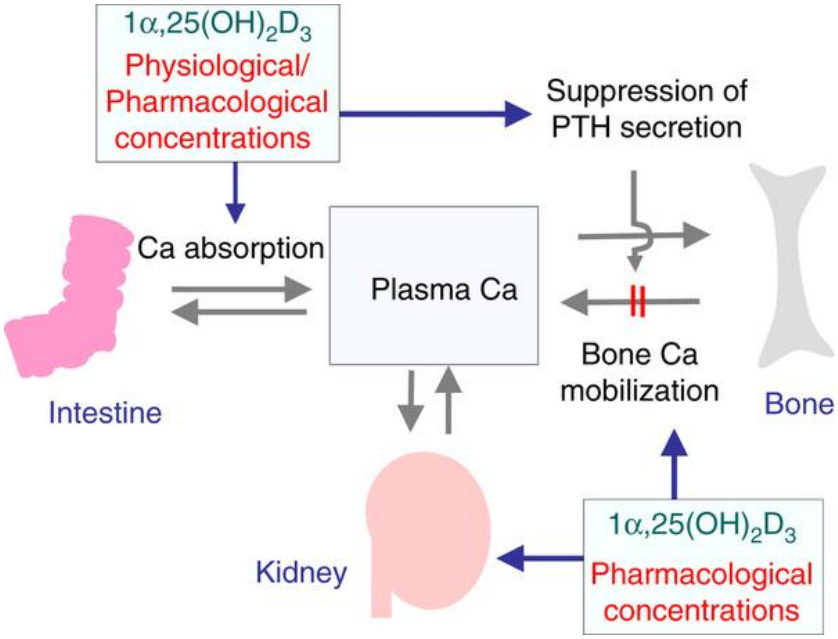


Figure 1.2: The vitamin D endocrine system.

A hypothetical concept for the calcium endocrine system controlled by pharmacological concentrations of 1α,25(OH)$_2$D$_3$. 1α,25(OH)$_2$D$_3$ at physiological and pharmacological concentrations stimulates intestinal calcium absorption and inhibits PTH secretion. The 1α,25(OH)$_2$D$_3$ at pharmacological concentrations may inhibit PTH secretion and stimulate calcium renal calcium re-absorption.

Source: Takahashi N, Udagawa N and Suda T. (2014).

1.4.4 Cell differentiation:

Rapidly dividing cells are said to be reproducing. Demarcation results in the specialization of cells for specific functions. Usually, differentiation of cells directs to a decrease in proliferation. Unrestrained proliferation of cells with certain mutations may lead to diseases like cancer whereas cellular proliferation is essential for growth and wound healing. The active form of vitamin D, 1,25-dihydroxyvitamin D, hinders proliferation and stimulates cell differentiation (Holick, 2004).

1.4.5 Immunity:

Vitamin D in the form of 1,25-dihydroxyvitamin D is a powerful immune system modulator (Griffin et al., 2003). The vitamin D receptor (VDR) is expressed by most cells of the immune system, including T cells or T lymphocytes and antigen-presenting cells, such as dendritic cells and macrophages (Lin and White, 2004). For

considerations, macrophages also produce the 25-hydroxyvitamin D_3-1-hydroxylase enzyme that converts 25-hydroxyvitamin D to 1,25-dihydroxyvitamin D (Hayes et al., 2003). A significant scientific evidence that 1,25-dihydroxyvitamin D has a range of effects on immune system function, which may improve natural immunity and reduce the development of autoimmunity (Griffin et al., 2003).

1.4.6 Insulin secretion:

The vitamin D receptor (VDR) is expressed by insulin-secreting cells of the pancreas and the results of animal studies suggest that 1,25-dihydroxyvitamin D plays a role in insulin secretion under conditions of increased insulin demand (Zeitz et al., 2003). Inadequate data in humans suggest that insufficient vitamin D levels may have an adverse effect on insulin secretion and glucose tolerance in type 2 diabetes (noninsulin-dependent diabetes mellitus (NIDDM), (Borissova et al., 2003, Orwoll et al., 1994, Inomata et al., 1986).

1.4.7 Blood pressure regulation:

Blood pressure is mainly regulated by the renin-angiotensin system (Sheng, 2000). Since inappropriate activation of the renin-angiotensin system is thought to play a role in some forms of human hypertension, adequate vitamin D levels may be important for decreasing the risk of high blood pressure. Angiotensin changing enzyme (ACE) catalyzes the cleavage of angiotensin I to form angiotensin II, a peptide that can increase blood pressure by suggesting the restriction of small arteries and by increasing sodium and water maintenance. The rate of angiotensin II synthesis is dependent on renin (Sigmund, 2002). Studies in mice missing the gene encoding the VDR designates that 1,25-dihydroxyvitamin D decreases the expression of the gene encoding renin through its interaction with the VDR (Li et al., 2002).

1.5 Assessing vitamin D status

Specifically, defining vitamin D deficiency or insufficiency on the basis of 25(OH)D values is still a matter of debate. A constructive simplistic classification of vitamin D status is shown in the Table 2.1. A cutoff value of 30 ng/mL is sometimes used for optimal vitamin status. On the basis of measured concentrations of 25(OH)D, many

patients are given a diagnosis of vitamin D deficiency or insufficiency when most have no evidence of disease (Tom et al., 2011).

Vitamin D is gauged by measuring the prohormone 25(OH) D, which is a measurement of stipulation rather than function. The most steadfast and plentiful metabolite of vitamin D in human serum, 25(OH)D has a half-life of about 3 weeks, making it the most appropriate indicator of vitamin D status. Previously, vitamin D deficiency was recognized by the presence of bone disease, either rickets or osteomalacia. Bone disease caused by vitamin D deficiency is associated with serum 25(OH)D values below 10 ng/mL (to convert to nmol/L, multiply by 2.496). Further lately, the term vitamin D insufficiency has been used to describe suboptimal levels of serum 25(OH)D that may be coupled with other disease outcomes (Tom et al., 2011).

Table 1.3: Classification of vitamin D status by serum $25(OH)_2$ D_3 concentration[a,b] for health and disease.

Vitamin D level	**$25(OH)_2$ D_3 concentration**	**Classification**
Vitamin D level nmol/L*	Vitamin D level ng/mL	Health status
< 25 nmol/L	≤10 ng/mL	**Deficient**
25-49 nmol/L	11-19 ng/mL	**Insufficient**
50 nmol/L	20 ng/mL	**Optimal (adequate)**
350 nmol/L	>130 ng/mL	**Toxic**

[a] 25(OH)D = 25-hydroxyvitamin D.
[b] To covert from ng/mL to nmol/L, multiply by 2.496.
*1 nmol/L= 40 IU
Source: (NHS, 2011).

1.6 Causes of vitamin D deficiency

Melanin is tremendously efficient in absorbing UV-B[2] radiation, and, thus, increased skin pigmentation distinctly reduces vitamin D3 synthesis (Diamond, 2005). Similarly, a sunscreen with a sun protection of 15 absorbs 99% of the incident UVB radiation, and, thus, when topically applied properly will decrease the synthesis of vitamin D3 in the skin by 99% (Dobbinson, 2002). African Americans with very dark

[2] UV-B is an Ultra Violet Ray which is strongest in the summer months when our part of the earth is closer to the Sun. This is known as the sunburn/tanning ray because it is responsible for most of the tanning changes in lighter skin tones.

skin have an (SPF[3]) of 15, and, thus, their ability to make vitamin D in their skin is reduced by as much as 99% (Engelsen, 2010). This along with decreased milk intake are the explanations for why most African Americans who live in a temperate climate are vitamin D deficient, whereas Africans living near the equator where vitamin D3 synthesis is more efficient because of the higher flux of UVB photons are not (Thacher et al., 2006).

The direction at which the sun reaches the earth has a spectacular outcome on the number of UVB photons that reach the earth's surface. This is why when the peak angle is increased during the wintertime and in the early morning and late afternoon, little if any vitamin D3 synthesis occurs (Holick, 2003). The application of Purdah, whereby all skin is covered and prevented from being exposed to sunlight places those who practice it at high risk of vitamin D deficiency and explains why in the sunniest areas of the world vitamin D deficiency is very common in both children and adults. This includes both children and adults living in the United States, Europe, Middle East, India, Australia and Asia. These studies suggest that upwards of 30–50 % of children and adults are at risk of vitamin D deficiency (Reddy et al., 2005).

Aging is associated with decreased concentrations of 7-dehydrocholesterol, the forerunner of vitamin D3 in the skin (Venning, 2005). A 70-year-old has 25% of the 7-dehydrocholesterol that a young adult does and thus has a 75% reduced capacity to make vitamin D3 in the skin (Holick et al., 2004). Because vitamin D is fat soluble, it is easily taken up by fat cells. Obesity is associated with vitamin D deficiency, and it is believed to be due to the impounding of vitamin D by the large body fat pool (Wortsman et al., 2000). Medications including antiseizure medications and glucocorticoids and fat malabsorption are also common causes of deficiency (Zhou, 2006).

Vitamin D deficiency is now recognized as a pandemic. The major cause of vitamin D deficiency is the lack of appreciation that sun exposure in moderation is the major source of vitamin D for most humans (Chen et al., 2008).

[3]The sun protection factor of a sunscreen is a laboratory measure of the effectiveness of sunscreen — the higher the SPF, the more protection a sunscreen offers against UV-B (the ultraviolet radiation that causes sunburn). The SPF is the amount of UV radiation required to cause sunburn on skin with the sunscreen on, as a multiple of the amount required without the sunscreen during 1 hour.

1.7 Prevention and treatment of vitamin D deficiency

The Institute of Medicine recommended that all children (approved by the American Academy of Pediatrics as well) and adults up to the age of 50 year entail 200 IU vitamin D and adults aged 51–70 and 71 year need 400 and 600 IU vitamin D (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine, 1999). The National Osteoporosis Foundation lately recommended that all postmenopausal women take 800–1000 IU vitamin D. Cheng et al (2003), reported a connection of low 25(OH)D concentrations with high serum parathyroid hormone (PTH) concentrations and low cortical bone density in early pubertal and prepubertal Finnish girls. This confirmed the earlier observations of Outila et al (2001), who noted elevated PTH concentrations and lower forearm bone density and vitamin D deficiency in the winter in adolescent females. When 171 prepubertal girls were given 400 IU vitamin D2 from October to February and 500 mg Ca supplementation, their serum 25(OH)D concentrations did not change. However, when these girls received 800 IU vitamin D2, their blood concentrations increased during the winter but did not reach concentrations observed during the summer (Lehtonen-Veromaa et al., 2003). Consequently, lots of professionals at this instant concur that in the absence of adequate sun exposure, 800–1000 IU vitamin D is needed for children of all ages and adults of all ages, though this is not the current recommendation of pediatric or governmental organizations. Higher doses may be required if fat malabsorption, obesity, or other causes exist that would enhance vitamin D catabolism and its destruction (Holick, 2007). Data suggest that vitamin D2 was effective in raising blood concentrations of 25(OH)D by 1 ng/100 IU as has been reported for vitamin D3 (Heaney et al., 2003). These data are consistent with the observation that 1000 IU vitamin D2 which was as effective as 1000 IU vitamin D3 in raising and maintaining serum 25(OH)D concentrations (Holick and Biancuzzo, 2007). Therefore, measurement of 25(OH)D is the only means to determine whether a patient is vitamin D deficient or sufficient. The measurement of $1,25(OH)_2D$ is not only useless, but can mislead the physician because it is often either normal or even elevated when a patient is vitamin D deficient and has secondary hyperparathyroidism. Most commercial laboratories report that a 25(OH)D less than 10 ng/mL is synonymous with vitamin D deficiency. Most experts recommend that less than 20 ng/mL should be designated as vitamin D

deficiency (Souberbielle et al., 2003). To maintain a healthy level of 25(OH)D, the recommendation is that it should be above 30 ng/mL.

The easiest way to correct vitamin D deficiency is to fill up the empty vitamin D tank by giving the patient an oral dose of 50,000 IU of vitamin D once per week for 8 weeks. To maintain vitamin D sufficiency, the patient should receive either 50,000 IU of vitamin D once or twice per month thereafter. There is an intramuscular form of vitamin D that is usually not very bioavailable and can cause significant discomfort; therefore it is not recommended. However, in Europe, intramuscular injection of 500,000 IU of vitamin D twice per year has appeared to be effective in preventing vitamin D deficiency. A multivitamin containing 400 IU of vitamin D is inadequate to satisfy the body's requirement (Tangpricha et al., 2003). It is estimated that at least 1,000 IU of vitamin D per day is needed to satisfy the body's requirement (Heaney et al., 2003).

1.8 Prevalence of low vitamin D status during pregnancy

Vitamin D capability depends on both internal, UV-induced synthesis, and external sources, i.e., diet and supplements. At the beginning, vitamin D combination depends on the level of environment UV-B, with this in turn depending on latitude and altitude, time of the year and time of the day (Holick, 2004). For any UV-B level, vitamin D synthesis is after that contingent on the quantity of skin exposed, skin pigmentation, use of sun protection such as gloominess, sunscreen and probably other physical or host related factors (Matsuoka et al., 2006). The same as for other population groups, pregnant women living at high latitude and low altitude, with dark skin pigmentation or skin usually covered by clothing will be at increased risk of vitamin D deficiency (van der Meer et al., 2006). Moreover, since 25(OH)D is stored in adipose tissue, there is some evidence that obesity is a further risk factor for vitamin D insufficiency (Grover and Morley, 2001).

A brief review is made on the importance of (VDD) in various other disorders prevalent in equivalent proportions such as type 2 diabetes mellitus (DM), cardiovascular diseases (CVD), immune competence including relation to tuberculosis, malignancy and osteoarthritis. Studies in Isfahan of Iran had shown that

the prevalence of vitamin D deficiency is higher in pregnant women, high school children, and newborns (Hovsepian et al., 2011).

1.9 Indications for vitamin D testing

Measuring serum 25(OH)D levels is indicated in selected conditions. Measurement of 25(OH)D levels will confirm vitamin D deficiency if clinical symptoms of rickets in children or osteomalacia in adults are present. Such testing would be appropriate in adults or children with bone pain, elevated serum alkaline phosphatase or parathyroid hormone (PTH) levels, and low serum calcium or phosphorus levels. Aged People, those with osteoporosis, or those at increased risk of falling down or fractures may also benefit from measurement of 25(OH)D levels. On the other hand, one could argue that providing at-risk groups with routine supplementation of sufficient quantities of vitamin D may make testing for vitamin D insufficiency needless (Kennel et al., 2010).

1.10 Clinical manifestations of vitamin D deficiency

Absorption of calcium cannot be increased enough to satisfy the body's calcium needs in vitamin D deficiency (Holick, 2003).As a result, PTH produced by the parathyroid glands is increased and calcium is developed from the skeleton to maintain normal serum calcium levels; a state known as secondary hyperparathyroidism. Although it has long been known that severe vitamin D deficiency has serious consequences for bone health, recent research suggests that less evident states of vitamin D deficiency are common and increase the risk of osteoporosis and other health problems (Heaney, 2003, Zittermann, 2003).

1.10.1 Nutritional Rickets:

The most traditional symptom of vitamin D deficiency is nutritional rickets, which results from insufficient mineralization of budding bone. As a result, rickets is a disease of children which is sustainable to take place throughout the world, with reports from at least 60 countries in the past 20 years (Thacher et al., 2006). In a review of published cases of rickets in the United States, most occurred in children younger than 30 months (Weisberg et al., 2004). The immense majority of cases in the United States occurred in African American infants who were fed with breast

milk rather than formula. Florid rickets manifests with leg deformities; enlargement of the growth plates of the wrists, ankles, and costochondral junctions; and rib cage deformities. Subtle symptoms that should raise the clinical suspicion of rickets in children include bone pain in the legs, delayed age of standing or walking, frequent falling, and delayed growth. Hypocalcemic seizures in the first year of life may be the initial manifestation of rickets.

Knees and wrists radiography are necessary to confirm the diagnosis of rickets. Radiography demonstrates weakened mineralization of the development plates, evident by widening of the growth plate and fraying of the margin of the metaphyses (Thache et al., 2000). Biochemical features most consistently include hypophosphatemia and an elevated alkaline phosphatase level. As a result of vitamin D deficiency, serum concentrations of 25(OH)D are very low in patients with rickets, usually less than 5 ng/mL. However, concentrations of 25(OH)D may not be markedly reduced if rickets results from calcium deficiency or if the child has recently received vitamin D or sun exposure. In some hot countries, where sun exposure is plentiful, calcium deficiency is more important than vitamin D deficiency as a cause of rickets (Fischer et al., 1999, Thacher et al., 1999). However, even in the United States, only 22% of children with nutritional rickets had deficient levels of 25(OH)D, indicating that calcium deficiency as a cause of rickets needs to be considered domestically as well (DeLucia et al., 2003).

1.10.2 Osteomalacia:

Osteomalacia refers to the breakdown of organic osteoid shaped by osteoblasts to become mineralized with calcium and phosphorus and is generally used to describe the bone disease caused by vitamin D deficiency in adults, who no longer have growing bones. The clinical manifestations of these 2 conditions are different.

A characteristic feature of osteomalacia is pain in bone, and it can be perplexed with arthritis or fibromyalgia. Bone pain caused by osteomalacia mostly affects the bones among the joints, while arthritis usually causes predominantly joint pain, and fibromyalgia causes more disperse muscle and soft tissue pain; however, it can be difficult to distinguish between these disorders. Because the growth plates have closed in adults, the radiographic features differ from those typical of rickets. Radiography may disclose pseudofractures of the pelvis, femurs, metatarsals, or

lateral margins of the scapulae. The biochemical features of osteomalacia are similar to those of rickets, with increased serum alkaline phosphatase and PTH values, and low calcium, phosphorus, and 25(OH)D values in most cases. A review of all the archived cases of bone biopsy–proven osteomalacia seen by the Bone Histomorphometry Laboratory at Mayo Clinic concluded that radiographic examination as well as serum calcium, phosphorus, and alkaline phosphatase assays are adequate screening tests in patients who have a clinical presentation suggestive of osteomalacia, but that 25(OH)D values may be normal (Bingham and Fitzpatrick, 1993).

In a cross-sectional study of iliac bone biopsy specimens obtained at autopsy, an excess accumulation of osteoid, which corresponds with histological osteomalacia, was found only in patients with 25(OH)D values less than 25 ng/mL (Priemel, von Domarus, Klatte et al., 2010). However, even patients with very low values of 25(OH)D did not consistently have evidence of osteomalacia.

1.10.3 Muscle weakness and pain:

Vitamin D deficiency triggers muscle weakness and pain in children and adults. Muscle pain and weakness were prominent symptoms of vitamin D deficiency in a study of Arab and Danish Moslem women living in Denmark (Bringhurst et al., 2003). In a cross-sectional study of 150 consecutive patients referred to a clinic in Minnesota for the assessment of constant, nonspecific musculoskeletal pain, 93% had serum 25-hydroxyvitamin D levels symptomatic of vitamin D deficiency (Plotnikoff, 2003).A randomized controlled trial found that supplementation of elderly women with 800 IU/day of vitamin D and 1,200 mg/day of calcium for three months increased muscle strength and decreased the risk of falling by almost 50% compared to supplementation with calcium alone (Bischoff, Stahelin and Dick et al., 2003). Further lately, a randomized controlled trial in 124 nursing home residents (average age, 89 years) found that those taking 800 IU/day of supplemental vitamin D had a 72% lower fall rate than those taking a placebo (Broe et al., 2007).

1.11 Risk factors for vitamin D deficiency

1.11.1 Breast-fed infants:

Infants who are completely breast-fed and do not receive vitamin D supplementation are at high risk of vitamin D deficiency, particularly if they have dark skin and/or receive little sun exposure (Wagner, Greer and the Section on the American Breastfeeding and Committee on Nutrition, 2008).Human milk generally provides 25 IU of vitamin D per liter, which is not enough for an infant if it is the sole source of vitamin D. Older infants and children exclusively fed milk substitutes and weaning foods that are not vitamin D prepared are also at risk of vitamin D deficiency (Wharton and Bishop, 2003). The American Academy of Pediatrics recommends that all breast-fed and partially breast-fed infants be given a vitamin D supplement of 400 IU/day (Wagner, Greer and the Section on the American Breastfeeding and Committee on Nutrition, 2008).

1.11.2 Dark skin:

People with light-colored skin synthesize more vitamin D on exposure to sunlight than those with dark-colored skin (Holick, 2004). The risk of vitamin D deficiency is particularly high in dark-skinned people who live far from the equator. A. study conducted in the U.S reported that 42% of African American women between 15 and 49 years of age were vitamin D deficient compared to 4% of white women (Nesby-O'Dell et al., 2002).

1.11.3 Aging:

Elderly people have reduced capacity to synthesize vitamin D in skin when exposed to UVB radiation, and the elderly are more likely to stay indoors or use sunscreen, which blocks vitamin D synthesis. Adults who are not extended with vitamin D are at tremendously high risk of vitamin D deficiency (Harris et al., 2000, Allain and Dhesi, 2003).

1.11.4 Covering all exposed skin or using sunscreen whenever outside:

Osteomalacia has been documented in women who cover all of their skin whenever they are outside for religious or cultural reasons (Dawodu et al., 2003 & (Glerup et

al., 2000). The application of sunscreen with the sun protection factor (SPF) of 8 reduces production of vitamin D by 95% (Holick, 2004).

1.11.5 Fat malabsorption syndromes:

Cystic fibrosis and cholestatic liver disease impair the absorption of dietary vitamin D (Food and Nutrition Board, Institute of Medicine, USA, 1999).

1.11.6 Inflammatory bowel disease:

People with inflammatory bowel disease like Crohn's disease appear to be at increased risk of vitamin D deficiency, especially those who have had small bowel resections (Jahnsen et al., 2002).

1.11.7 Liver dysfunction and kidney disease:

In cases of liver dysfunction, the hepatic enzymes that catalyze the first hydroxylation of cholecalciferol may be inhibited. Additionally, kidney disease or dysfunction leads to an inability of the kidneys to effectively convert vitamin D into its active form. Certain medications may also block the uptake of vitamin D from the gastrointestinal tract (Griffin et al., 2003).

1.11.8 Parathyroid hormone:

PTH increases the activity of 1-α-hydroxylase enzyme, which converts 25-hydroxycholecalciferol to 1,25-dihydroxycholecalciferol, the active form of vitamin D (Walter, 2003).

1.12 Problem statement

Until the present time, no data or information are available on Palestinian women's knowledge of vitamin D deficiency. Vitamin D deficiency has been a matter of debate in Palestine in the last years, especially in pregnant women. It is well known that vitamin D deficiency leads to many diseases such as rickets, osteomalacia, skin pigmentation and other diseases. According to the investigator's knowledge, there are few studies in Palestine that have investigated deficiency of vitamin D but lack of studies about awareness of pregnant women; such information are few and provide conflicting results. Out of 460 cases who had lab testing in 2009 and 2010, there were

236 cases who had vitamin D deficiency, therefore it was encouraging to assess the pregnant women awareness of vitamin D deficiency in private clinics in Ramallah district.

1.13 Justification and significance of the study

The Palestinian health care system is a mixture of governmental, non-governmental, United Nation Relief and Work Agency (UNRWA) and private (profit and non-profit) services delivery. These health providers are providing over lapping health in services, and none of these sectors can provide comprehensive health services (Mataria et al., 2004). Insignificant information denotes and discusses the deficiency of vitamin D in these health sectors. Given that such data could put forward managers' insight to better direct strategies for improving awareness of pregnant women. Therefore, this study was conducted to provide and to assess pregnant women awareness of VDD. Such study has never been conducted before in the West Bank according to investigator's knowledge and the outcome is expected to be used by policy makers and planners to realize the importance of vitamin D and awareness of the society.

Vitamin D deficiency in pregnancy is associated with neonatal hypocalcaemia and childhood nutritional rickets (Specker, 2004). Furthermore, there are reports that vitamin D deficiency may also be linked to significant pregnancy complications including pre-eclampsia (Bondar et al., 2007), gestational diabetes (Zhang , Qiu , Hu et al., 2008), and first trimester bacterial vaginosis (Bondar et al., 2009). In pregnancy, low vitamin D status or intake is detrimental to mother and fetus and predisposes to VDD in early infancy (Mulligan et al., 2009). In Pakistan, 23 women out of 50 women having deficiency of vitamin D, which means 46% of these cases are suffering from vitamin D deficiency, so, vitamin D deficiency is high among pregnant urban Pakistani women and their newborns. There was a positive correlation between the vitamin D levels in maternal and cord blood ($r=0.03$; $P<0.003$). This public health problem needed urgent awareness (Karim et al., 2011). There is growing concern that VDD during pregnancy and from birth through childhood is a global public health issue, but the magnitude is not well described. In view of new knowledge of possible multiple adverse health effects of low vitamin D

status, it is appropriate and timely to review the scale of VDD in mothers and re-examine the strategies for prevention (Institute of Medicine, 2011).

In the last 2 years, it was seen that many of pregnant women were suffering from vitamin D deficiency during pregnancy (Medicare Medipal, 2010-2012). Moreover, the Ministry of Health has identified the need to establish nutritional surveillance of the population; there are pockets in Gaza of rickets in young children and osteomalacia in mothers, probably due to a vitamin D deficiency (Palestinian Ministry of Health, 2005).

Therefore this study will assess the pregnant women awareness in the 8 private women's clinics in Ramallah district.

1.14 Aim of the study

To assess pregnant women's awareness of vitamin D deficiency in eight (8) private clinics in Ramallah district in order to identify groups most in need of education and improve their healthcare.

1.15 General objectives of the study

1. To identify women's demographic characteristics who had vitamin D deficiency and who attend the private clinics.
2. To assess the knowledge of pregnant women about vitamin D deficiency.
3. To assess the relationship between women's characteristic and demographic variables and their awareness about vitamin D deficiency.
4. To identify the most useful sources of information about VDD among this population.

1.16 Research questions

To understand the problem being addressed, this study answers the following questions:

1. What are the factors that affect pregnant women's awareness of vitamin D deficiency in Ramallah district?
2. Is there a significant relationship between pregnant women's awareness of vitamin D deficiency and the independent variables (age, education, income, number of children, life style and nutrition, history of vitamin D deficiency, wearing veil, and skin tones).

1.17 Hypotheses of the Study

1. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and age.
2. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and level of education.
3. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and income.
4. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and number of children.
5. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and skin tones.
6. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and exposure to sunlight.
7. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and wearing veil.
8. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and intake cod liver oil.
9. There is no significant relationship at $P<0.05$ between pregnant women's awareness of vitamin D deficiency and history of vitamin D deficiency.

1.18 Summary

This introductory chapter provided a synopsis about the importance of vitamin D. This chapter encompassed sources of vitamin D, causes of vitamin D deficiency, mechanisms of action of vitamin D, prevention and treatment of vitamin D deficiency and assessing vitamin D status. Also, this chapter included background information about the significance and justification of the study. The overall goal, aim, general objectives were also stated.

Chapter Two: Literature review

2.1 Introduction

This chapter reviews national and international studies conducted in the area of assessment of awareness of pregnant women of vitamin D deficiency. A comprehensive search was employed to uncover theoretical and research work related to the study concepts. Internet search, previous master thesis, books and journals were reviewed in regard to pregnant women awareness of vitamin D deficiency. Search failed to find out core rich local studies, but succeeded to find international published studies similar to this study.

2.2 Historical perspective

The researcher selected studies with the strongest level of evidence for clinical decision making related to vitamin D and health outcomes of the vitamin D literature and from a search of the PubMed database and other websites using the term vitamin D in combination with the following terms related to the potential issues; sources of vitamin D, causes of vitamin D deficiency, mechanisms of action of vitamin D, prevalence of low vitamin D status during pregnancy, assessing vitamin D status, indications for vitamin D testing, clinical manifestations of vitamin D deficiency.

The Nobel prize for chemistry for the year 1928 was awarded to Adolf Windaus "for his studies on the creation of the sterols and their connection with vitamins"; the first person to receive an award mentioning vitamins (Farber, 1953).

The way to the detection of vitamin D began with recognition of the babyhood bone disease of rickets. The initial official medical dissertation on rickets was published by Francis Glisson in 1650, when it was identified as a new disease that was more frequent in the rich than in the poor(Thacher and Clarke,2011). Numerous causes and medications for rickets had been proposed. Although cod-liver oil had been used medicinally for a long time, Scheutte, in 1824 was the first to prescribe it for the treatment of rickets. It was not until 1906 that Hopkins put forward the subsistence of necessary nutritional factors essential for the prevention of diseases such as scurvy or rickets when it was identified as a new disease that was more frequent in the rich than in the poor (Hopkins, 1906). During the industrial revolution of the 1800s, the prevalence of rickets increased dramatically, ranging from 40% to 60% among

children in crowded and polluted urban areas. In 1822, Sniadecki was the first to recognize and report the association of rickets with a lack of sunlight exposure. By the mid-1800s, cod liver oil had been established as an effective treatment for rickets. The work of Mellanby and McCollum led to the discovery of vitamin D as the agent in cod liver oil that had antirachitic properties. This discovery eventually led to the fortification of milk and other foods with vitamin D in the 1930s, and as a result rickets all but disappeared in North America and Europe (Thacher and Clarke, 2011). To date, much of the data on vitamin D deficiency in pregnancy have derived from high-risk populations, in particular those with darker skin or limited skin sun exposure. Such data have led to calls for pregnant women, especially those who are dark-skinned or veiled, to be screened and treated for vitamin D deficiency (Munns et al., 2006). This is still not a routine practice in many areas.

2.3 Previous studies

A cross-sectional face-to-face survey using a piloted questionnaire was conducted by Varnam and Alemu (2012) in order to identify groups most in need of education and to assess the level of awareness of vitamin D deficiency among consecutive at risk patients without a diagnosis of vitamin D deficiency arriving at a large inner city general practice in the North West of England over a five day period from 1st of June 2009 to 5th of June 2009. Conclusions of this study highlighted the existence of differences in awareness of vitamin D deficiency among men and women whilst age playing a significant role. Thus, a concerted collaboration is required amongst the health care providers and others such as community members to promote the awareness and bridge this gap.

In their study, Pirrone et al (2013), a convenient sampling study was conducted with women living in particular high-rise public housing. Five focus group discussions were conducted (n=30). Thematic analysis was used to code and categorize the data to develop a deeper, conceptual understanding of the issue. Researchers found that participants were aware of VDD and could identify the impacts that VDD had on their health. Barriers to addressing VDD included the women's: 1) living conditions in Australia, 2) risk of skin cancer, and 3) cultural roles in the family. The most positive strategy for preventing and addressing VDD was peer information sharing. This study has highlighted the significant need for health promotion strategies to

combat VDD in this population. Future health promoting public health strategies for this population should encompass community-based peer education programs. This study demonstrates the critical role of qualitative inquiry in gaining a deeper understanding of VDD in a particular migrant community. It is clear that this issue requires a coordinated solution that must involve the community themselves. Health care professionals must take into consideration the multiple barriers that exist to address VDD which is a significant public health issue.

Brand et al (2008) had conducted a qualitative exploratory study that was undertaken by an acute and community care partnership group based in the City of Melbourne and City of Moonee Valley areas, Victoria, Australia. Community-dwelling people 18 years or more who were dark-skinned or veiled participated. A trained facilitator used semi-structured questions to explore awareness of vitamin D deficiency, knowledge about risks and barriers to risk management (to investigate socio-cultural barriers and enablers to reducing risk of vitamin D deficiency among dark-skinned and veiled community groups in a Melbourne metropolitan area). Discussion was summarized and dominant themes extracted. Results determined that there were gender differences in awareness of risk. Men were unaware or considered themselves not to be at risk of vitamin D deficiency. Cultural issues influenced access to, and sourcing of, health information. In particular, community opinion leaders and use of local media such as radio were considered important avenues for knowledge transfer in addition to health care providers. Relocation from community settings in Africa to the built environment of Melbourne was reported to inhibit safe, comfortable and culturally appropriate access to sun exposure. Access to, and sustained use of vitamin D supplementation was limited by financial constraints. Conclusion recommended a comprehensive health promotion response that includes health provider and community partnerships is required to meet the complex needs of these communities.

A focus group using a convenience sample of 17 female students and eight in depth one-to-one semi-structured interviews were conducted and analysed using thematic analysis in Prince Sultan University, Saudi Arabia, by Christie and Mason, 2011, with the aim was to investigate the knowledge, attitude and practice (KAP) towards vitamin D deficiency, sun exposure, supplementation and fortification in a sample of female Saudi Arabian students. Results demonstrated that participants were limited in their knowledge about vitamin D and vitamin D deficiency. They reported limited sun exposure due to intense heat, cultural reasons for covering the body, and an

infrastructure that makes sun exposure difficult. The study concluded important barriers for the prevention of vitamin D deficiency in Saudi Arabia were highlighted. Recommendations for more research in specific areas including the prevalence of vitamin D deficiency and recommended daily allowances of supplementation are made. Governmental actions including increasing awareness of the importance of vitamin D and guidelines on how to obtain it are necessary. Creating areas where women, particularly those of lower socio-economic status, can enjoy sun exposure as well as fortifying more foods would go some way towards tackling this problem.

A case-referent design study was conducted by Brunvand et al (1998) to determine whether vitamin D deficiency is common among pregnants in Pakistan and to test the hypothesis that vitamin D deficiency in nulliparous pregnant women is associated with mechanical dystocia. The results demonstrated that mothers with obstructed labor were shorter (on average 150 vs. 155 cm, p= 0.0001) and lighter (on average 58 vs. 60.5 kg, p= 0.005) than their referents. Seventy-one percent of all the participants had marginal or low vitamin D status defined as serum level of calcidiol (25-OH vitamin D3) below 30 nmol/l. Vitamin D deficiency was, however, not more widespread among the mothers with obstructed labor (20/37 vs. 63/80). Furthermore, there were no significant differences in the serum levels of the carboxyterminal telopeptide of type I collagen, a sensitive biochemical marker of bone resorption, (7.2 vs. 6.6 microg/l), and bone specific alkaline phosphate (18.1 vs. 22.0 U/l) a sensitive marker of bone formation. This study concluded that vitamin D deficiency in pregnancy is common in Karachi, but is not associated with mechanical dystocia.

In a cross-sectional study conducted by Ostad Rahimi et al (2006), on 252 reproductive, 15-49 year old women of the city of Tabriz randomly selected from among the general population. The results indicated that vitamin D deficiency in women was as follows: severe vitamin D deficiency 15.1%, moderate deficiency 15.5%, and mild deficiency 33.7%. Of these women 3.7% were underweight and 59.8% had different stage of obesity. Only 37.5% had BMI within normal range. There was a significant correlation between serum levels of vitamin D and weight and age (r=0.16, p=0.01 and r=0.19, p=0.003). There was no significant association between BMI and serum vitamin D level. Conclusions denoted that vitamin D

deficiency is prevalent in the women of Tabriz. No relationship was found between vitamin D and nutritional status. Therefore, interventions such as education and sun exposure are recommended for the health promotion of these women.

A study conducted by Larson (2011) was designed to highlight the unique rural women's circumstance surrounding health literacy about vitamin D. A sample of 400 women was randomly selected for the mailed survey, yielding a response rate of 41.2% (n = 126). The results showed that the majority of the participants had (a) marginal health literacy about vitamin D, (b) took widely varying amounts of vitamin D, (c) and got their information about vitamin D from their primary care provider, their most trusted source, and (d) reported access to health care services as easy. No significant relationship between access to services and vitamin D health literacy was found. The relationship between vitamin D health literacy and self-efficacy for health promotion was the only factor that showed significance. The study has implications for additional research about the relationship between self-efficacy for health promotion and health literacy of rural women. Additionally, research into rural women's relationships with their primary health care providers, may, in turn, improve rural women's health literacy. Implications for nurses include the importance of (a) obtaining histories about vitamin supplement dosages, (b) providing education about vitamin D; (c) addressing vitamin D and cardiovascular health, (d) and addressing rural women's health literacy needs verbally and through appropriately written material.

A simple descriptive cross-sectional design was carried out in two PHC centers by Al Bathi et al (2012). Two hundred patients were selected randomly from a list of all registered patients in the selected centers. Objective was to explore knowledge, attitude and practice of patients receiving vitamin D supplement and attending primary health care (PHC) in Kuwait. Results revealed only 28.5% of participants were aware about their condition, 53.5% related pain to vitamin D deficiency, and 33.5% knew the presence of relation between vitamin D deficiency and joint pain. One third of the participants received the loading dose of vitamin D, and, 17.5% had the maintenance dose. Only 21.0% believed that they feel better regarding musculoskeletal symptoms after taking treatment doses and 12.5% of the participants knew that the level of vitamin D dropped again after stopping medication. Only

29.5% knew the relation between vitamin D and other diseases. The majority of patients (85.5%) agreed about the importance of sunshine as a source of vitamin D and 60.0% thought that they can get vitamin D from the nutrients. Regarding the main sources of knowledge about vitamin D, 40.5 % of patients got knowledge from physicians, 12.5% from the media, 29.0% from relatives and friends, 8.5% from background information and 9.5% from journals and magazines. Conclusions reported that the majority of the study participants had limited knowledge, poor practices, and negative attitude toward vitamin D problems. Planning health education interventions for this group of patients are essential.

Zhuang et al (2012) had conducted a study in China to determine the relationship between maternal and neonatal vitamin D status and related factors. Serum 25-(OH)D levels were measured by ELISA in 499 pregnant women at 30-37 weeks gestation and in cord blood of their infants born at term (37-42 weeks gestation) in Southeastern China at 28.9°N latitude. One-way analysis of variance (ANOVA) was used to explore maternal and neonatal vitamin D levels by season. Pearson linear and linear regression of partial correlation was used to analyze the relationship between maternal and neonatal 25-(OH) D levels. Serum 25-(OH)D < 50 nmol/L was shown in 88.8% of mothers and 91.2% of their neonates. Both maternal and neonatal 25-(OH)D levels varied with season (P = 0.000). Vitamin D level was the lowest in spring, with the 25-(OH)D concentration < 50 nmol/L in 98.6% of mothers and 99.3% of their neonates. The highest vitamin D level was presented in fall, but there were still 64.0% of mothers and 75.0% of neonates with 25-(OH)D < 50 nmol/L. Except for season, calcium-vitamin D supplement and intake of egg ≥ 600 g per week during pregnancy benefited to improve maternal vitamin D level [25-(OH)D ≥ 50 nmol/L] [OR = 2.3 (95%CI:1.0, 5.3), 3.4 (95%CI:1.2, 9.9) respectively]. There was a positive correlation between maternal and neonatal 25-(OH)D measures in the sample as a whole (r = 0.45, P = 0.000, N = 499), the correlation was of no statistical significance when maternal serum 25-(OH)D was ≤ 25 nmol/L. Conclusions revealed that hypovitaminosis D was common in late pregnant mothers and their newborns in southeastern China, especially in spring. Vitamin D supplement and intake of vitamin D-rich food were beneficial to improvement of maternal vitamin D level. There was a moderate and positive correlation between maternal and neonatal 25-(OH)D

concentrations in this population. The correlation was lost when maternal serum 25-(OH)D ≤ 25 nmol/L.

A cross-sectional observation study by Dror et al, conducted between December 2006 and February 2008 was to identify associations between observed and measured maternal characteristics and vitamin D status at term in pregnant women and their infants in a multiethnic community in Oakland, CA, USA. Two hundred seventy-five pregnant women aged 18 to 45 years and carrying a singleton fetus were recruited and data from 210 mother-infant pairs were included in analyses. Analysis of covariance identified predictors of maternal and cord serum 25-hydroxyvitamin D [25(OH)D] in a multivariate model considering vitamin D intake, lifestyle factors, and skin pigmentation. Maternal serum 25(OH)D was significantly associated with season of delivery (P=0.0002), average daily D intake (P=0.0008), right upper inner arm pigmentation (P=0.0035) and maternal pre- or early-pregnancy body mass index (calculated as kg/m²) (P=0.0207). The same factors were significant for cord serum 25(OH)D, which was highly correlated with maternal serum 25(OH)D (r=0.79; P<0.0001). During the year, 54% of mothers and 90% of neonates had 25(OH)D <30 ng/mL (<75 nmol/L). Of women taking daily prenatal vitamin/mineral supplements (400 IU vitamin D), 50.7% had serum 25(OH)D <30 ng/mL (<75 nmol/L). In conclusion, 25(OH)D <30 ng/mL (<75 nmol/L) was prevalent in mothers and neonates across racial groups and seasons, and vitamin D status was associated with both modifiable and nonmodifiable risk factors.

Vandevijvere et al conducted a multi-stage proportionate-to-size stratified sampling design study with the aim to estimate the prevalence of vitamin D deficiency among Belgian pregnant women and to assess the determinants of vitamin D status in the first and third trimester of pregnancy from September 2010 to June 2011. Blood samples were collected and a questionnaire was completed face-to-face. The median serum 25-hydroxyvitamin D [25-(OH)D] concentration was significantly lower in the first trimester (20.4 ng/ml) than in third trimester (22.7 ng/ml). Of all women, 74.1% (95%CI = 71.8–76.5%) were vitamin D insufficient (25-(OH)D <30 ng/ml), 44.6% (95%CI = 41.9–47.3%) were vitamin D deficient (25-(OH)D <20 ng/ml), while 12.1% (95%CI = 10.3–13.8%) were severely vitamin D deficient (25-(OH)D <10

ng/ml). Of all women included, 62.0% reported taking vitamin D-containing multivitamins, of which only 24.2% started taking those before pregnancy. The risk of vitamin D deficiency (25-(OH)D <20 ng/ml) was significantly higher for less educated women and women who reported not going on holidays to sunny climates. The risk of severe vitamin D deficiency (25-(OH)D <10 ng/ml) decreased for women who reported alcohol consumption during pregnancy, decreased with more frequent use of sunscreen lotion and increased for smokers and women who reported preference for shadow. In conclusion, vitamin D deficiency is highly prevalent among pregnant women in Belgium and this raises concerns about the health consequences for the mother and the offspring. A targeted screening strategy to detect and treat women at high risk of severe vitamin D deficiency is needed in Belgium and in Europe.

A study conducted in Turkey within the period March to May 2008 was carried out by Halicioglu et al, in order to measure serum 25-hydroxyvitamin D3 [25(OH)D] concentrations of the pregnant women in the last trimester and in their neonates at delivery and to determine the factors associated with maternal serum 25(OH)D concentrations. Among the patients visiting the Ege Obstetrics and Gynecology Hospital, 258 healthy pregnant women ≥37 weeks of gestation were included in this study. Blood samples from the mothers and umbilical cord of the newborns were taken to measure 25(OH)D. The mean 25(OH)D concentrations of the mothers and their infants were 11.5 ± 5.4 ng/mL and 11.5 ± 6.8 ng/mL, respectively. A strong positive correlation was found between maternal serum and umbilical cord blood 25(OH)D concentrations ($r = 0.651$, $P < 0.001$). The concentration of 25(OH)D was ≤ 20 ng/mL in 233 mothers (90.3%) and ≤10 ng/mL in 130 mothers (50.4%). Maternal serum 25(OH)D concentrations related strongly to factors such as uncovered dressing style, sufficient consumption of dairy products and multivitamin use during gestation ($P < 0.05$). About half (52.7%) of these women had a covered dressing style. 25(OH)D concentrations of these covered dressing mothers and their infants were 9.7 ± 5.1 ng/mL and 9.7 ± 5.6 ng/mL, respectively, which were significantly lower compared with those of uncovered mothers and their babies ($P < 0.001$). This study showed that, despite a sunny environment, vitamin D deficiency and insufficiency are highly prevalent among the mothers and their neonates. This is generally due to the

life style and nutritional status of the mothers. These findings suggest that much more effective vitamin D prophylaxis programmes should be implemented for pregnant women as well as for their babies.

Al-Mutairi et al (2012) had presented a study constituted of two main parts. First part comprised a questionnaire-based survey of representative group of people aged 18 and above with the aim to assess their knowledge, awareness and attitude towards sun protection and, also study the correlation of the level of sun protective measures used and vitamin D levels in these groups. The second part consisted of measuring serum vitamin D levels in 150 volunteers amongst the responders of the questionnaire, who had been regularly using sunscreens for at least 2 years and compare to the levels seen in 150 age and sex-matched responders of similar skin phototypes, who had never used sunscreens. Results showed out of the total of 1044 responders, 80% of them had adequate knowledge of the beneficial and harmful effects of sun exposure, and had been using sunscreens regularly, and adopting other sun protective measures in their daily life. The levels of vitamin D were found to be deficient in both sunscreen users and those who had never used sunscreens. The difference between the two groups was statistically insignificant (60.67%vs.54.67%; *P* value>0.001). Conclusion determined that population at large seems to be adequately informed about the beneficial and deleterious effects of sun exposure. Vitamin D levels are deficient in majority of this population, and there is a need to do larger surveys covering all parts of the country and give supplemental doses of vitamin D to those found deficient.

Bondar et al (2010) had carried out a nested case-control study of nulliparous pregnant women with singleton pregnancies to elucidate the association between maternal serum 25-hydroxyvitamin D [25(OH)D] concentrations in early pregnancy and the risk of small-for-gestational age birth (SGA) and explore the association between maternal single nucleotide polymorphisms (SNP) in the vitamin D receptor (VDR) gene and the risk of SGA. Women were followed from <16 week gestation to delivery. Women's banked sera at <22 week were newly measured for 25(OH)D and DNA extracted for VDR genotyping. SGA was defined as live-born infants that were <10th percentile of birth weight according to nomograms based on gender and gestational age. After confounder adjustment, there was a U-shaped relation between

serum 25(OH)D and risk of SGA among white mothers, with the lowest risk from 60 to 80 nmol/L. Compared with serum 25(OH)D 37.5–75 nmol/L, SGA odds ratios (95% CI) for levels <37.5 and >75 nmol/L were 7.5 (1.8, 31.9) and 2.1 (1.2, 3.8), respectively. There was no relation between 25(OH)D and SGA risk among black mothers. One SNP in the VDR gene among white women and 3 SNP in black women were significantly associated with SGA. The results suggest that vitamin D has a complex relation with fetal growth that may vary by race.

A randomized controlled trial in population in which vitamin D deficiency is endemic was carried out by Dawodu et al (2013) with the objective of the study was to demonstrate effectiveness and safety of prenatal 2000 IU and 4000 IU/d compared with 400 IU/d vitamin D3 supplementation. Arab women were randomized at 12–16 weeks of gestation to 400, 2000, and 4000 IU/d vitamin D3, which were continued to delivery. Serum 25-hydroxyvitamin D [25(OH)D] concentrations were measured during pregnancy and at delivery. The primary outcome was the maternal and cord blood 25(OH)D, and the secondary outcomes were the achievement of sufficient serum 25(OH)D of 32 ng/mL or greater (≥80 nmol/L) at delivery. The locations were primary care and tertiary prenatal care centers. Results denoted that of 192 enrolled, 162 (84%) continued to delivery. Mean serum 25(OH)D of 8.2 ng/mL (20.5 nmol/L) at enrollment was low. Mean serum 25(OH)D concentrations at delivery and in cord blood were significantly higher in the 2000 and 4000 IU than the 400 IU/d group ($P <$ .001) and was highest in the 4000 IU/d group. The percent who achieved 25(OH)D greater than 32 ng/mL and greater than 20 ng/mL concentrations in mothers and infants was highest in 4000 IU/d group. Safety measurements were similar by group and no adverse event related to vitamin D supplementation. Conclusions determined that vitamin D supplementation of 2000 and 4000 IU/d appeared safe in pregnancy, and 4000 IU/d was most effective in optimizing serum 25(OH)D concentrations in mothers and their infants. These findings could apply to other populations in which vitamin D deficiency is endemic.

A systematic review and meta-analysis was conducted by Aghajafari et al (2013) to assess the effect of 25-hydroxyvitamin D (25-OHD) levels on pregnancy outcomes and birth variables. Study selection was on studies reporting on the association between serum 25-OHD levels during pregnancy and the outcomes of interest (pre-

eclampsia, gestational diabetes, bacterial vaginosis, and caesarean section, small for gestational age infants, birth weight, birth length, and head circumference). Results determined that 3357 studies were identified and reviewed for eligibility. 31 eligible studies were included in the final analysis. Insufficient serum levels of 25-OHD were associated with gestational diabetes (pooled odds ratio 1.49, 95% confidence interval 1.18 to 1.89), pre-eclampsia (1.79, 1.25 to 2.58), and small for gestational age infants (1.85, 1.52 to 2.26). Pregnant women with low serum 25-OHD levels had an increased risk of bacterial vaginosis and low birth weight infants but not delivery by caesarean section. Conclusion revealed that vitamin D insufficiency is associated with an increased risk of gestational diabetes, pre-eclampsia, and small for gestational age infants. Pregnant women with low 25-OHD levels had an increased risk of bacterial vaginosis and lower birth weight infants, but not delivery by caesarean section.

An observational cohort study conducted in 12 U.S. medical centers from 1959 to 1965 by Gernandet al (2013) measured maternal 25(OH)D in mothers from the Collaborative Perinatal Project, with an objective to examine the association between maternal 25-hydroxyvitamin D [25(OH)D] levels and measures of newborn and placental weight. Main outcome measures were birth weight, ponderal index, placental weight, the placental to fetal weight ratio, and small for gestational age were measured. Results showed that after confounder adjustment, mothers with 25(OH)D of 37.5 nmol/liter or greater gave birth to newborns with 46 g [95% confidence interval (CI), 9–82 g] higher birth weights and 0.13 cm (0.01–0.25 cm) larger head circumferences compared with mothers with less than 37.5 nmol/liter. Birth weight and head circumference rose with increasing 25(OH)D up to 37.5 nmol/liter and then leveled off ($P < 0.05$). No association was observed between 25(OH)D and ponderal index, placental weight, or the placental to fetal weight ratio. Maternal 25(OH)D of 37.5 nmol/liter or greater *vs.* less than 37.5 nmol/liter in the first trimester was associated with half the risk of small for gestational age (adjusted odds ratio 0.5; 95% CI 0.3–0.9), but no second-trimester association was observed. Conclusions determined that maternal vitamin D status is independently associated with markers of physiological and pathological growth in term infants. Adequately powered randomized controlled trials are needed to test whether maternal vitamin D supplementation may improve fetal growth.

A systematic literature search was performed in Pubmed for relevant English language publications published until October 2011 with the aim to assess the studies that evaluated the relationship between vitamin D and fertility in women and men as well as in animals. Results showed that the vitamin D receptor (VDR) and vitamin D metabolizing enzymes are found in reproductive tissues of women and men.VDR knockout mice have significant gonadal insufficiency, decreased sperm count and motility, and histological abnormalities of testis, ovary and uterus. Moreover, evidence presented that vitamin D is involved in female reproduction including IVF outcome (clinical pregnancy rates) and polycystic ovary syndrome (PCOS). In PCOS women, low 25-hydroxyvitamin D (25(OH)D) levels are associated with obesity, metabolic, and endocrine disturbances and vitamin D supplementation might improve menstrual frequency and metabolic disturbances in those women. Moreover, vitamin D might influence steroidogenesis of sex hormones (estradiol and progesterone) in healthy women and high 25(OH)D levels might be associated with endometriosis. In men, vitamin D is positively associated with semen quality and androgen status. Moreover, vitamin D treatment might increase testosterone levels. Testiculopathic men showed low CYP21R expression, low 25(OH)D levels, and osteoporosis despite normal testosterone levels.

van der Meer et al (2006) had carried a study to ascertain the prevalence of vitamin D deficiency in pregnant women of several ethnic backgrounds who were living in The Hague, a large city in the Netherlands. The women were grouped ethnically as Western, Turkish, Moroccan, and other non-Western. The results showed that the vitamin D concentrations of 358 women were found in the women's files. Of these women, 29% were Western, 22% were Turkish, and 19% were Moroccan. Mean serum 25(OH)D concentrations in Turkish (15.2-12.1 nmol/L), Moroccan (20.1-13.5 nmol/L), and other non-Western women (26.3-25.9 nmol/L) were significantly (P=0.001) lower than those in Western women (52.7-21.6 nmol/L). Serum 25(OH)D was below the detection limit in 22% of the Turkish women. The differences between ethnic groups were not confounded by other determinants such as age, socioeconomic status, or parity. Conclusions determined that the prevalence of vitamin D deficiency in pregnant non-Western women in the Netherlands is very high, and screening should be recommended.

A prospective Irish observational study examined maternal and infant nutritional supplement use in Dublin (during 2004-2006), 450 eligible mothers were followed up at 6 weeks and 6 months postpartum. Only 200 women (44.4%) complied with periconceptional folic acid at the recommended time with strong social patterning associated with its uptake. Almost 10% of the sample (n=44) consumed a combined multivitamin and mineral supplement during pregnancy. A vitamin D-containing supplement was provided to only 5 (1.1%) and 15 (3.3%) infants at 6 weeks and 6 months, respectively. A national guideline that advises on adequate and safe use of both vitamin and multivitamin supplements during pregnancy with particular reference to vitamin A and D is warranted. Given the re-emergence of rickets in Ireland, and the reported morbidities associated with vitamin D insufficiency, promoting and monitoring compliance with 200 IU [5 microg] daily vitamin D supplements to all infants particularly those from higher risk groups from birth to 1 year, should be a public health priority.

A retrospective hospital based study was carried out by ELidrissy in Medina Maternity and Children Hospital (MMCH) in Saudi Arabia with the aim to confirm the hypothesis that maternal deficiency of vitamin D is a major factor in development of rickets in breastfeeding infant. In the period of six months from October 2008 to March 2009, about 136 cases of rickets were diagnosed clinically and biochemically, but for evaluating the vitamin D status of the breastfeeding mothers, 40 pairs of rachitic infants and their mothers were selected to evaluate and compare their vitamin D status. Blood samples were collected from mothers and breast fed babies who were admitted to hospital with their mothers or seen in the clinic. Also, radiography of the right wrist was done for all infants to confirm the status of rickets being active or healed. On comparing parathormone (MPTH) in mothers and children (CPTH) with active rickets and healed rickets, MPTH was 94.8 and CPTH 199.9, this was considered significant at P value.0104. As for children with healed rickets and their mother's PTH the mean PTH was 199.8 in active rickets and 60.8 in healed rickets, the P value is 0.002 which is very significant. The 25OHD levels in mother and breastfed infants with active rickets were very low in infants with active rickets and low in their mothers. In the healed group 25OHD was significantly high in infants but not in mothers. The hypothesis that maternal vitamin D deficiency is a major factor in pathogenesis of their infants was further confirmed. The results clearly indicate the

need for vitamin D supplementation during pregnancy and lactation for the mother and breastfeeding infants as a recommendation to prevent vitamin D deficiency and rickets and their serious complications.

2.4 Summary

This chapter has reviewed the historical literatures available about vitamin D deficiency. Besides some studies about assessment of awareness of pregnant women of vitamin D deficiency were presented.

Chapter Three: Conceptual Framework

3.1 Introduction

This chapter entails the conceptual framework of the study, which is considered as a guide/blueprint for the research process. The framework which was developed after a thorough literature review includes different factors that affect the awareness of vitamin D deficiency as demographic and personal characteristics, life style and nutrition and health related issues.

3.2 Conceptual Framework

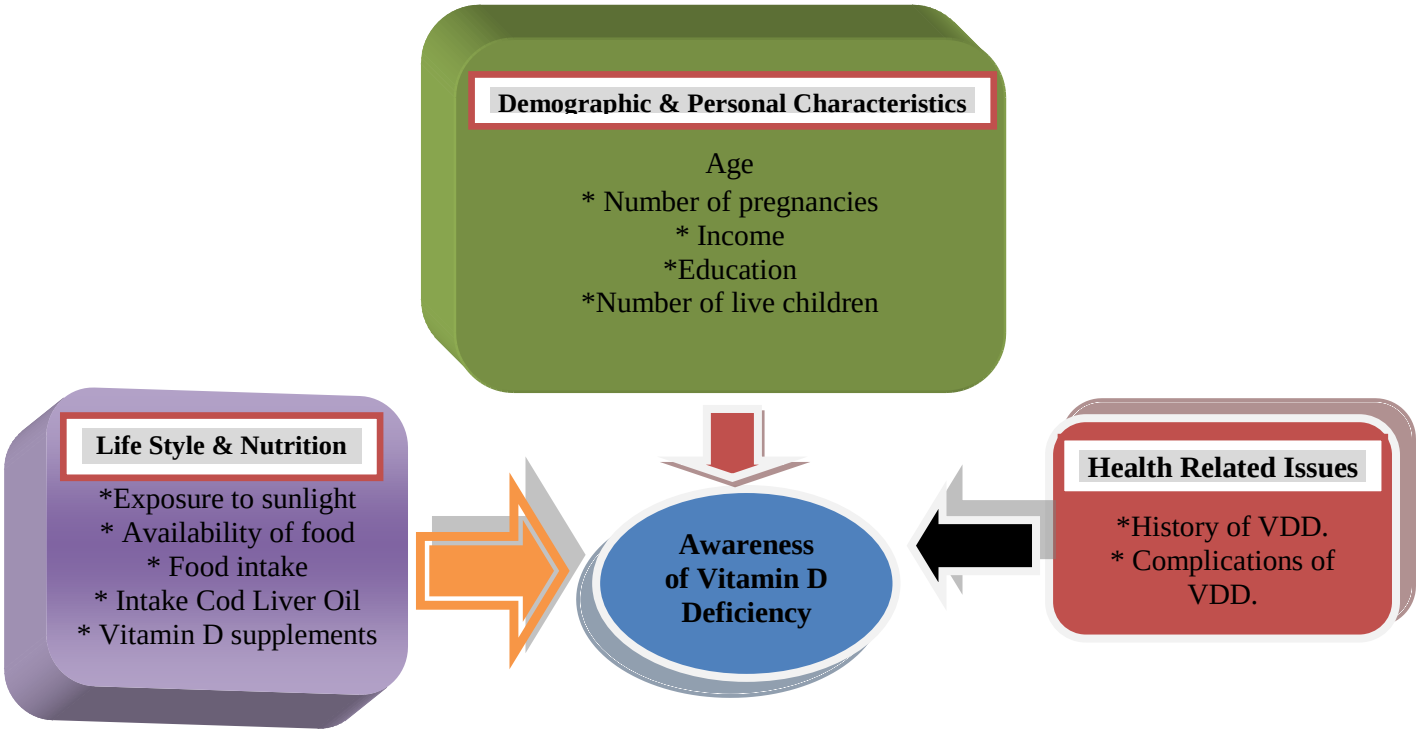


Figure 3.1: Conceptual framework of the study.

3.3 Operational definitions

Vitamin D: is a group of fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium and phosphate. In humans, the most important compounds in this group are vitamin D_3 (also known as cholecalciferol) and vitamin D_2 (ergocalciferol). Colecalciferol and ergocalciferol can be ingested from the diet and from supplements. The body can also synthesize vitamin D (specifically colecalciferol) in the skin, from cholesterol, when sun exposure is adequate hence its nickname, the "sunshine vitamin" (Calvo et al., 2005).

Deficiency of vitamin D (hypovitaminosis D): Vitamin D deficiency is defined by most experts as a 25-hydroxyvitamin D level of less than 20 ng per milliliter (50 nmol per liter). 25-Hydroxyvitamin D levels are inversely associated with parathyroid hormone levels until the former reach 30 to 40 ng per milliliter (75 to 100 nmol per liter), at which point parathyroid hormone levels begin to level off. It can result from inadequate nutritional intake of vitamin D coupled with inadequate sunlight exposure (in particular sunlight with adequate ultraviolet B rays), disorders that limit vitamin D absorption, and conditions that impair the conversion of vitamin D into active metabolites including certain liver, kidney, and hereditary disorders. Deficiency results in impaired bone mineralization and leads to bone softening diseases including rickets in children and osteomalacia and osteoporosis in adults (Holick, 2007).

Awareness: is the state or ability to perceive, to feel, or to be conscious of events, objects, or sensory patterns. More broadly, it is the state or quality of being aware of something.

Knowledge: Human faculty resulting from interpreted information; understanding that germinates from combination of data, information, experience and an individual interpretation. Variously defined as, "Things that are held to be true in a given context and that derive us to action if there were no impediments" (Andre Boudreau). "Capacity to act" (Karl Sweiby). "Justified true belief that increases an entity's capacity for effective action" (Nonaka and Takeuchi) and "The perception of the agreement or disagreement of two ideas" (John Locke). In an organizational context, knowledge is the sum of what is known and resides in the intelligence and the competence of people. In recent years, knowledge has come to be recognized as a factor of production in its own right and distinct from labor (http://www.buisnessdictionary.com).

Life style: is the typical way of life of an individual, group, or culture. The term was originally used by Austrian psychologist Alfred Adler. The term was introduced in the 1950s as a derivative of that of style in modernist art (The free dictionary by Farlex, 2014). The term refers to a combination of determining intangible or tangible factors. Tangible factors relate specifically to demographic variables, i.e. an individual's demographic profile, whereas intangible factors concern the

psychological aspects of an individual such personal values, preferences, and outlooks. In geographical terms, a rural environment as opposed to an urban metropolis would yield different results. This factor is most important as even within the urban scope a particular neighborhood acts as a determinant due to varying degrees of affluence and proximity to open spaces. For example, in areas within a close proximity to the sea, a surf culture or lifestyle is often present. The concept of lifestyle management has developed as a result of the growing focus on lifestyle (Spaargaren, 2000).

Sunlight: is a portion of the electromagnetic radiation given by the sun, particularly infrared, visible and ultraviolet light. On earth, sunlight is filtered through the Earth's atmosphere, and is obvious as daylight when the Sun is above the horizon. When the direct solar radiation is not blocked by clouds, it is experienced as sunshine, a combination of bright light and radiant heat. When it is blocked by the clouds or reflects off other objects, it is experienced as diffused light. The World Meteorological Organization uses the term "sunshine duration" to mean the cumulative time during which an area receives direct irradiance from the Sun of at least 120 watts per square meter. Sunlight on the skin is an effective source of vitamin D (World Meteorological Organization, 2008).

Parity: is the number of lived children for the pregnant woman.

Gravidity: is the number of pregnancies for each interviewed woman.

Fortified vitamin D foods: foods that have vitamin D added to them such as margarine, some cereals and infant formula milk.

Diabetes mellitus or simply **diabetes**: is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst), and polyphagia (increased hunger) (David, 2011).

Osteomalacia: is the softening of the bones caused by defective bone mineralization secondary to inadequate amounts of available phosphorus and calcium or because of overactive resorption of calcium from the bones as a result of hypothyroidism (which

cause hypercalcemia, in contrast to other etiologies). Osteomalacia in children is known as rickets. The term osteomalacia is often restricted to the milder, adult form of disease. It may show signs as diffuse body pains, muscle weakness and fragility of the bone. It is the most common cause of the disease in vitamin D, which is normally obtained from the diet and/or from sunlight exposure (Medline Plus Medical Encyclopedia, 2014).

Osteoporosis: is a progressive bone disease that is characterized by a decrease in bone mass and density which can lead to an increased risk of fracture. In osteoporosis, the bone mineral density (BMD) is reduced, bone microarchitecture deteriorates, and the amount and variety of proteins in bone are altered. Osteoporosis is defined by the World Health Organization (WHO) as a bone mineral density of 2.5 standard deviations or more below the mean peak bone mass (average of young, healthy adults) as measured by dual-energy X-ray absorptiometry (Brian, 2009).

Hepatitis C: Hepatitis is an inflammation of the liver. One type, hepatitis C, is caused by the hepatitis C virus (HCV). It usually spreads through contact with infected blood. It can also spread through sex with an infected person and from mother to baby during childbirth. Most people who are infected with hepatitis C don't have any symptoms for years. If one gets symptoms, he/she may feel as if got the flu. A person may also have jaundice, a yellowing of skin and eyes, dark-colored urine, and pale bowel movements. A blood test can tell if one has it. Usually, hepatitis C does not get better by itself. The infection can last a lifetime and may lead to scarring of the liver or liver cancer. Medicines sometimes help, but side-effects can be a problem. Serious cases may need a liver transplant. There is no vaccine for HCV (NIH: National Institute of Diabetes and Digestive and Kidney Diseases, 2014).

3.4 Summary

This chapter illustrated the conceptual framework of our research study for factors affecting pregnant women's awareness to VDD as well as the operational definitions of the variables.

Chapter Four: Study Methodology

4.1 Introduction

This study focuses on awareness of the pregnant women about vitamin D deficiency in eight private clinics in Ramallah district in the West Bank. In this chapter, research methodology is presented. The study population and sample size, design, tools and equipment, study period, response rate, piloting and the sampling method are described. Moreover, it illustrates validity and reliability of the instrument that constructed and used for the purpose of data collection. The methods of data analysis and ethical matters were also included in this study.

4.2 Study design

A self-administered questionnaire was conducted by utilizing a convenience study targeting a sample of pregnant women to assess their awareness of vitamin D deficiency. The population consisted of all women seeking care at eight private women clinics in Ramallah district at the time of data collection. The sample estimated by 500 pregnant women during 6 months in the targeted private women clinics after women provided informed written consent. The Institutional Review Board of Al-Quds University approved the study.

4.3 Study tool

The tool was developed after thorough review of literature (Appendices 2,4) . A survey tool was developed with reference to the literature on common risk factors for deficiency and measures of pregnant awareness and belief likely to influence relevant aspects of such awareness. A part of the questionnaire had been adapted with permission from Alemu and Varnam (2011); (Appendix 4). The other part was developed according to two health behaviour theories; Social Cognitive Theory [(Figure 4.1) (Bandura, 2001)] and the Health Belief Model [(Figure 4.2) (Glanz et al., 2002)]; informed sampling, development of the interview guide and analysis. Social Cognitive Theory suggests that behaviour is influenced by social and physical environments, along with the features of the behaviour. The Health Belief Model specifies that individuals adopt a health protective behaviour (e.g., sun protection for skin cancer or sun exposure for vitamin D), to the extent that they perceive

themselves to be susceptible to a health threat (i.e., skin cancer or deficiency), perceive the threat to be severe, perceive the benefits of the proposed health action for mitigating the threat and can overcome perceived barriers to the health behaviour.

Questions were structured under the headings: medical history, life style and nutrition and knowledge and the health status which correspond respectively to each of the three project objectives. This provided a directive framework for identifying key areas which needed to be explored

The first section consisted of sociodemographic and personal data (pregnant's age, place of residence, parity (number of live children), complexion (skin color), wearing a veil, education, monthly net income and gravidity (number of pregnancies).

The second section provided information on medical history and the diseases which the pregnant suffered from such as diabetes mellitus, osteomalacia, osteoporosis, hepatitis C, renal failure, skin cancer, depression and if the pregnant been ever told if she had VDD.

The third section provided information on life style and nutrition about including vitamin D fortified food such as milk, fish oil cod, egg yolk, and if she had been out in the sun within the last six months with exposed face, arms and legs whenever possible.

The fourth section consisted of questions related to knowledge and the health status about different determinants, risk factors such as: signs and symptoms related to VDD, reasons related to deficiency of VD, diseases produced through VDD and how to prevent the deficiency of VD and diseases.

Quinn, 2000, described the questionnaire as “a sequence of questions that the respondent is required to answer “(p.519). Billings and Halstead, 2005, defined the questionnaire as a method in which a person answers questions in writing in a form. Structured instruments consist of a set of questions (items) in which the wording of both the questions and response alternatives is predetermined (Polit and Beck, 2006).

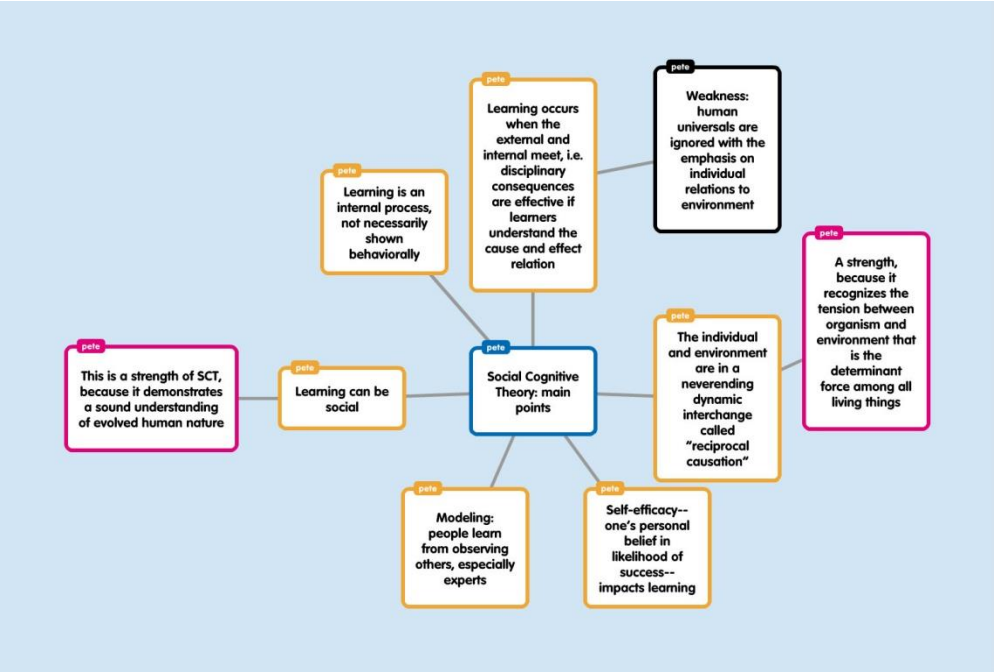


Figure 4.1: Social Cognitive Theory
(Source: Bandura, 2001)

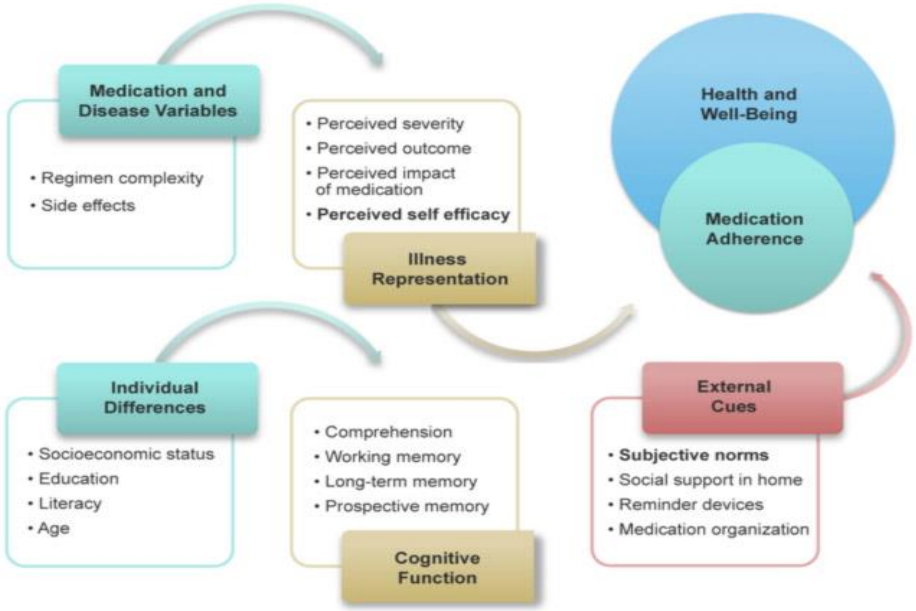


Figure 4.2: Health Belief Model
Source: (Glanz et al., 2002)

4.4 Data collection

Recruitment commenced in September 2013 until December 2013. Data about intake, demographics, socioeconomic and health status were collected. After reading the consent form, participants signed the consent form to partake in the study. On average, it took 20 minutes to fill in the questionnaire and ended with a short "thank you" message. If participants had any questions, they were encouraged to contact the researcher. The researcher (himself) had visited all targeted clinics in Ramallah district. Coordination with clinics' managements has been set through sending a letter from Al-Quds University. Data quality control and cleaning commenced in the field by the researcher ensuring that all the information had been properly collected, recorded and checked for completeness of data and consistency.

4.5 Data analysis

A data matrix was produced from the completed questionnaires using Statistical Product and Service Solutions [(formerly; Statistical Package for the Social Sciences) (SPSS 16.0 Software)]. Variables for each question on the questionnaire were defined and entered according to their identification number on the SPSS Data Editor and analysed. The frequencies, means, percentages and standard deviations were computed for continuous numeric variables, one-way ANOVA statistical test and correlations were used to test the study hypotheses. Chi Square T-test was applied for comparing proportions and the independent T-test for mean differences and $p < 0.05$ was considered as statistically significant. Also, the Microsoft Office Excel 2007 was used in the analysis figure process. The calculated numbers were rounded off to the nearest whole number.

Pilot and Beck (2006) defined Analysis of Variance (ANOVA) as “a statistical procedure for testing mean differences among three or more groups by comparing variability between groups to variability within groups”. They defined T-test as “a parametric statistical test for analyzing the difference between means“. Moreover, correlation was defined as “an association or connection between variables such as variation in one variable is related to variation in another”.

4.6 Management of missing data and data cleaning

Descriptive analysis was conducted but there were mainly data considered as 'missing'. All of missing values were identified in the statistical analyses. A "missing" value is assigned an extreme numeric value; either very high or very low. Hence, values coded as missing can be compared to other values, or vice versa.

To eliminate errors that may have occurred during data collection and coding stages, data cleaning was commenced once the data coding was completed. First, each of the variables was screened to check whether there was a lack or excess of data, outliers or inconsistencies and strange patterns. If errors occurred, then the value would be corrected or deleted after checking the questionnaire.

4.7 Strengths of the study

1. Strength of this study was the fact that the researcher is himself a medical practitioner who therefore had direct contact and access with obstetrics and gynecology physicians in Ramallah.
2. Also, it would have been more likely to elicit truthful responses from pregnant women.
3. Thereby saving on time and reducing the potential for error from direct contact.

4.8 limitations of the study

1. Unavailability of relevant literatures and lack of research studies about vitamin D in Palestine.

2. One limitation of this study was the fact that the study is limited to Ramallah district; therefore, it would have been less likely to generalize study recommendations.

4.9 Study assumptions

1. Sufficient numbers of participants partake, respond and cooperate in filling the study instrument.

2. All items and concepts, in the study instruments were understood and clear for participants.
3. All the participants filed in the questionnaires honestly and sincerely that will reflect the real situation of their perceptions.

4.10 Study variables

Consists of independent and dependent variables as follows:

1. Independent variables: are the characteristics of the respondents which included: age; (years) categorized as 18-<20, 20-<30, 30-<40 and ≥40 (reference group), residency; categorized as city, village, refugee camp and bedouins (reference group), parity (number of children), complexion (skin color); categorized as white, black, corny and blond (reference group), veil; categorized as putting on (Yes) or not putting on (No) (reference group), qualification; categorized as primary, secondary, diploma, bachelor and postgraduate (reference group), monthly net income categorized as <1500 NIS, 1500-<3000 NIS, 3000-<5000 NIS and ≥5000 NIS (reference group), and gravidity (number of pregnancies); categorized as being first pregnancy, once, 2-4, 5-7 and >7 pregnancies (reference group).

Also, independent variables included the followings:

1. Section 2 [(Medical history) (q9 - q16)]
2. Section 3 [(Life style and nutrition) (q17- q22)]

2. Dependent variable: Section 4 included the following:

i. Health related issues (q23 - q31)
ii. Symptoms related to vitamin D deficiency (q32 - q39)
iii. Causes of vitamin D deficiency (q40 - q50)
iv. Diseases resulting in vitamin D deficiency (q51- q62)
v. How can a pregnant lady avoid vitamin D deficiency and its resulted in diseases? (q63 - q69).

4.11 Sampling Methodology

4.11.1 Study population:

Polit and Beck, 2006, described a population as "the entire group of persons or subjects that is of interest to the researcher, which also meets the criteria which the researcher is interested in studying".

The study population covers all pregnant women who attended 8 private clinics in Ramallah district during 4 months (September–December) 2013. The population selected in Ramallah district because it is the most area where vitamin D test is mostly requested and nearly done in Medicare Medipal laboratories. Such test, when requested in governmental hospitals, is not found in Governmental hospitals and pregnant has to do it outside these hospitals, therefore, this is why the study targeted the private clinics.

4.11.2 Sample size:

In total, 460 participants completed this survey with notably 8 women refused to participate 20 questionnaires were excluded from the study for piloting.

For a survey design based on a convenient sample, the sample size required can be calculated according to Cochran's (1977) formula.
Cochran's formula allows determination of an appropriate sample size indicative and representative of the population.
Cochran's formula is stated as:

$$n = \frac{t^2 xp(1-p)}{m^2}$$

We calculated the study sample size of 488 pregnant women according to the formula of random sample provided. Eight (8) questionnaires were not returned. The estimated awareness prevalence was about 50%, of 5% error and 95% confidence interval. Therefore, using the equation, the calculated sample size of random sample was 232 women. To correct for the design effect (D=2), the final sample size was 488 (Final sample size = n*d*z=232 *2 * 1.05 = 488).

Description:

n = required sample size
t = confidence level at 95% (standard value of 1.96)
p = estimated awareness of pregnant women in the project area.
m = margin of error at 5% (standard value of 0.05)
D = 2; design effect for the sample.
Z=5% for contingencies related to non-response or recording error.

Table 4.1: Clinics, revisions, number of pregnant women and sample sizes.

Physician's name (Clinic)	Sample size (margin of error at 7%)	Sample size (margin of error at 6%)	Sample size (margin of error at 5%)	Sample size (margin of error at 4.5%)	Yearly pregnant	Monthly pregnant	Daily number of pregnant Woman visiting clinics
Dr. Odwan Barghothi	32	43	62	75	7800	650	25
Dr. O'deh Abu Nahleh	38	52	75	90	9360	780	30
Dr. Mai Abu Helo	13	17	25	30	3120	260	10
Dr. Kefah Sa'di	13	17	25	30	4056	338	13
Dr. Madlin Sabbobah	25	34	50	60	7800	650	25
Dr. Dima Amin	21	28	40	48	8112	676	26
Dr. Olga Majaj	31	43	62	75	14040	1170	45
Dr. Randa Assi	23	31	45	52	9360	780	30
Total	**196**	**265**	**384**	**460**	**63648**	**5304**	**204**

4.11.3 Sampling technique

This study used convenience sampling technique to identify 460 women to partake in the study. Access to the participants was facilitated by their physicians in the clinics who had a long-standing relationship with their clients (pregnant women) who are residing in Ramallah district in the last four months. The researcher himself distributed the questionnaires in these 8 antenatal private clinics and saw the sub-population targeted pregnants explaining to them the aim and objectives of this study. Most of those women filled in the questionnaires. In some clinics, the secretaries handled the questionnaires to these women after elaborating every question to the secretaries making sure it is understood and clear by the researcher. In other clinics, the researcher himself handled the forms and explained elements and issues of the questionnaire while they filled in questionnaires. Some of them refused to partake

while others did not complete the questionnaire. Ethical approval was obtained from Al-Quds University and participants confirmed their participation by reading the Arabic plain language statements and signing consent forms while all participants were able to verbally communicate.

4.12 Piloting of the study

The pilot study was conducted for the whole research to test sampling methods, detecting files and testing questionnaires. Indeed, twenty pregnant women were asked to fill in the questionnaires to examine the clarity, validity and comprehensiveness of the instrument. As a result of this pre-test (pilot testing), no major changes were found to be necessary on the questionnaire. However, minor modifications were made to improve the questionnaire's clarity and presentation of questions for the local Palestinian conditions. The data gathered from the pilot study were not included in the main study.

4.13 Inclusion criteria

1. All pregnants having registered files in those eight private clinics.
2. All pregnant women residing in Ramallah area.
3. Only women over the age of 18 years were included.
4. Only pregnants were included in this study during the period that extended from September 2013 through December 2013.
5. All pregnant who consented the form of participation.

4.14 Exclusion criteria

1. Non pregnant women.
2. Pregnants not residing in Ramallah.
3. Women under the age of 18.
4. Pregnants did not sign the consent form.

4.15 Validity of the study tool

After developing the questionnaire, it was sent to a team of (6) experts (Appendix 5) in the field of public health and who have expertise in research to determine whether the items in the questionnaire were relevant and suitable to study purpose. The questionnaire was modified slightly according to experts' suggestions. According to Polit and Hungler (2001), validity refers to "the degree to which the instrument measures what is supposed to measure "(p.353). The content validity is the degree to which the items in an instrument adequately represent the universe of the content.

4.16 Reliability of the study tool

Reliability of the instrument was tested using Cronbach's Alpha. The questionnaire as a total score, showed an excellent coefficient (α=0.85) for 61 items excluding independent variables, and virtually good coefficients for all domains (medical history, life style and nutrition, health related issues and awareness, symptoms of vitamin D deficiency, causes of vitamin D deficiency, diseases resulted in vitamin D deficiency and the applicability that a pregnant lady avoid vitamin D deficiency and its resulted in diseases) were: 0.85, 0.89, 0.87, 0.81, 0.91, 0.87 and 0.78 respectively.

Table 4.2: Instrument reliability.

No:	Field	No. of items	Reliability coefficient
1	Medical history	8	0.85
2	Life style and nutrition	6	0.89
3	Health related issues and vitamin D deficiency awareness	10	0.87
4	Symptoms of vitamin D deficiency	8	0.81
5	Reasons of vitamin D deficiency	12	0.91
6	Diseases resulted in vitamin D deficiency	11	0.87
7	How can a pregnant lady avoid vitamin D deficiency and its resulted in diseases?	6	0.78
8	**Total**	**61**	**0.85**

To ensure reliability of the research, examination of trustworthiness is crucial. Seale (1999), while establishing good quality studies through reliability and validity in qualitative research, states that the "trustworthiness of a research report lies at the heart of issues conventionally discussed as validity and reliability" (p. 266). When judging (testing) qualitative work, Strauss and Corbin (1990) suggest that the "usual

canons of ‘good science’…require redefinition in order to fit the realities of qualitative research" (p. 250).

4.17 Permissions and ethical considerations

4.17.2 Formal Letter:

Before beginning the study, letters were sent from Al-Quds University to the private clinics (Appendices 6,7,8,9,10 and 11) in which the study purpose was explained. An official permission had been asked for the researcher to visit the clinics to distribute the questionnaires and to facilitate data collection procedures. The researcher had visited the targeted clinics before beginning the study in order to get to know the place and to explain the research purpose.

4.17.2 Informed Consent:

An informed consent was attached to the questionnaire. Participants were given full explanations about the research, including the purpose, nature of the study and importance of participation. In addition, the participants were assured confidentiality of information and voluntary participation, and were given total freedom to accept or reject participation in this research (Appendices 1and 3).

All questions were written in Arabic.

4.18 Period of the Study

This study was conducted within the period from September 2013 to December 2013.

4.19 Summary

This chapter covered the study design, study tool, study variables and operational definition of the concepts, sampling methodology, piloting, validity and reliability of the study tool, data collection, data analysis besides to ethical consideration and statistical analyses used in this study and period of the study.

Chapter Five: Results

5.1 Introduction

This chapter introduces the survey's results including the characteristics of the respondents as well as the average, percentages and frequencies of the responses for each of the survey's items. Moreover, the results of the hypotheses are presented.

5.2 Socio-demographic characteristics of the respondents

The number of the respondents was 460 with 98.3% response rate. Table 5.1 shows the sample characteristics.

As shown in Table 5.1, the largest number of respondents among pregnant women indicated their age was between "20 and <30 years" (76.1%). The least age group between respondents was above 40 years old (1.5%) as well.

Moreover, the majority of the respondents (47.2%) reported that they live in villages while one-hundred ninety four (42.2%) indicated that they live in cities.

The majority of respondents (52.6%) reported having no children. About 38.9% indicated having between 1-3 children. Thirteen respondents (2.8%) indicated that they have more than six children. This variable showed a significant relationship with the awareness of the pregnant women towards VDD.

The majority of the subjects reported their skin color as "White" (52.6%). A hundred sixty-six (36.1%) participants indicated their skin color as "Corny" and "Blond" was the least (3%).

The majority (81.1%) indicated that they were "veiled", while (18.9%) reported being "unveiled". A significant relationship with the awareness of the pregnant women of VDD.

Regarding the highest level of education completed by the respondents, the largest group (43.7%) reported completion of a Bachelor degree. The second largest group (26.3%) reported finishing secondary school. 15.4% of the respondents reported illiterate while ten respondents (2.2%) reported having Postgraduate degree level. This was significantly related with the pregnant women's awareness to VDD.

Moreover, the largest number of respondents (60.7%) reported that their incomes fell within the range of 1500-3000 NIS. And few respondents (2.6%) reported having income more than 5000 NIS" range.

Moreover, the results showed that the majority of respondents were pregnant "2-4 times" (58.7%). Then the primigravida accounted 27.2% while those who were pregnant more than 7 times accounted 4.3%. A significant relationship was found between the gravidity and the awareness of pregnant women to VDD.

Table 5.1: Distribution of the respondents according to characteristics and demographic variables (n=460).

Q No:	Variable	n (%)	*P*-Value*
Q 1	**Age**		
	18-< 20 years	44 (9.6)	0.862
	20-<30 years	350 (76.1)	
	30-<40 years	59 (12.8)	
	≥ 40 years	7 (1.5)	
Q 2	**Residence place**		
	City	194 (42.2)	0.084
	Village	217 (47.2)	
	Refugee camp	48 (10.4)	
	Bedouin (Nomads)	1 (0.2)	
Q 3	**Parity (Number of live children)**		
	No children¡	242 (52.6)	0.013*
	1-3 children	179 (38.9)	
	4-6 children	26 (5.7)	
	> 6 children	13 (2.8)	
Q 4	**Complexion (Skin color)**		
	White	242 (52.6)	0.151
	Black	38 (8.3)	
	Corny	166 (36.1)	
	Blond	14 (3.0)	
Q 5	**Veiled (Head covered)**		
	Yes	373 (81.1)	0.039*
	No	87 (18.9)	
Q 6	**Education**		
	Illiterate	71 (15.4)	0.014*
	Primary	34 (7.4)	
	Secondary	121 (26.3)	
	Diploma	33 (7.2)	
	Bachelor	201 (43.7)	
	Postgraduate	10 (2.2)	
Q 7	**Monthly net income**		
	< 1500 NIS	71 (15.4)	0.395
	1500-<3000 NIS	279 (60.7)	
	3000-<5000 NIS	98 (21.3)	
	≥ 5000 NIS	12 (2.6)	
Q 8	**Gravidity (Number of pregnancies)**		
	Once	125 (27.2)	0.011*
	2-4 times	270 (58.7)	
	5-7 times	45 (9.8)	
	> 7 times	20 (4.3)	

*Some percentages may be less or more than 100% due to rounding. * Statistically significant ($p \leq 0.05$). ¡ No children indicates first pregnancy not delivered yet.*

5.3 Participants' medical history

Of the respondents, 95.9% never been told that they have had vitamin D deficiency as shown in Table 5.2 and 95.9% did not suffer from diabetes mellitus as seen in Table 5.2. However, Table 5.2 shows that 96.5% of the participants did not have osteomalacia. While 97% were not having osteoporosis as depicted in Table 5.2 and 99.6% were not infected in hepatitis C as shown in Table 5.2. None of the respondents suffered from renal failure or skin cancer. However, six point six percent (6.6%) of the participants had depression as illustrated in Table 5.2.

Table 5.2: The self-reported frequency (percent) of diseases that subjects suffer from.

Q No:	Variable	Pregnant women n (%)*	*P-Value**
Q 9	**Do you suffer from diabetes mellitus?**		
	Yes	19 (4.1)	0.000**
	No	441 (95.9)	
Q 10	**Do you suffer from osteomalacia?**		
	Yes	16 (3.5)	0.000**
	No	444 (96.5)	
Q 11	**Do you suffer from osteoporosis?**		
	Yes	15 (2)	0.034*
	No	445 (96.7)	
Q 12	**Do you suffer from hepatitis C?**		
	Yes	2 (0.4)	0.011*
	No	458 (99.6)	
Q 13	**Do you suffer from renal failure?**		
	Yes	0 (0.0)	0.000**
	No	460 (100)	
Q 14	**Do you suffer from skin cancer?**		
	Yes	0 (0)	0.000**
	No	460 (100)	
Q 15	**Do you suffer from depression?**		
	Yes	30 (6.5)	0.020*
	No	430 (93.5)	
Q 16	**Have you ever been told that you have vitamin D deficiency (not enough vitamin D)?**		
	Yes	19 (4.1)	0.000**
	No	441 (95.9)	

**Data are expressed as number (percent) of pregnant. **Statistically significant ($p \leq 0.05$).*

5.4 Pregnant women's life style and eating habits

Table 5.3 shows that 76.1% of the participated pregnant women did not have fish oil pills. While 83.7% of the respondents indicated that enriched food is unavailable to them, 80.7% reported they were exposed to sun and (40.0%) were practicing exercises daily. A significant relationship was found between the lifestyle and habits of the respondents and awareness of VDD.

Table 5.3: Distribution of respondents according to their eating habits and life style (n=460).

Q No:	Variable	Yes Frequency (%)	No Frequency (%)	*P-Value**
Q 17	**Drinking milk daily**	One cup 197 (42.8) Two cups 14 (3.0) Three cups 2 (0.4)	247 (53.7)	0.000**
Q 18	**Fish oil pills**	110 (23.9)	350 (76.1)	0.031*
Q 19	**Eating eggs daily**	One egg 223 (48.5) Two eggs 5 (1.1)	232 (50.4)	0.002*
Q 20	**Exposure to sun**	371 (80.7)	89 (19.3)	0.011*
Q 21	**Availability of enriched healthy food**	75 (16.3)	385 (83.7)	0.002*
Q 22	**Practicing daily exercises**	184 (40)	276 (60)	0.002*

**Data are expressed as number (percent) of pregnant. **Statistically significant (p ≤0.05).*

5.5 Participants' awareness about VDD and related issues

The results showed that 78.5% never heard of vitamin D deficiency as seen in Table 5.4, while 85.8% believed that vitamin D is important for their wellbeing. While 79.6% denied being asked by the physician to do a lab test for the VD, out of them, 80.5% reported not having any lab test in the last six months, which, in turn, might explain their answers about lab test result of VD (not low=81.6%). Those who were fully committed in taking VD tablets were low in number (40.8%). Moreover, the largest group (52.2%) informed that were not fully relaxed in taking VD tablets.

Table 5.4: Participants' awareness about VDD and health related issues.

Q No:	Variable	Pregnant women n (%)*	*P-Value**
Q 23	**Have you ever heard of vitamin D deficiency?**		
	Yes	99 (21.5)	0.000**
	No	361 (78.5)	
Q 24	**Do you think vitamin D is important for your health?**		
	Yes	395 (85.8)	0.002****
	No	65(14.2)	
Q 25	**Did your physician ask you to do vitamin D test?**		
	Yes	94 (20.4)	0.002*
	No	366 (79.6)	
Q 26	**Did you do a lab test for your vitamin D in the last six months?**		
	Yes	61 (13.3)	0.000**
	No	399 (86.7)	
Q 27	**Was the lab test result low?**		
	Yes	85 (18.4)	0.001*
	No	375(81.6)	
Q 28	**Did your physician prescribe vitamin D supplements (tablets) for you?**		
	Yes	102 (22.2)	0.011*
	No	358 (77.8)	
Q 29	**Were you been fully committed taking vitamin D tablets daily?**		
	Yes	188 (40.8)	0.000**
	No	272 (59.2)	
Q 30	**How many times did your physician recommend vitamin D tablets in the year?**		
	Once	77 (16.7)	0.000**
	Twice	10 (2.2)	
	Thrice	4 (0.9)	
	> Thrice	5 (1.1)	
	No	373 (81.1)	
Q 31	**Were you fully relaxed (either physically or psychologically) once taking vitamin D tablets?**		
	Yes	220 (47.8)	0.000**
	No	240 (52.2)	

**Data are expressed as number (percent) of pregnant. **Statistically significant (p <0.05).*

5.6 Respondents' knowledge and awareness about symptoms associated with VDD:

The results in Table 5.5 showed that the majority of the study participants reported that most common VD deficiency symptom they were aware about was bone pain (43.7%) while the involuntary bedwetting (11.5%) was the least common symptom they knew about (for more details see Table 5.5). Generally, there was a significant relationship between respondents' knowledge about the symptoms of VDD and awareness of VDD.

Table 5.5: Distribution of participants according to their knowledge about symptoms of VDD (n=460 participants).

Q No:	Symptoms	Yes Frequency (%)	No Frequency (%)	*P-value**
Q 32	**Depression**	165 (35.9)	295 (64.1)	0.034*
Q 33	**Diabetes mellitus**	82 (17.8)	378 (82.2)	0.040*
Q 34	**Muscle pain**	175 (38.0)	285 (62.0)	0.005*
Q 35	**Bone pain**	201 (43.7)	259 (56.3)	0.002*
Q 36	**Rickets in children**	159 (34.6)	301 (65.4)	0.000**
Q 37	**Lack or low calcium in the body**	160 (34.8)	300 (65.2)	0.010*
Q 38	**Thirstiness**	104 (22.6)	356 (77.4)	0.020*
Q 39	**Involuntary bedwetting**	53 (11.5)	407 (88.5)	0.003*

**Data are expressed as number (percent) of pregnant. **Statistically significant ($p \leq 0.05$).*

5.7 Knowledge and awareness about reasons associated with VDD:

The most common reason detected by the respondents (73.7%) was that they believe that not comprising egg yolk from hens as a rich source of vitamin D in their meals as depicted in Table 5.6. An important contributor to VDD status as reported by the respondents is not including milk as a rich source of vitamin D (28%) in their meal. Besides, participants consider that lack of exposure to sunlight whenever possible is one of the reasons of VDD which revealed a percentage of 47.6%, whilst approximately 15% tended to think that incidence with infectious diseases is a reason for getting VDD. The reported rarity of education recorded a percentage of 77.6% as a reason of VDD. Generally, there was a significant relationship between respondents' knowledge about the reasons of VDD and awareness of VDD.

Table 5.6: Knowledge and awareness about reasons associated with VDD.

Q No:	Variable	Pregnant women n (%)*	*P-Value**
Q 40	**Not exposing to solar radiation (sunlight) within the last six months with exposed face, arms or legs whenever possible?**		
	Yes	218 (47.6)	0.000**
	No	241 (52.4)	
Q 41	**Not including milk as a rich source of vitamin D in your meal?**		
	Yes	331 (72)	**0.000****
	No	129 (28)	
Q 42	**Not embracing fish liver oil as a rich source of vitamin D in your meal?**		
	Yes	327 (71.3)	0.002*
	No	132 (28.7)	
Q 43	**Not taking in spinach as a rich source of vitamin D in your meal?**		
	Yes	270 (58.9)	0.002****
	No	190 (41.1)	
Q 44	**Not adding in poultry as a rich source of vitamin D in your meal?**		
	Yes	270 (58.9)	0.000**
	No	190 (41.1)	
Q 45	**Not comprising egg yolk as a rich source of vitamin D in your meal?**		
	Yes	339 (73.7)	0.001*
	No	121 (26.3)	
Q 46	**Not involving olive oil as a rich source of vitamin D in your meal?**		
	Yes	235 (51.1)	0.002*
	No	225 (48.9)	
Q 47	**Incidence with internal (infectious) diseases?**		
	Yes	75 (16.3)	0.000**
	No	385 (83.7)	
Q 48	**Incidence with stomach (intestinal) diseases?**		
	Yes	75 (16.3)	0.000**
	No	385 (83.7)	
Q 49	**Paucity (low level) of education?**		
	Yes	357 (77.6)	0.000**
	No	103 (22.4)	

**Data are expressed as number (percent) of pregnant. **Statistically significant ($p \leq 0.05$).*

5.8 Distribution of participants according to their knowledge about diseases associated with VDD:

Table 5.7 illustrates that the vast majority of participants (42.8%) think that rickets is the most common disease associated with VDD. While depression (32.6%) is the second largest disease associated with VDD, disorders of the immune disease (22.8%) is also a causative factor as reported by the participants. The least common disease associated with VDD according to the study respondents' opinion is the nose infection (12.6%), whereas infection of the skin (19.6%). In general, there was a significant relationship between diseases associated with VDD and awareness of VDD. (For more details see Table 5.7).

Table 5.7: Distribution of participants' knowledge about the diseases associated with VDD (n=460).

Q No:	Diseases resulting from vitamin D deficiency	Yes Frequency (%)	No Frequency (%)	*P-Value**
Q 51	Rickets	197 (42.8)	263 (57.2)	0.001*
Q 52	Diabetes mellitus	100 (21.7)	360 (78.3)	0.020*
Q 53	Autism	92 (20.0)	368 (80.0)	0.001*
Q 54	Depression	150 (32.6)	310 (67.4)	0.000**
Q 55	Hypertension	102 (22.2)	358 (77.8)	0.023*
Q 56	Cardiac disease	104 (22.6)	356 (77.4)	0.003*
Q 57	Cancer	90 (19.6)	370 (80.4)	0.003*
Q 58	Allergic disorders	99 (21.5)	361 (78.5)	0.003*
Q 59	Immune system disorders	105 (22.8)	355 (77.2)	0.001*
Q 60	ENT nose infections	58 (12.6)	402 (87.4)	0.003*
Q 61	Infections of skin	90 (19.6)	370 (80.4)	0.010*

**Data are expressed as number (percent) of pregnant. **Statistically significant ($p \leq 0.05$).*

5.9 Suggested ways for avoiding VDD according to participants' opinion:

This included recommended ways for promoting VD among pregnant women such as increasing intake of foods fortified with vitamin D (96.1%) as seen in Table 5.8, visiting and checking with the physician (93.7%), and increasing recognition of vitamin D through reading, research and consultancy (92.4%). Furthermore, these results show that to promote the awareness and bridge this gap, exposing to sunlight with exposed face, arms or legs whenever possible (74.1%) and practicing physical training daily (87.4%) were also perceived. Carrying out laboratory testing on regular basis (91.7%) is also a contributory aspect to eliminate this deficiency as reported by study subjects as apparent in Table 5.8.

Table 5.8: Suggested ways for avoiding VDD according to participants' opinions.

Q No:	Variable	Pregnant women n (%)*	*P-Value**
Q 63	**Exposing to sunlight within the last six months with exposed face, arms or legs whenever possible?**		
	Yes	340 (74.1)	0.001*
Q 64	**Increasing intake of foods fortified with vitamin D?**		
	Yes	442 (96.1)	0.001*
Q 65	**Increasing recognition of vitamin D through reading, research and consultancy?**		
	Yes	425 (92.4)	0.001*
Q 66	**Checking with the physician?**		
	Yes	431 (93.7)	0.001*
Q 67	**Carrying out laboratory testing on regular basis?**		
	Yes	421 (91.7)	0.001*
Q 68	**Practicing training (physical education) daily?**		
	Yes	402 (87.4)	0.001*

5.10 Hypotheses of the study

The hypotheses were tested using one-way ANOVA and T-test. The one-way analysis of variance (ANOVA) is used to determine whether there are any significant differences between the means of three or more independent (unrelated) groups. However, the T-test compares the actual difference between two means in relation to the variation in the data (expressed as the standard deviation of the difference between the means) and determines whether there is a statistically significant difference between the means in two unrelated groups.

Hypotheses one, two, three, four and five:

There are no significant relationships at $p<0.05$ between pregnant women's awareness of vitamin D deficiency and personal characteristics.

Table 5.9 indicates that there were no significant differences at $p<0.05$ between the means of participants' awareness attributed to personal characteristics, but, there was a significant relationship between the educational level and pregnant women's awareness of vitamin D deficiency of the respondents. Also, there was a significant relationship between the number of children and pregnant women's awareness of vitamin D deficiency of the respondents.

Table 5.9: Participants' awareness of vitamin D deficiency according to personal characteristics (ANOVA).

		Sum of Squares	DF	Mean Square	F	Sig.*	Decision	Remark
Age	Between Groups	0.110	3	0.037	0.249	0.862	Accept Ho	Not significantly related
	Within Groups	67.273	456	0.148				
	Total	67.383	459					
Level of education	Between Groups	1.066	4	0.267	1.829	0.014	Reject Ho	Significantly related
	Within Groups	66.316	455	0.146				
	Total	67.383	459					
Income	Between Groups	0.438	3	0.146	0.995	0.395	Accept Ho	Not significantly Related
	Within Groups	66.945	456	0.147				
	Total	67.383	459					
Number of children	Between Groups	0.105	3	0.035	0.237	0.013	Accept Ho	significantly Related
	Within Groups	67.278	456	0.148				
	Total	67.383	459					
Skin tones	Between Groups	0.778	3	0.259	1.775	0.151	Accept Ho	Not significantly Related
	Within Groups	66.605	456	0.146				
	Total	67.383	459					

Hypothesis six: There is no significant relationship at $p<0.05$ between pregnant women's awareness of vitamin D deficiency and exposure to sunlight.

Table 5.10 indicates that there was no significant differences at $p<0.05$ between the level of participants' awareness attributed to sunlight exposure.

Table 5.10: Participants' awareness of vitamin D deficiency according to exposure to sunlight.

Exposure to sunlight	N	Mean	SD	T	Sig.*	Decision	Remark
Yes	371	0.2156	0.4118	0.510	0.610	Accept Ho	Not significantly related
No	89	0.1910	0.3953				

Hypothesis seven: There is no significant relationship at $p<0.05$ between pregnant women's awareness of vitamin D deficiency and wearing veil.

Table 5.11 indicates that there was no significant differences at $p<0.05$ between the level of participants' awareness attributed to wearing veil.

Table 5.11: Participants' awareness of vitamin D deficiency according to wearing veil.

Wearing veil	N	Mean	SD	T	Sig.*	Decision	Remark
Yes	373	1.1769	0.3821	0.153-	0.879	Accept Ho	Not significantly related
No	87	1.1839	0.3896				

Hypothesis eight: There is no significant relationship at $p<0.05$ between pregnant women's awareness of vitamin D deficiency and eating fish (cod liver oil).

Table 5.12 indicates that there was significant differences at $p<0.05$ between the level of participants' awareness attributed to eating fish (cod liver oil). The differences in the awareness were in favor of those who are eating fish.

Table 5.12: Participants' awareness of vitamin D deficiency according to eating fish (cod liver oil).

Intake cod liver oil	N	Mean	SD	T	Sig.*	Decision	Remark
Yes	110	0.3909	0.4902	5.465	0.000	Reject Ho	Significantly related
No	350	0.1543	0.3617				

Hypothesis nine: There is no significant relationship at $p<0.05$ between pregnant women's awareness of vitamin D deficiency and history of vitamin D deficiency.

Table 5.13 indicates that there was no significant differences at $\alpha<0.05$ between the level of participants' awareness attributed to medical history of VD.

Table 5.13: Participants' awareness of vitamin D deficiency according to history of VD.

Medical history	N	Mean	SD	T	Sig.	Decision	Remark
Know	58	0.3143	0.4425	0.5358	0.438	Accept Ho	Not significantly related
Do not know	402	0.1653	0.3182				

5.11 Research question

Vitamin D deficiency awareness among pregnant women and selected independent factors:

Research question number two was; "Is there a significant relationship between pregnant women's awareness of vitamin D deficiency and the independent variables (age, education, income, and number of children, life style and nutrition, history of vitamin D deficiency, wearing veil and skin tones)". All but three of the selected factors showed no significant relationships with vitamin D deficiency awareness when examined using Pearson's Chi Square. A significant association was found between vitamin D deficiency awareness and life style and nutrition. A significant association was also found between vitamin D deficiency awareness and education. A significant relationship was also found between parity and vitamin D deficiency awareness. A presentation of the results of research question number two is followed by Table 5.14 which contains a summary of the Chi Square results.

Table 5.14: Pearson Chi Square analyses between vitamin D deficiency awareness and the selected factors.

vitamin D deficiency awareness by:	**DF**	***P-Value****
Age	3	0.403
Education	4	0.014*
Income	3	0.071
Parity (number of live children)	3	0.013*
Veil	1	0.329
Complexion (skin tones)	3	0.666
Life style and nutrition	1	0.000 *
History of vitamin D deficiency	5	0.438

** Statistically significant (p <0.05).*

5.12 Summary

This chapter included the characteristics of the respondents as well as the average, percentages and frequencies of the responses for each of the survey's items. In addition, results of hypotheses testing were presented.

Chapter Six: Discussion and Conclusion

6.1 Introduction

This study provides basic understanding of the pregnant women's knowledge and awareness of vitamin D deficiency in eight private clinics in Ramallah district. In this chapter, discussion, conclusion and recommendations of this study are presented. In addition, the study findings are discussed in relation to other literature and previous studies.

6.2 Socio-demographic factors of the participants

Findings of this study indicated that the majority of pregnant women were between "20 and 30 years" old and the association between age and pregnant women's awareness of vitamin D deficiency was not significant. This means that the perceived capacity to be in control in times of awareness is not dictated by the age of the respondents meaning that the age of the respondents has nothing to do with the extent to which they hold themselves accountable for any awareness; neither has it determined the necessary contribution they can give for improving the situation. This is reliable with the study conducted by Larson (2011) but in contrast to the study conducted by Varnam and Alemu (2012) which indicated the mean age 35 years old is playing a significant role. Age was a factor associated with awareness of vitamin D and was the only predictive factor for giving correct answers to the actions and sources of vitamin D as revealed by Kung and Lee (2006) which was inconsistent to this study.

The majority of the subjects among pregnant women reported living in villages. Considering, hypothetically, villages as "rural areas", Bales (2010) and Bales et al. (2010) found that rural women were more likely to have deficits in education. The participants in this study showed differences and dissimilarities from the research results of Bales (2010), Bales et al. (2010) and Larson (2011).

The majority of the subjects reported that they were in their first pregnancy. There was a significant relationship between the number of children and pregnant women's awareness of vitamin D deficiency of the respondents. This signifies that the children they have affects their awareness regarding how many children they have; meaning that having children does not have the same effect the same manner as those not having children.

The darker a skin is, the more difficult it is to produce vitamin D. It can take 5 to 10 times the amount of sun exposure for an individual with very dark skin to produce the same amount of pre-vitamin D compared to an individual with very light skin (Bonevski, 3013). In this study, the majority of the subjects have white skin color (52.6%). There was no significant relationship between the skin tones and pregnant women's awareness of vitamin D deficiency. Thus, the degree of skin tone of any pregnant is not related with the pregnant women's awareness of vitamin D deficiency.

The majority of the subjects indicated that they were "veiled. There was no significant relationship between the wearing a veil and pregnant women's awareness of vitamin D deficiency of the respondents. This is contrast to the study done by Halicioglu et al, (2008) who concluded that 25(OH)D concentrations in covered dressing mothers were significantly lower compared with those of uncovered mothers ($P < 0.001$).

Regarding the highest level of education completed by the respondents, the largest group reported completion of a Bachelor's degree. However, these women are relatively highly educated. As this is a convenience-based study, mostly educated pregnant women who could respond and were able to be efficient were expected to be involved in this study. It is not surprising that participation through the interview was high. The association between pregnant women's awareness of vitamin D deficiency and level of education was found to be significant ($p=0.014$). This implies that the degrees earned by the respondents determine the level of knowledge, and has contributed to the gauge of their part in improving the scenario caused by the awareness and in handling difficult challenges that come along the way of their knowledge. This is not congruent with the study conducted by Larson (2011) which denoted the majority of the participants were well educated.

Most of the respondents reported that their incomes fell within the range of 1500-3000 NIS. The relationship between pregnant women's awareness of vitamin D deficiency and income was not significant. This connotes that the income they intake in is not related to extent to which the respondents hold themselves accountable for improving the knowledgeable situation. Therefore, whether a respondent earning less than 1500 NIS or more than 5000 NIS, she is not accountable for the result of any financial improvement and is not expected to take part in making the educational

situation better and the ability to face an adversity in a way that it limits the outcomes. This is consistent with the study conducted by Larson (2011).

The results of this study indicated non-significant relationships between the sociodemographic independent variables and pregnant women's awareness of VDD; pregnant women's age, family monthly income, place of residency, veil covering, skin color, but the educational level and parity (number of live children) were significantly associated with pregnant women's awareness of VDD.

6.3 Factors affecting awareness

6.3.1 Medical history:

Vitamin D plays a central role in bone metabolism and maintaining bone health and is important for muscle functioning. The long-term effects of VDD on calcium homeostasis have been associated with the development of chronic bone disorders, such as osteoporosis. Despite this, there is a worldwide problem of vitamin D deficiency that is largely being unheeded and under-treated. This problem is not isolated but affects populations of all ages. Vitamin D deficiency may pose a bigger threat in Palestine as the assessment of vitamin D status and vitamin D education are largely overlooked particularly in pregnant women.

To assess the knowledge of pregnant women in Ramallah, Palestine about vitamin D deficiency toward medical history, life style, nutrition and health related issues and between vitamin D awareness, we conducted a convenience survey of pregnant women who are likely to be at increased risk of vitamin D deficiency. Different pathological characteristics that may impact on the participants' medical history were explored.

These self-evaluations of the medical history were inversely correlated with awareness of vitamin D deficiency suggesting that the respondents were consistent in their replies during the interviews.

6.3.2 Knowledge and awareness about life style and nutrition (eating habits and use of supplements or tablets):

This survey provides insight into the current awareness and understanding of the role of vitamin D and attitudes toward vitamin D deficiency among pregnant women in Ramallah, Palestine. The study provides new and unique knowledge in this emerging area, with implications for the development of a message to detect pregnant women at higher risk that may be unaware of vitamin D deficiency issues. The findings can be used as baseline measures for future behavioural interventions for vitamin D deficiency prevention targeting pregnant women.

Very few foods contain significant amounts of vitamin D. Vitamin D is found in small quantities in a few foods such as fatty fish, liver, eggs, fortified foods such as margarine, low fat milk (if fortified) also contain very small amounts of vitamin D, and some UV-exposed mushrooms contain vitamin D. For most people dietary vitamin D is limited. Most adults are unlikely to obtain more than 5-10% of their vitamin D requirement from dietary sources.

In this study, findings had shown that 46.3% of the respondents according to their eating habits and use of supplements were including milk daily.

On the other hand, 76.1% of the interviewed pregnant women did not have fish oil pills. While 83.7% of the respondents indicated that their fortified (enriched) food is unavailable, 80.7% reported they were exposured to the sun and 40.0% told they were practicing exercises daily.

Unlike Alemu and Varnam (2012) who depicted hundred and forty three participants (89%) included vitamin D rich foods such as milk, fish or eggs in their meals whereas 11% of them did not include any of these foods.

Grossly, the results showed that the majority (76.6%) of the subjects were unaware about their lifestyle and nutrition (eating habits and use of supplements) associated with vitamin D, and took on the odd occasion varying amounts of vitamin D supplements in spite of statistical significance ($p=0.000$) between the lifestyle and nutrition and awareness of vitamin D deficiency was found.

This was consistent with the study conducted in Scandinavian countries by Ostad Rahimi et al (2006) which reported having fortified nutrition with vitamin D. Lack of availability of vitamin D fortified foods and low consumption of vitamin D enriched

sea foods in East Azerbaijan, could explain the vitamin D deficiency. Also, reliable with the study done by Lips, 2001, which stated that vitamin D deficiency is less common in the United States than elsewhere due to the fortification of milk and use of supplements and concluded prevention of deficiency is feasible by food fortification and supplements, but unlikely coincides with the study of Christie and Mason (2011), *"although most participants had heard of vitamin supplementation, only a minority were taking supplements. All subjects believed it to be essential to consult a health-care professional before taking these supplements. Similarly, none of the subjects had heard of fortification, but most believed this to be useful when introduced to the concept."* Also, this result was inconsistent with the findings of the study presented by Khadrawi (2013) that signified 80.5% of the Irish cohort of Muslim mothers took supplements during their pregnancy, also consistent with the finding presented by Tarrant et al, 2011, that reported a high prevalence of notional supplementation was used among the pregnant women in Dublin, Ireland.

Apart from playing a significant role in preventing vitamin D deficiencies amongst pregnant women regarding health style and nutrition, the researcher thinks these results are not strongly associated with the awareness and knowledge of VDD because pregnant women may receive these supplements and health nutritional practices unintentionally not considering awareness to VD due to less education by media or physician or low self literacy.

Awareness of the benefits of supplements needs to be increased by provision of specific guidelines about how often supplements and fortified food and nutritional practices required, and how much of the body should have for optimal vitamin D uptake. The results identify a significant unmet need for education about life style and nutrition associated with vitamin D among people at risk of deficiency pregnant women. A recommendation needs to be proposed and then promoted by the profession there.

6.3.3 Knowledge and awareness about health related issues and VDD:

Results of health related issues associated with vitamin D deficiency awareness showed that 78.5% never heard of vitamin D deficiency, while 85.8% opined that vitamin D is important for their wellbeing. 79.6% denied being asked by the physician to do a lab test for the VD, of them, 80.5% reported not having any lab test

in the last six months, which, in turn, might explain their answers about lab test result of VD (not low=81.6%).

When subjects were asked the question "Have you ever heard about vitamin D?". Our results suggest that pregnants included in this study were unaware of VDD, and they are not taking long-term action to prevent the deficiency. This finding was not consistent with the literature study presented by Varnam and Alemu (2012) in order to identify groups most in need of education and to assess the level of awareness of vitamin D deficiency among consecutive at risk patients without a diagnosis of vitamin D deficiency. 28% of them (n=61) had never heard about vitamin D. Older patients (p=0.003) were less likely to have heard about vitamin D. But reliable with the study carried out by Larson (2011) about health literacy about Vitamin D; the results of the true-false measure of health literacy about vitamin D indicated that a majority of the participants (52%) were classified as having marginal health literacy about vitamin D. Participants with adequate health literacy about vitamin D (38.9%) were the next largest group, and those with limited health literacy (8.7%) were the smallest group. These results showed that the participants had some prior knowledge about vitamin D and conclusions determined that this study highlighted the existence of differences in awareness of vitamin D deficiency among pregnant women who have heared about VD. Correspondingly, Christie and Mason (2011) concluded from their study that the targeted group displayed minimal awareness of vitamin D. *"I know of vitamins, and they're good to take, that's all I know". "I know it's good for the bones and we get it from the sun"*. However, none were really aware of any other health benefits, the risks of vitamin D deficiency. Further, this does not coincide with the study conducted by Kung and Lee (2006) designated that 397 respondents (72.6%) replied yes. The rate of positive response to this question differed significantly between age groups and occupation classification: 78.3% of those aged 50–54 years had heard of vitamin D compared with only 25.0% of those aged ≥ 85 years and that the majority had heard about vitamin D despite low level of awareness of sources and role of vitamin, but 42.4% did not think that vitamin D was good for bone health.

When respondents were asked if vitamin D was important for their wellbeing, 85.8% answered confidently. Most participants felt they knew further about the benefits or role of vitamin D. Many participants presumed vitamin D had to be essential and offer some health benefits. The results indicate that participants in this study were

familiar with what VD was and its impact on their health. Although the vast majority reported they consider VD important for their health, they remained knowledgeably underprovided.

Several women in the study expressed concerns about the doing lab tests, 79.6% denied being asked by the physician to do a lab test for the VD, of them, 80.5% reported not having any lab test in the last six months, which, in turn, its lab test result was high (81.6%). These findings are consistent with findings of Bonevski et al, (2013) who found that most participants did not know whether their vitamin D level had ever been tested or not been asked by their physician or assumed it had been tested as part of a blood test for a range of things. A participant responded with the following quote which was a common view held by most of the participants:

"*... I have a cholesterol test usually at least once a year, but I have got no idea whether there is a vitamin D component in that.*"

Of the participants who reported doing lab tests, they were found to be low in vitamin D and did not recall being told by their physician why it was important.

Obviously, the researcher attributes, this question is self-evident to be answered with high percentage because everyone believes that vitamins are important for her/his health, so we find this percentage high with a lack of knowledge of all kinds but the prevailing idea that each vitamin is important for their health.

These results, in general, suggested that 76.6% of participants notified that they do not have awareness of VDD and could not identify the impacts that VDD had on their health suggesting that lab testing is not a "culture" reaching most of the community. These results suggest that even those at risk of deficiency are not aware of the need to increase their knowledge and awareness. One factor, which may be contributing to the low levels of knowledge and difficulty of lab testing of VD, is the lack of conclusive acquaintance evidence regarding how much consideration the public needs in order to assist their vitamin D status.

6.3.4 Knowledge and awareness about symptoms associated with VDD:

Many people have no symptoms, or only vague ones such as tiredness or general aches. Because symptoms of vitamin D deficiency are often very nonspecific or vague, the problem is often missed. The diagnosis is more easily reached in severe deficiencies with some of the classical (typical) symptoms and bone deformities. Three hundred and seventy eight subjects were unaware of the symptoms of vitamin D deficiency. Of all women tested, 82.2% were not aware about the association of the symptoms with vitamin D deficiency (p=0.000). The majority of the study participants reported that most common symptom they were aware about was the bone pain (43.7%) while the involuntary bedwetting (11.5%) was the least common symptom they were aware about. Our findings are similar to those reported by Alemu and Varnam (2012) who suggested that 54% of participants were unaware of the commonest symptoms of vitamin D deficiency. However, it is expected that unawareness of vitamin D deficiency is prevalent among the pregnant women of Palestine, and symptoms have a positive effect on vitamin D status of studied subjects. Interventions like education and understanding of factors is recommended for the health promotion of such women.

6.3.5 Knowledge and awareness about reasons associated with VDD:

The most common reason detected by the respondents (73.7%) was that they believe that not comprising egg yolk from hens as a rich source of vitamin D in their meals. An important contributor to VDD status as reported by the respondents is not drinking milk as a rich source of vitamin D (28%) in their meal. Besides, participants consider that lack of exposure to sunlight whenever possible is one of the reasons of VDD which revealed a percentage of 47.6%, whilst approximately 15% tended to think that incidence with infectious diseases is a reason for getting VDD. The reported paucity of education recorded a percentage of 22.4% as a reason of VDD.

Overall, participants displayed unawareness of VDD's reasons when findings highlighted (72.2%) of the respondents and experienced disparities and existence of differences in awareness in determining reasons of VDD and this corresponds to the study carried out by Bonevski et al, (2013), regarding sun exposure; who identified a number of barriers from receiving adequate sun exposure: lack of information and

knowledge about the effects of vitamin D deficiency, concern about skin cancer and sun burn, ability to go outside, the weather and work. These results suggest that even those at risk of deficiency are not aware of the need to increase their vitamin D intake. Also, consistent with the study presented by Christie and Mason (2011) who reported the lack of knowledge regarding vitamin D was further demonstrated in the use of sun protection by the participants, cultural reasons for covering the body, and an infrastructure that makes sun exposure difficult, and the need for more health education is highlighted by the conclusion that participants were unaware of any health benefits of vitamin D, and Al Bathi et al (2012) who indicated that only 28.5% of participants were aware about their condition, 53.5% related pain to vitamin D deficiency, 33.5% knew the presence of relation between vitamin D deficiency and joint pain, but not consistent with the study conducted by Pirrone et al (2013) found that participants were aware of VDD and could identify the impacts that VDD reasons had on their health. Results of this study revealed that participants were limited in their knowledge about vitamin D and vitamin D deficiency.

Gaps in basic knowledge around VD and its benefits became more apparent in this study. Thus, the need for planning health education interventions for this group of patients is essential.

6.3.6 Knowledge and awareness about diseases associated with VDD

Understanding the role of vitamin D has been evolving since its discovery in the early 20_{th} century from being a simple vitamin to a steroid pro-hormone, it has been recognised to be involved in various immune functions as well as bone and muscle development. Vitamin D deficiency has been reported to be linked to depression, autism, type 1diabetes, as well as chronic widespread muscle and bone pain (Alemu and Varnam, 2012).

In the main, 83.3% of the survey subjects revealed considerable ignorance and confusion about their knowledge and awareness towards the diseases of VDD. The relationship between pregnant women's awareness about VDD and awareness and knowledge of diseases resulting from VDD was found to be significant (p=0.000).

These findings do not correlate with those by Larson (2011) who indicated that some respondents felt it was of benefit to them to take vitamin D for treatment of specific health conditions. These conditions included bone and joint health, history of breast

cancer, multiple sclerosis, osteoporosis, gastrointestinal disease, pregnancy, low vitamin D blood level, fall prevention, and depression. These written responses show that some participants in this study had prior knowledge about vitamin D, and perceived that vitamin D was beneficial for health promotion, disease prevention, and treatment of a health problem.

Our findings suggest that study participants were not entirely aware to the role played by VD in helping them address VDD.

The current study recommends pregnants should continue to heed awareness of VDD.

6.3.7 Knowledge and awareness about ways to address the barriers to overcome VDD:

This study highlighted the existence of differences in addressing the barriers to conquer unawareness of VDD.

Generally, 89.2% answered positively to overwhelm unawareness of VDD, and there found to be there was no statistical relationship between awareness of pregnants about VDD and ways of avoiding VDD. Therefore, health promotion messages and interventions need to be designed to accommodate these barriers and assist people in overcoming them. For example, increasing intake of foods fortified with vitamin D.

This finding does not correlate with the study presented by Khadrawi (2013) who denoted that of the Muslim mothers interviewed in Ireland almost 28.6% reported taking a vitamin D supplement and fortified food during their pregnancy. In spite of the recommendation to supplement with vitamin D during pregnancy, the study showed a low intake of vitamin D supplementation during pregnancy among Irish cohort Muslim mothers, which may explain vitamin D deficiency among Irish women (Hill et al., 2006). In a study, vitamin D supplementation among the mothers in Saudi Arabia during pregnancy was uncommon with only 7.4% of them taking vitamin D supplements. This percentage reveals that the vast majority is not supplementing with vitamin D during pregnancy and is consistent with the findings reported by Elidrissy (2006). Also, consistent with Pirrone (2013) who determined that most women were aware that supplementation was an effective way in treating VDD.

Also, as for exposuring to solar radiation, current guidelines for vitamin D were communicated to participants, and most felt they were getting adequate sunlight in

the summer months on most days of the week. Most participants thought they would easily meet the recommendations on most days largely through incidental exposure.

6.4 Sources of information about vitamin D

Several participants could not recall a specific source of information for their knowledge of vitamin D. Sources of information on vitamin D mentioned by participants included:

- *Media:* articles in newspapers, magazines and current affairs programs, community networks (internet) appear to be a promising vector for the dissemination of education about this important problem;
- *Physicians and general practitioners:* some participants had learnt about vitamin D from their physicians and other stakeholders although often information they had received was limited;
- *Family members/friends:* few participants mentioned that they had heard about vitamin D through family members, friends or significant others;
- *School and further education:* a small number of participants said they had learnt what they know from school or further education.

6.5 Conclusions

This study highlighted considerable ignorance, confusion and the existence of differences in awareness of vitamin D deficiency among pregnant women, that may affect VD status, whilst education playing a significant role. Attitudes toward awareness were largely negative and pregnants have to take measures to avoid VDD. The majority of participants was unaware about the VDD and thus has demonstrated the significant need for health promotion strategies in Palestine to combat VDD in their awareness. It is well established that simply providing knowledge and information about a particular health issue is not enough to result in constant behaviour and lifestyle change. As reported in this study, there are extensive determinants and enablers that influence behaviour. Health promotion and public health practitioners must consider these critical factors that encompass cultural influences. Interference highlighted on reducing VDD awareness should focus on creating more accommodating environments for pregnant women who will enable and support behaviours that are heedful and responsive to cultural difference.

Continued promotion to promote long-term change, pregnant women susceptible to VDD need to be able to understand the perceived severity, combined with their perceived susceptibility. Through this study, results revealed that the majority of subjects are not aware or knowledgeable about VDD to understand its consequences. They did not know the negative effects of prolonged VDD and its relationship with chronic diseases such as cancer, cardiovascular disease and diabetes. While the study participants highlighted the need for extra vitamin D awareness to compensate for the needs associated with physiological changes including to pregnancy, their views are not supported by the literature as these physiological characteristics require no extra amount of vitamin D knowledge. This misconception could be addressed through the provision of correct information disseminated through miscellaneous sources.

There are some influencing factors that may affect pregnant women's VDD related awareness such as educational level, lifestyle and nutrition. These might be important indicators when screening for pregnant women at risk of vitamin D deficiency awareness in Palestine. Furthermore, pregnant women have a relatively good knowledge of vitamin D, even though there is considerable confusion (knowing of the health problems of vitamin D deficiency, but not being able to cite symptoms or diseases). However, their attitudes to vitamin D are ambiguous with dissimilar proportions on either positive or negative sides. Additionally, the knowledge and attitudes do not directly result in actual behaviours.

6.6 Recommendations

This study has implications for practice, research and policy. Based on the findings of this study, the following recommendations are suggested:

6.6.1 Recommendations for practice:

- Generally, greater understanding of underlying ignorance, cultural behaviours, practices that contribute to VDD present a public health opportunity to re-address misconceptions and to develop education strategies that are targeted and specific for susceptible populations. Ultimately, improving knowledge and public health education to tackle modifiable preconceptions and behaviour may be an effective first step toward increasing individual responsibility for preventing VDD and its related diseases. If the risk of VDD

is to be minimized in the future, particularly among pregnant women groups, the problem of VDD needs to be addressed and prevention strategies should be implemented.

6.6.2 Recommendations for policy makers:

- The overall awareness of VDD was not sufficient among pregnant women studied in the present investigation Thus, pregnant women should be educated about VD diseases, reasons, symptoms and sources, and it would be best to recommend taking the correct supplementary amounts to meet their bodily needs under the guidance of their licensed healthcare provider. It is important to detect and treat vitamin D deficiency in this population. Pregnancy is an opportune time for health care providers to give targeted practical advice that will help women to better understand the risks associated with being vitamin D deficient. At present, vitamin D screening, fortification and supplementation are not routinely offered to all pregnant women. Thus, it is important for health care providers to identify those pregnant women at a higher risk of vitamin D deficiency.
- It was found that gaps in knowledge in the population and dereliction in healthcare professionals (physicians) may be a barrier to the prevention of vitamin D deficiency. It is recommended that this is addressed by health promotion campaigns with national and international specific guidelines. Support from healthcare professionals is needed to change health behaviour. Furthermore, from their accounts, we believe that participants were unable to experience sufficient education to prevent vitamin D deficiency. Thus, a concerted collaboration is required amongst the health care providers and others such as community members to promote the awareness and bridge this gap.

6.6.3 Recommendations for future research:

- This research was an exploratory study about awareness and knowledge during pregnancy. Further research should be carried out to explore specific awareness and practices that are suitable for pregnant women. Another area that needs further research is a detailed assessment of vitamin D deficiency

among other social sections and segments in Palestine as a result of socio-cultural factors.

- With the mounting evidence that lower levels of vitamin D are associated with an increased risk of adverse pregnancy outcomes, improving the awareness of vitamin D status in pregnancy has a tremendous capacity to benefit public health. These study's data add to the growing body of research supporting the assertion that the current individual lifestyle and nutrition might be directly attributable to the epidemic of vitamin D deficiency during pregnancy in Palestine.
- Taking into account the limitations of the current study, large-sample-sized, case-controlled studies, with representative populations are needed in the future to better investigate the potential influencing factors for antenatal vitamin D related behaviours during pregnancy and their direct implications for pregnancy outcomes.
- Some pregnant women cannot obtain adequate vitamin D through sun exposure, and limited food sources are available and supplementation seems to be more easily implemented, but how much vitamin D should be recommended to pregnant women is still debated. More studies are needed to provide conclusive evidence on effective and safe doses of vitamin D supplements during pregnancy.
- Finally, public health and health promotion campaigns should encompass peer education as an effective approach in addressing VDD. This misconception could be addressed through the provision of correct information disseminated through peer networks to be able to achieve the desired effect of informing the population.

6.7 Summary

This chapter presented the discussion and implications of the major findings related to this study with the comparison to the results of other studies conducted in the related fields and to the related conceptual models. Consistency and inconsistency of the findings are also compared to other studies related to this field.

References:

Aghajafari F, Nagulesapillai T, Ronksley PE, Tough SC, O'Beirne M, Rabi DM. (2013). Association between maternal serum 25-hydroxyvitamin D level and pregnancy and neonatal outcomes: systematic review and meta-analysis of observational studies. BMJ 10 ;346:f1169.

Al Bathi B A., Al Zayed Kh E., Al Qenai M., Makboul G., El Shazly M K,. (2012). Knowledge, attitude and practice of patients attending primary care centers toward vitamin D in Kuwait. Alexandria Journal of Medicine. 48 (3), 277–282

Alagol F, Shihadeh Y, Boztepe H, et al. (2000). Sunlight exposure and vitamin D deficiency in Turkish women. J Endocrinol Invest.;23:173–7.

Allain TJ, Dhesi J. (2003). Hypovitaminosis D in older adults. Gerontology.;49(5):273-278.

Al-Mutairi N, Issa BI, Nair V. (2012). Photoprotection and vitamin D status: A study on awareness, knowledge and attitude towards sun protection in general population from Kuwait, and its relation with vitamin D levels. Indian J Dermatol Venereol Leprol;78 (3) 342-349)

American Academy of Pediatrics, Committee on Environmental Health. (1999). Ultraviolet light: a hazard to children. Pediatrics;104 (2 pt 1):328–33.

Arunabh S, Pollack S, Yeh J, Aloia JF. (2003). Body fat content and 25-hydroxyvitamin D levels in healthy women. J Clin Endocrinol Metab.;88(1):157-161.

Bales, R. L. (2010) Health perceptions, needs, and behaviors of remote rural women of childbearing and childrearing age. In C. Winters, & H. J. Lee (Eds.), Conceptual Basis for Rural Nursing (pp. 61-75). New York: Springer.

Bales, R. L., Winters, C. A., and Lee, H. J., (2010). Health needs and perceptions of rural

Bandura A. (2001). Social Cognitive Theory: An Agentic Perspective. Vol. 52: PP 1-26 Annual Review of Psychology

Barker, Helen M. (2002). Nutrition and dietetics for health care. Edinburgh: Churchill Livingstone. p. 17. ISBN 0-443-07021-0. OCLC 48917971

Bikle DD. (2005). Vitamin D: role in skin and hair. In: Feldman D, ed. Vitamin D. Burlington, MA: Elsevier Academic Press,:609 –30.

Bingham CT, Fitzpatrick LA. (1993). Noninvasive testing in the diagnosis of osteomalacia. Am J Med.;95(5):519-523.

Bischoff HA, Stahelin HB, Dick W, et al.(2003). Effects of vitamin D and calcium supplementation on falls: a randomized controlled trial. J Bone Miner Res.;18(2):343-351.

Bodnar LM, Catov JM, Simhan HN, Holick MF, Powers RW, Roberts JM.(2007). Maternal vitamin D deficiency increases the risk of preeclampsia. J Clin Endocrinol Metab; 92: 3517–3522.

Bondar LM, Catoy JM, Zmuda JM, Cooper ME, Parrott MS, Robert JM, Marazita ML, Simhan HN. (2010). Maternal Serum 25-Hydroxyvitamin D Concentrations Are Associated with Small-for-Gestational Age Births in White Women. The Journal of nutrition 140 (5), 999-1006.

Borissova AM, Tankova T, Kirilov G, Dakovska L, Kovacheva R. (2003). The effect of vitamin D3 on insulin secretion and peripheral insulin sensitivity in type 2 diabetic patients. Int J Clin Pract.;57(4):258-261.

Bowyer L, Catling-Paull C, Diamond T, Homer C, Davis G, Craig ME. (2009). Vitamin D, PTH and calcium levels in pregnant women and their neonates. Clin Endocrinol; 70: 372–377.

Brand, C. A., Abi, H. Y., Couch, D. E., Vindigni, A. and Wark, J. D. (2008), Vitamin D deficiency: a study of community beliefs among dark skinned and veiled people. International Journal of Rheumatic Diseases, 11: 15–23. doi: 10.1111/j.1756-185X.2008.00323.x

Brian K Alldredge; Koda-Kimble, Mary Anne; Young, Lloyd Y.; Wayne A Kradjan; B. Joseph Guglielmo (2009). Applied therapeutics: the clinical use of drugs. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins. pp. 101–3. ISBN 0-7817-6555-2.

Bringhurst FR, Demay MB, Kronenberg HM. (2003). Mineral Metabolism. In: Larson PR, Kronenberg HM, Melmed S, Polonsky KS, eds. Larsen: Williams Textbook of Endocrinology: Elsevier: 1317-1320.

Broe KE, Chen TC, Weinberg J, Bischoff-Ferrari HA, Holick MF, Kiel DP. (2007). A higher dose of vitamin d reduces the risk of falls in nursing home residents: a randomized, multiple-dose study. J Am Geriatr Soc.; 55(2):234-239.

Brot C, Vestergaard P, Kolthoff N, Gram J, Hermann AP, Sorensen OH. (2001). Vitamin D status and its adequacy in healthy Danish perimenopausal women: relationships to dietary intake, sun exposure and serum parathyroid hormone. Br J Nutr; 86:S97–103.

Brunvand L, Shah SS, Bergström S, Haug E. (1998). Vitamin D deficiency in pregnancy is not associated with obstructed labor. A study among Pakistani women in Karachi. Acta Obstet Gynecol Scand. 77(3):303-6.Department of Pediatrics, Ullevål Hospital, Oslo, Norway.

Calvo MS, Whiting SJ, Barton CN. (2005). "Vitamin D intake: a global perspective of current status". *J. Nutr.* 135 (2): 310–6

Chen TC, Chimeh F, Lu Z, et al. (2007). Factors that influence the cutaneous synthesis and dietary sources of vitamin D. Arch Biochem Biophys; 460:213–7.

Cheng S, Tylavsky F, Kroger H, et al. (2003). Association of low 25- hydroxyvitamin D concentrations with elevated parathyroid hormone concentrations and low cortical bone density in early pubertal and prepubertal Finnish girls. Am J Clin Nutr; 78:485–92.

Clemens TL, Adams JS, Henderson SL, Holick MF. (1982). Increased skin pigment reduces the capacity of skin to synthesize vitamin D3. Lancet; 74 –76.

David G. Gardner, Dolores (2011). *Greenspan's basic & clinical endocrinology* (9th ed.). New York: McGraw-Hill Medical. pp. Chapter 17. ISBN 0-07-162243-8.

Dawodu A, Absood G, Patel M, et al. (1998). Biosocial factors affecting vitamin D status of women of childbearing age in the United Arab Emirates. J Biosoc Sci; 30:431–7.

Dawodu A, Agarwal M, Hossain M, Kochiyil J, Zayed R. (2003). Hypovitaminosis D and vitamin D deficiency in exclusively breast-feeding infants and their mothers in summer: a justification for vitamin D supplementation of breast-feeding infants. J Pediatr.; 142(2):169-173.

Dawodu A, Agarwal M, Sankarankutty M, Hardy D, Kochiyil J, Badrinath P. (2005). Higher prevalence of vitamin D deficiency in mothers of rachitic than nonrachitic children. J Pediatr; 147:109–11.

Dawodu A, Saadi HF, Bekdache G, Javed Y, Altaye M, Hollis BW. (2013). Randomized Controlled Trial (RCT) of Vitamin D Supplementation in Pregnancy in a Population With Endemic Vitamin D Deficiency. The Journal of Clinical Endocrinology & Metabolism(JCEM) 98: 2337-2346; doi:10.1210/jc.-1154

Dawodu A, Wagner CL. (2012). Prevention of vitamin D deficiency in mothers and infants worldwide — a paradigm shift. Pediatrics and International Child Health VOL. 32 NO. 13

DeLuca H. (2004). Overview of general physiologic features and functions of vitamin D. Am J Clin Nutr; 80(suppl):1689S–96S.

DeLucia MC, Mitnick ME, Carpenter TO. (2003). Nutritional rickets with normal circulating 25-hydroxyvitamin D: a call for reexamining the role of dietary calcium intake in North American infants.J Clin Endocrinol Metab. *; 88*(8):3539-3545.

Diamond, J. (2005). Evolutionary biology: Geography and skin colour. Nature, 435(7040), 283-284.

Dobbinson, S., Hill, D., and White, V. (2002). Trends in sun protection: Use of sunscreen, hats and clothing over the past decade in Melbourne, Australia. Paper presented at the UV Radiation and its effects Workshop: an update 2002.

Dror DK, King JC, Durand DJ, Allen LH. (2011). Association of modifiable and nonmodifiable factors with vitamin D status in pregnant women and neonates in Oakland, CA,J Am Diet Assoc;111(1):111-6. USA.

Engelsen, O. (2010). The relationship between ultraviolet radiation exposure and vitamin D status. Nutrients, 2(5), 482-495.

Farber E. (1953). Nobel Prize Winners in Chemistry 1953 Abelard-Schuman New York, NY. Windaus' Nobel lecture is available online at http://www.nobel.se/chemistry/laureates/1928/windaus-lecture.html. Accessed 13 January 2013.

Feldman D, Pike JW, Glorieux FH, eds. (2005). Vitamin D. San Diego, CA: Elsevier Academic Press.

Fischer PR, Rahman A, Cimma JP, et al.(1999). Nutritional rickets without vitamin D deficiency in Bangladesh. *J Trop Pediatr*. ;45(5):291-293.

Food and Nutrition Board, Institute of Medicine. (1999). Vitamin D. Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. Washington D.C.: National Academies Press; 250-287.

Gannage-Yared MH, Chemali R, Yaacoub N, Halaby G. (2000). Hypovitaminosis D in a sunny country: relation to lifestyle and bone markers. J Bone Min Res.;15:1856–62.

Gernand AD, Simhan HN, Klebanoff NA, Bodnar LM. (2013**).** Maternal Serum 25-Hydroxyvitamin D and Measures of Newborn and Placental Weight in a U.S. Multicenter Cohort Study. JCEM. 98 (1) 398-404

Glanz, K., Rimer, B.K. & Lewis, F.M. (2002). Health Behavior and Health Education. Theory, Research and Practice.San Fransisco: Wiley & Sons.

Glerup H, Mikkelsen K, Poulsen L, et al. (2000). Commonly recommended daily intake of vitamin D is not sufficient if sunlight exposure is limited. J Intern Med.;247(2):260-268.

Griffin MD, Xing N, Kumar R. (2003). Vitamin D and its analogs as regulators of immune activation and antigen presentation. Annu Rev Nutr.;23:117-145.

Grover SR, Morley R. (2001). Vitamin D deficiency in veiled or dark skinned pregnant women. Med J Aust; 175: 251–252.

Halicioglu O, Sadik A, Koc F, Sezin A. Albudak E, Isin Y, Isil C; Ayfer C, Can O; Gulec, Ebru S. (2011). Vitamin D deficiency in pregnant women and their neonates inspring time in western Turkey.Paediatr Perinat Epidemiol; 26(1):53-60

Halicioglu O, Aksit S, Koc F, Akman SA, Albudak E, Yaprak I, Coker I, Colak A, Ozturk C, Gulec ES. (2012). Vitamin D deficiency in pregnant women and their neonates in spring time in western Turkey. (1):53-60**.** Department of Pediatrics, The Ministry of Health Tepecik Teaching and Research Hospital, Izmir, Turkey**.**

Harris SS, Soteriades E, Coolidge JA, Mudgal S, Dawson-Hughes B. (2000). Vitamin D insufficiency and hyperparathyroidism in a low income, multiracial, elderly population. J Clin Endocrinol Metab.;85(11):4125-4130.

Hayes CE, Nashold FE, Spach KM, Pedersen LB. (2003). The immunological functions of the vitamin D endocrine system. Cell Mol Biol.;49(2):277-300.

Heaney RP, Davies KM, Chen TC, Holick MF, Barger-Lux MJ. (2003). Human serum 25-hydroxycholecalciferol response to extended oral dosing with cholecalciferol. Am J Clin Nutr;77:204 –10.

Heaney RP. (2003). Long-latency deficiency disease: insights from calcium and vitamin D. Am J Clin Nutr.;78(5):912-919.

Holick MF (2006). "High prevalence of vitamin D inadequacy and implications for health". Mayo Clin. Proc. 81 (3): 353–373.

Holick MF, Biancuzzo RM, Chen TC, et al. (2007). Vitamin D2 is as effective as vitamin D3 in maintaining circulating concentrations of 25- hydroxyvitamin D. J Clin Endocrinol Metab.

Holick MF, Garabedian M. (2006). Vitamin D: photobiology, metabolism, mechanism of action, and clinical applications. In: Favus MJ, ed. Primer on the metabolic bone diseases and disorders of mineral metabolism, 6th ed. Washington, DC: American Society for Bone and Mineral Research:129 –37.

Holick MF. (2002). Vitamin D: the underappreciated D-lightful hormone that is important for skeletal and cellular health. Curr Opin Endocrinol Diabetes.- Volume 9 - Issue 1 - pp 87-98.

Holick MF. (2003). Vitamin D deficiency: what a pain it is. Mayo Clin Proc.;78(12):1457-1459.

Holick MF. (2004). Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. Am J Clin Nutr;80 (suppl):1678–88S.

Holick MF. (2004). Vitamin D: Importance in the prevention of cancers, type 1 diabetes, heart disease, and osteoporosis. Am J Clin Nutr;79:362–71.

Holick MF. (2004). Vitamin D: importance in the prevention of cancers, type 1 diabetes, heart disease, and osteoporosis. Am J Clin Nutr.;79(3):362-371.

Holick MF. (2006). Resurrection of vitamin D deficiency and rickets. J Clin Invest;116:2062–72.

Holick MF. (2007). Vitamin D deficiency. N Engl J Med;357:266–81.

Hollis, B.W.; Wagner, C.L. (2004). Assessment of dietary vitamin D requirements during pregnancy and lactation. Am. J. Clin. Nutr., 79, 717-726.

Hopkins, F. G. (1906). The analyst and the medical man. Analyst 31:385-404

Hovsepian S, Amini M, Aminorroaya A, Amini P, Iraj B. (2011). Prevalence of Vitamin D Deficiency among Adult Population of Isfahan City, Iran. J Health Popul Nutr; 29(2): 149–155.

http://en.wikipedia.org/wiki/Osteomalacia. Accessed January 23,2014.

http://www.businessdictionary.com/definition/knowledge.html. Accessed January 22, 2014.

Inomata S, Kadowaki S, Yamatani T, Fukase M, Fujita T. (1986). Effect of 1 alpha (OH)-vitamin D3 on insulin secretion in diabetes mellitus. Bone Miner.;1(3):187-192.

Institute of Medicine. (2011). Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC, USA: The National Academies Press.

Jahnsen J, Falch JA, Mowinckel P, Aadland E. (2002). Vitamin D status, parathyroid hormone and bone mineral density in patients with inflammatory bowel disease. Scand J Gastroenterol.;37(2):192-199.

Jones G. (2007). Expanding role for vitamin D in chronic kidney disease: importance of blood 25-OH-D levels and extra-renal 1_-hydroxylase in the classical and nonclassical actions of 1_,25-dihydroxyvitaminD3. Semin Dial;20:316 –24.

Judkins A, Eagleton C. (2006). Vitamin D deficiency in pregnant New Zealand women. N Z Med J; 119: U2144.

Karim SA, Nusrat U, Aziz S. (2011). Vitamin D deficiency in pregnant women and their newborns as seen at a tertiary-care center in Karachi, Pakistan. Int J Gynaecol Obstet. 2011 Jan;112(1):59-62

Kazemi A, Sharifi F, Jafari N, Mousavinasab N. (2009). High prevalence of vitamin D deficiency among pregnant women and their newborns in an Iranian population. J Women's Health (Larchmt). 2009 Jun;18(6):835-9. Zanjan Metabolic Diseases Research Center, Zanjan, Iran.

Kennel KA, Drake MT, Hurley DL. (2010). Vitamin D deficiency in adults: when to test and how to treat. Mayo Clin Proc.;85(8):752-757.

Kung A WC, Lee KK. (2006). Knowledge of vitamin D and perceptions and attitudes toward sunlight among Chinese middle-aged and elderly women: a population survey in Hong Kong. BMC Public Health. doi: 10.1186/1471-2458-6-226

Larson JL . (2011). A descriptive study of rural women's health literacy about vitamin D. Montana State University. Master in nursing thesis.

Lehtonen-Veromaa M, Mottonen T, Nuotio I, Irjala K, Viikari J. (2002). The effect of conventional vitamin D2 supplementation on serum 25(OH)D concentration is weak among peripubertal Finnish girls: a 3-yr prospective study. Eur J Clin Nutr;56:431–7.

Lerchbaum E, Obermayer-Pietsh B. (2012). Mechanisms in endocrinology: Vitamin D and fertility: A systematic review. Eur J Endocrinology -11(1) -0984.

Li YC, Kong J, Wei M, Chen ZF, Liu SQ, Cao LP. (2002). 1,25-Dihydroxyvitamin D(3) is a negative endocrine regulator of the renin-angiotensin system. J Clin Invest.;110(2):229-238)

Li YC. (2003). Vitamin D regulation of the renin-angiotensin system. J Cell Biochem;88:327–31.

Lieberman S, Bruning N. (1990). The Real Vitamin & Mineral Book. NY: Avery Group, 3, ISBN 0-89529-769-8

Lips P. (2001). Vitamin D deficiency and secondary hyperparathyroidism in the elderly: consequences for bone loss and fractures and therapeutic implications. Endocr Rev. (4):477-501.

Malabanan A, Veronikis IE, Holick MF. (1998). Redefining vitamin D insufficiency. Lancet;351:805– 6.

Malabanan A, Veronikis IE, Holick MF. (1998). Redefining vitamin D insufficiency. Lancet.;351(9105):805-806.

Mangrio E, Hansen K, Lindström M, Köhler M, Rosvall M. (2011). Maternal educational level, parental preventive behavior, risk behavior, social support and medical care consumption in 8-month-old children in Malmö, Sweden. BMC Public Health10.1186/1471-2458-11-891

Mantell DJ, Owens PE, Bundred NJ, Mawer EB, Canfield AE. (2000). 1_,25-dihydroxyvitaminD3 inhibits angiogenesis in vitro and in vivo. Circ Res;87:214 –20.

Marwaha RK, Tandon N, Reddy D, et al. (2005). Vitamin D and bone mineral density status of healthy schoolchildren in northern India. AmJ Clin Nutr;82:477– 82.

Mataria, A., Donaldson, C., Luchini, S., & Moatti, JP, (2004).A stated preference approach to assessing health care-quality improvements in Palestine: from theoretical validity to policy implications. Elsevier. Journal of Health Economics 23 (2004) 1285–1311.

Matsuoka LY, Ide L, Wortsman J, MacLaughlin JA, Holick MF. (2006). Sunscreens suppress cutaneous vitamin D3 synthesis. J Clin Endocrinol Metab; 64:1165– 8.

Michael F, Holick and Tai C Chen**.** (2008).Vitamin D deficiency: a worldwide problem with health consequences. The American Journal of Clinical Nutrition ;87(suppl):1080S– 6S.

Mulligan ML, Felton SK, Riek AE, Bernal-Mizrachi C. (2009). Implications of vitamin D deficiency in pregnancy and lactation. Am J Obstet Gynecol;202:e1–9.

Munns C, Zacharin MR, Rodda CP. (2006). Prevention and treatment of infant and childhood vitamin D deficiency in Australia and New Zealand: a consensus statement. Med J Aust; 185: 268–272

Nagpal S, Na S, Rathnachalam R. (2005). Noncalcemic actions of vitamin D receptor ligands. Endocr Rev; 26:662– 87.

National Health Service (2011). Sunlight and vitamin D [Online]. Available http://www.nhs.uk/Livewell/summerhealth/Pages/vitamin-D-sunlight.aspx. Accessed 24 February 2013.

National Osteoporosis Foundation. Statement on calcium and vitamin D. Internet: *http://www.nof.org/prevention/calcium/htm* (Accessed 11 February 2014).

Nesby-O'Dell S, Scanlon KS, Cogswell ME, et al. (2002). Hypovitaminosis D prevalence and determinants among African American and white women of reproductive age: third National Health and Nutrition Examination Survey, 1988-1994. Am J Clin Nutr.;76(1):187-192.

NIH: National Institute of Diabetes and Digestive and Kidney Diseases. http://www.nlm.nih.gov/medlineplus/hepatitisc.html. (Accessed 11 February 2014).

Norman AW. Vitamin D. In: Bowman BA, Russell RM, eds. (2001). Present Knowledge in Nutrition. 8th ed. Washington, DC: ILSI Press; 146-155.

Orwoll E, Riddle M, Prince M. (1994). Effects of vitamin D on insulin and glucagon secretion in non-insulin-dependent diabetes mellitus. Am J Clin Nutr.;59(5):1083-1087.

Ostad Rahimi A, Zarghami N, Sadighi A. (2006). Relationship Between Vitamin D and Nutritional Status in Healthy Reproductive Age Women. Int J Endocrinol Metab; 4: 1-7.

Outila TA, Karkkainen MU, Lamberg-Allardt CJ. (2001). Vitamin D status affects serum parathyroid hormone concentrations during winter in female adolescents: associations with forearm bone mineral density.AmJ Clin Nutr;74:206 –10.

Palestinian National Authority. (2005). Palestinian Ministry of Health, WHO, West Bank and Gaza strip, Nutrition Department, Palestinian National Authority.

Persons. In C. Winters, & H. J. Lee (Eds.), Conceptual Basis for Rural Nursing (pp.57-71). New York: Springer.

Plotnikoff GA, Quigley JM. (2003). Prevalence of severe hypovitaminosis D in patients with persistent, nonspecific musculoskeletal pain. Mayo Clin Proc.;78(12):1463-1470.

Priemel M, von Domarus C, Klatte TO et al. (2010). Bone mineralization defects and vitamin D deficiency: histomorphometric analysis of iliac crest bone biopsies and circulating 25-hydroxyvitamin D in 675 patients. *J Bone Miner Res.* ;25(2):305-312.

Salle BL, Delvin E, Glorieux F. (2002).Vitamin D and pregnancy. Bull Acad Natl Med;186(2):369-76; discussion 376-7.

Seale, C. (1999). Quality in qualitative research. Qualitative Inquiry, 5(4), 465-478.

Sheng H-W. (2000).Sodium, chloride and potassium. In: Stipanuk M, ed. Biochemical and Physiological Aspects of Human Nutrition. Philadelphia: W.B. Saunders Company: 686-710.

Sigmund CD. (2002). Regulation of renin expression and blood pressure by vitamin D(3). J Clin Invest.; 110(2):155-156.

Souberbielle J, Lawson-Body E, Hammadi B, et al. (2003). The use in clinical practice of parathyroid hormone normative values established in vitamin D-sufficient subjects. *J Clin Endocrinol Metab* ;88:3501-3504.

Spaargaren, G., and B. VanVliet. (2000). 'Lifestyle, Consumption and the Environment: The Ecological Modernisation of Domestic Consumption.' Environmental Politics. 9(1): 50-75.

Specker B. (2004). Vitamin D requirements during pregnancy. Am J Clin Nutr; 80: 1740S–1747S.

Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. (1999). Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D and fluoride. Washington, DC: National Academy Press.

Strauss, A., & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage Publications, Inc.

Takahashi N, Udagawa N and Suda T. (2014). Vitamin D endocrine system and osteoclasts. *BoneKEy Reports 3.* Article number: 495.

Tangpricha V, Koutkia P, Rieke SM, et al. (2003). Fortification of orange juice with vitamin D: a novel approach to enhance vitamin D nutritional health. *Am J Clin Nutr* ;77:1478-1483.

Tarrant, RC., Sheridan-Pereira, M., McCarthy, RA., Younger, KM. & Kearney, JM. (2011). Maternal and Infant Nutritional Supplementation Practices in Ireland: Implications for Clinicians and Policymakers. Irish Medical Journal, 104(6), 173-77.

Thacher TD and Clarke BL. (2011). Vitamin D Insufficiency. Journal List. Mayo Clin Proc>v.86(1); 50–60.

Thacher TD, Fischer PR, Pettifor JM, et al. (1999). A comparison of calcium, vitamin D, or both for nutritional rickets in Nigerian children. *N Engl J Med.* ;341(8):563-568.

Thacher TD, Fischer PR, Pettifor JM, Lawson JO, Manaster BJ, Reading JC. (2000). Radiographic scoring method for the assessment of the severity of nutritional rickets. J Trop Pediatr. ;46(3):132-139.

Thacher TD, Fischer PR, Strand MA, Pettifor JM. (2006). Nutritional rickets around the world: causes and future directions. Ann Trop Paediatr; 26:1–16.

US Environmental Protection Agency. (1989). Report to Congress on Indoor Air Quality, Volume II: Assessment and Control of Indoor Air Pollution., Report No. 400-1-89-001C. Washington, DC: EPA.

van der Meer IM, Karamali NS, Boeke AJ et al. (2006). High prevalence of vitamin D deficiency in pregnant non-Western women in The Hague, Netherlands. Am J Clin Nutr; 84: 350–353, Quiz 468–469

Vandevijvere S, Amsalkhir S, Van Oyen H, Moreno-Reyes R. (2012) High Prevalence of Vitamin D Deficiency in Pregnant Women: A National Cross-Sectional Survey. PLoS ONE 7(8): e43868. doi:10.1371/journal.pone.0043868.

VarnamR. (2012).Awareness of vitamin D deficiency among atrisk patients. BioMed Central Ltd. http://www.biomedcentral.com/1756-0500/5/17.

Venning G. (2005). Recent developments in vitamin D deficiency and muscle weakness among elderly people. BMJ 2005; doi: http://dx.doi.org/10.1136/bmj.330-524

Wagner CL, Greer FR, and the Section on Breastfeeding and Committee on Nutrition. (2008). Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. American Academy of Paediatrics.; 122(5):1142-1152. Available at: http://www.aap.org/new/VitaminDreport.pdf . (Accessed 12 January 2013.)

Walter F. (2003). Page 1094 (The Parathyroid Glands and Vitamin D): A Cellular And Molecular Approach. Elsevier/Saunders. p. 1300. ISBN 1-4160-2328-3.

Weisberg P, Scanlon KS, Li R, Cogswell ME. (2004). Nutritional rickets among children in the United States: review of cases reported between 1986 and 2003. *Am J Clin Nutr.* ; 80(6 suppl):1697S-1705S.

Wharton B, Bishop N. (2003). Rickets. Lancet.; 362(9393):1389-1400.

WHO. (2011). Vitamin D supplementation during pregnancy for the prevention and treatment of pre-eclampsia and eclampsia.

http://www.who.int/elena/titles/vitamind_pregnancy/en/. Approved by the WHO Guidelines Review Committee (Accessed 21 January 2013).

World Meteorological Organization. (2008). "Chapter 8 – Measurement of sunshine duration" *CIMO Guide*. Accessed 28. May 2014.

Wortsman J, Matsuoka LY, Chen TC, Lu Z, Holick MF. (2000). Decreased bioavailability of vitamin D in obesity. Am J Clin Nutr;72:690 –3.

Zeitz U, Weber K, Soegiarto DW, Wolf E, Balling R, Erben RG. (2003). Impaired insulin secretory capacity in mice lacking a functional vitamin D receptor. FASEB J.;17(3):509-511.

Zhang C, Qiu C, Hu FB et al. (2008). Maternal plasma 25- hydroxyvitamin D concentrations and the risk for gestational diabetes mellitus. PLoS ONE; 3: e3753

Zhou C. (2006). Steroid and xenobiotic receptor and vitamin D receptor crosstalk mediates CYP24 expression and druginduced osteomalacia. J Clin Invest;116:1703–12.

Zhuang XL, Zhu ZW, Zhu DB, Chen LQ, Zhao ZY, Shao J. (2012).Maternal-neonatal vitamin D status and related factors Department of Child Health Care, Zhejiang University School of Medicine, Hangzhou;50(7):498-503. China.

Zittermann A. (2003). Vitamin D in preventive medicine: are we ignoring the evidence? Br J Nutr.; 89(5):552-572.

Appendix 1: Arabic version of consent form.

استمارة موافقة المرأة الحامل على المشاركة بالاستبانة

الاسم: _____
تاريخ الميلاد : ____ / _____ / _____

(قياس وعي النساء الحوامل المراجعات للعيادات النسائية في رام الله لنقص فيتامين "د")

عزيزتي المشاركة:

نود دعوتك للمشاركة في هذا البحث والذي يهدف إلى تحديد العوامل التي قد تؤثر على نقص فيتامين "د" لدى السيدات الحوامل واستخدام أقراص المكملات في 8 عيادات خاصة خلال الفترة الواقعة ما بين أيلول إلى كانون أول 2013 في منطقة رام الله. ستستخدم نتائج هذا البحث في تخطيط وتحسين نوعية الخدمات الصحية المقدمة للسيدة الحامل في تلك العيادات والتي ستساعد في تحسين الوضع الصحي للمرأة الحامل بشكل عام.

نرجو من حضرتك الموافقة على المشاركة وذلك بإتمام المقابلة والتي تتضمن إجابتك الدقيقة على الأسئلة المطروحة من قبل الباحث.

نضمن لحضرتك السرية التامة في المعلومات التي ستقدمينها للبحث ولك الحرية التامة في عدم ذكر إسمك أو عدم الإجابة عن أي سؤال يطرح عليك ولك كامل الحرية في الانسحاب متى شئت من الدراسة و إنهاء المقابلة والمغادرة في أي وقت، دون أي التزام.

سيعرض عليكم الباحث النتائج إذا رغبتم في ذلك. إذا كان لديكم أية استفسارات الرجاء عدم التردد في الاتصال بالباحث.

وبناء عليه أوافق على المشاركة في هذه الدراسة.

توقيع المشاركة: _____

تاريخ الموافقة : ____ / _____ /_____ شكرا جزيلا للمشاركة الكريمة.

الباحث : خالد طارق حرز الله

Mobile: 0598914519
Mails: fsh_112@yahoo.com
kherzallah@medipal.ps
kherzallah@gmail.com

Appendix 2: Arabic version of questionnaire

القسم الأول : المواصفات الديموغرافية والشخصية:

الرجاء الإجابة على الأسئلة التالية بشكل دقيق:

1. العمر : ☐ 18- < 20 ☐ 20- < 30 ☐ 30 -< 40 ☐ ≥ 40 عاما
2. مكان السكن : ☐ المدينة ☐ القرية ☐ المخيم ☐ متنقل (البدو)
3. عدد الأولاد : .....
4. لون البشرة : .....
5. محجبة : ☐ نعم ☐ لا
6. التحصيل العلمي : ☐ غير متعلمة ☐ أساسي ☐ ثانوي ☐ دبلوم متوسط ☐ بكالوريوس ☐ دراسات عليا
7. مستوى الدخل الشهري : < 1500 شيقل ☐ 1500-<3000 ☐ 3000-5000>☐ ≥ 5000
8. عدد مرات الحمل : .....

القسم الثاني : التاريخ الطبي

(الأمراض التي تعانين منها إن وجدت): الرجاء الإجابة بنعم أو لا

9. هل تعانين من مرض السكري ؟
10. هل تعانين من مرض لين العظام ؟
11. هل تعانين من مرض هشاشة العظام ؟
12. هل تعانين من مرض التهاب الكبد الوبائي؟
13. هل تعانين من مرض الفشل الكلوي؟
14. هل تعانين من الاكتئاب؟
15. هل سبق وأصبت بنقص فيتامين "د"؟
16. هل تتناولين الحليب يوميا؟ إذا كانت الإجابة نعم , فكم كوبا يوميا؟

القسم الثالث: نمط الحياة والتغذية: الرجاء الإجابة بنعم أو لا

17. هل تتناولين حبوب زيت السمك يوميا؟
18. هل تتناولين البيض يوميا؟ إذا كانت الإجابة نعم , فكم يوميا؟
19. هل تعُرّضينَ جسمك إلى أشعة الشمس بما في ذلك الوجه, الذراعين والساقين يوميا؟
20. هل الطعام الغني بفيتامين "د" متوفر لك بشكل يومي؟
21. هل تمارسين الرياضة يوميا؟

القسم الرابع : القضايا المتعلقة بالصحة ومدى الوعي لنقص فيتامين "د" الرجاء الإجابة بنعم أو لا

22. هل سمعت عن نقص فيتامين "د" من قبل؟
23. هل تعتقدين أن فيتامين "د" مهم لصحتك؟
24. هل طلب منك طبيبك من قبل فحص فيتامين "د"؟
25. هل فحصت نسبة فيتامين "د" في دمك داخل المختبر في الستة أشهر الأخيرة؟
26. هل كانت النتيجة عادية أم منخفضة أم عالية؟
27. هل وصف لك طبيبك حبوب فيتامين "د"؟
28. ما هي الكمية التي وصفها الطبيب لك من فيتامين "د"؟
29. هل التزمت بتناول حبوب فيتامين "د" بشكل كامل؟
30. كم مرة وصف لك طبيبك حبوب فيتامين "د" في العام؟
31. هل شعرت بارتياح جسماني بعد تناول حبوب فيتامين "د"؟

ما هي الأعراض الخاصة بنقص فيتامين "د": الرجاء وضع إشارة (x) في المربع المقابل للأعراض الناتجة عن نقص فيتامين "د" : الرجاء الإجابة بنعم أو لا

32. الاكتئاب
33. مرض السكري
34. ألم في العضلات
35. ألم في العظام
36. الكساح لدى الأطفال
37. نقص الكالسيوم في الجسم
38. العطش
39. التبول اللاإرادي

ما هي أسباب نقص فيتامين"د" : الرجاء وضع إشارة (X) في المربع المقابل للأسباب المؤدية إلى نقص فيتامين "د" الرجاء الإجابة بنعم أو لا

40. عدم التعرض للشمس
41. عدم تناول المأكولات الغنية بفيتامين "د" مثل الحليب
42. عدم تناول المأكولات الغنية بفيتامين "د" مثل السمك
43. عدم تناول المأكولات الغنية بفيتامين "د" مثل السبانخ
44. عدم تناول المأكولات الغنية بفيتامين "د" مثل الدجاج
45. عدم تناول المأكولات الغنية بفيتامين "د" مثل البيض
46. عدم تناول المأكولات الغنية بفيتامين "د" مثل زيت الزيتون
47. الإصابة بأمراض معدية
48. الإصابة بأمراض معوية
49. قلة التعليم
50. أسباب أخرى الرجاء أن تذكريها:.....

ما هي الأمراض التي تنشأ عن نقص فيتامين "د": الرجاء الإجابة بنعم أو لا

51. كساح الأطفال
52. مرض السكري
53. التوحد
54. الاكتئاب
55. ارتفاع ضغط الدم
56. أمراض القلب
57. السرطان
58. اضطرابات الحساسية
59. عدم انتظام الجهاز المناعي
60. التهابات الأنف
61. التهابات في الجلد
62. أمراض أخري الرجاء أن تذكريها:.....

يمكن أن تتجنب السيدة نقص فيتامين "د" والأمراض الناتجة عن نقصه؟ الرجاء الإجابة بنعم أو لا

63. التعرض للشمس
64. زيادة تناول الأطعمة الغنية بفيتامين "د"
65. زيادة التعرف على فيتامين "د" من خلال القراءة والبحث والاستشارة
66. مراجعة الطبيب
67. إجراء فحص مخبري بشكل دوري
68. ممارسة الرياضة
69. طرق أخرى لتجنب نقص فيتامين "د" أذكريها:.....

توقيع المشاركة

Appendix 3: Consent form for subjects participating in research study

Consent Form for Pregnant Women

Name: _____ Version date: March, 2014

Title of Research: "Pregnant Women Awareness of Vitamin D Deficiency in Eight Private Clinics in Ramallah District, Palestine."

Principle Investigator:

Mr. Khaled Herzallah, Health Policy and Management Master Student, 2014 at Al-Quds University / School of Public Health, Telephone: 2799234, 5890400

Direct Supervisor: Dr. Asma Imam; BSc, MPH, PhD.
Associated Professor; Faculty of Public Health ; Al-Quds University
P.O.Box 51915 Telefax: +970-2-2799234

Purpose of Research:

We wish to find the factors that are associated with Pregnant Women Awareness of Vitamin D Deficiency in Eight Private Clinics in Ramallah District, Palestine during the year 2013. This may be encompass important information to our research and the recommended results will be useful for planning and improvement of antenatal health services programs which will have an impact on the quality of life of pregnant women attending these clinics.

I am highly appreciated with your cooperation if you could take the time to go through this questionnaire and answer the relevant questions. Hopefully, it will not take you longer than 10 minutes to fill in this questionnaire post careful reading each single statement because of its high impact to attain accurate results, so, please be completely honest in your assessments and answer the questions as fully as possible.

We appreciate your participation in this study and in providing the information needed for filling the questionnaire, we will keep your information as confidential, maintain your privacy; and you have the right to participate and to leave the study at any time you decide with no any obligation noting that the introduced information will not be used but for scientific research only. The researcher will offer you the results if you would like to. Please if you have any other queries, please do not hesitate to contact me.

Thank you for your time and kind consideration.

Mobile: 0598914519
Mails: fsh_112@yahoo.com
kherzallah@medipal.ps
kherzallah@gmail.com

Signature of participant: _____

Date of Approval: _____/_____ /_____

Researcher: Khaled Tariq Herzallah

Appendix 4: English version of the questionnaire:

First:

Socio-Demographic Characteristics:

Please insert (X) sign in the scoring box in front of the truthful answer:

1. Age:
   □ 18 - <20 years □ 20 - <30 □ 30 - 40 □ older than 40 years
2. Place of residence :
   □ City □ Village □Refugee camp □ Bedouins (Nomads)
3. Parity (Number of live children) :
4. Complexion (Skin color) :
   □ White □ Black □ Corny □ Blond
5. Veiled (head covered) :
   □ Yes □ No
6. Education:
   □ Primary □ Secondary □ Diploma □ Bachelor □ Postgraduate
7. Monthly net income:
   □ < 1500 NIS□1500 – 3000 NIS □ 3001 – 5000 NIS □ > 5000 NIS
8. Gravidity (Number of pregnancies) :
   □ Once □ 2-4 pregnancies □ 5-7 pregnancies □ > 7 pregnancies

Second:

Medical history:

Do you suffer from any of these diseases? (YES or NO questions)

9. Do you suffer from diabetes mellitus?
10. Do you suffer from osteomalacia?
11. Do you suffer from osteoporosis?
12. Do you suffer from hepatitis C?
13. Do you suffer from renal failure?
14. Do you suffer from skin cancer?
15. Do you suffer from depression?
16. Have you ever been told that you have vitamin D deficiency (not enough vitamin D)?

Third:

Life style and nutrition: (YES or NO questions)

17. Do you include milk as a rich source of vitamin D in your meal? If yes, name how many cups daily!
18. Do you include fish oil as a rich source of vitamin D in your meal? If yes, name how many daily!
19. Do you include egg yolk as a rich source of vitamin D in your meal? If yes, name how many!
20. Have you been out in the sun within the last six months with exposed face, arms or legs whenever possible?
21. Is your enriched food with vitamin D daily available?
22. Do you practice physical education daily?

Fourth:

Health related issues and vitamin D deficiency awareness: (YES or NO questions)

23. Have you ever heard of vitamin D deficiency?
24. Do you think vitamin D is important for your health?
25. Did your physician asked you to do vitamin D test?
26. Did you do a lab test for your vitamin D in the last six months?
27. Was the lab test result low?

28. Did your physician prescribe vitamin D supplements (tablets) for you? If so, how many tablets?
29. Were you been fully committed taking vitamin D tablets?
30. How many times did your physician recommend vitamin D tablets in the year?
31. Were you fully relaxed once taking vitamin D tablets?

What are the symptoms of vitamin D deficiency? <u>(YES or NO questions)</u>

32. Depression?
33. Diabetes mellitus?
34. Muscle pain?
35. Bone pain?
36. Rickets in children?
37. Lack of calcium in the body?
38. Thirstiness?
39. Involuntary bedwetting?

What are the reasons for vitamin D deficiency? <u>(YES or NO questions)</u>

40. Not exposuring to sunlight within the last six months with exposed face, arms or legs whenever possible?
41. Not including milk as a rich source of vitamin D in your meal?
42. Not embracing fish liver oil as a rich source of vitamin D in your meal?
43. Not taking in spinach as a rich source of vitamin D in your meal?
44. Not adding in poultry as a rich source of vitamin D in your meal?
45. Not comprising egg yolk as a rich source of vitamin D in your meal?
46. Not involving olive oil as a rich source of vitamin D in your meal?
47. Incidence with infectious diseases?
48. Incidence with intestinal diseases?
49. Paucity of education?
50. Are there any other areas/aspects of discussion/comments agreed, not noted elsewhere? Please, specify if necessary …….....

What are the diseases resulting from vitamin D deficiency? <u>(YES or NO questions)</u>

51. Rickets?
52. Diabetes mellitus?
53. Autism?
54. Depression?
55. Hypertension?
56. Cardiac disease?
57. Cancer?
58. Allergic disorders?
59. Irregularity of the immune system?
60. The nose infections?
61. Infections of skin?
62. Are there any other diseases not noted elsewhere? Please, identify if necessary …….....**.....**

How do you think the pregnant woman can avoid vitamin D deficiency and its diseases resulting from vitamin D deficiency? <u>(YES or NO questions)</u>

63. Exposuring to sunlight within the last six months with exposed face, arms or legs whenever possible?
64. Increasing intake of foods fortified with vitamin D?
65. Increasing recognition of vitamin D through reading, research and consultancy?
66. Checking with your physician?

67. Carrying out laboratory testing on regular basis?
68. Practicing physical education daily?
69. Are there any other areas/aspects of discussion/comments agreed, not noted elsewhere to avoid vitamin D deficiency? Please, specify if necessary …….....**.....**

Signature of participant:

Appendix 5: List of persons shared the questionnaire preparation and critique:

No:	Name	Title	Location
1	Dr. Asma Imam	Ph.D, Supervisor / Associate Professor, School of Public Health	Al-Quds University
2	Dr. A'mer Aljawabreh	Ph.D, Researcher, Lecturer	Arab American University
3	Dr. Kamal Dmaidi	Ph.D-Assistant Professor at faculty of Allied medical science	Arab American University
4	Dr. Hazem Agha	Ph.D, Assistant Professor of Public Health Nutrition, School of Public Health	Al-Quds University
6	Mr. Mohammad Almasri	Statistician	Palestinian Central Bureau of Statistics

Appendix 6: The College letters to the private clinics to facilitate the student's mission

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2013/1/16
الرقم: ك ص ع/2/2013

حضرة الدكتورة كفاح السعدي المحترمة

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

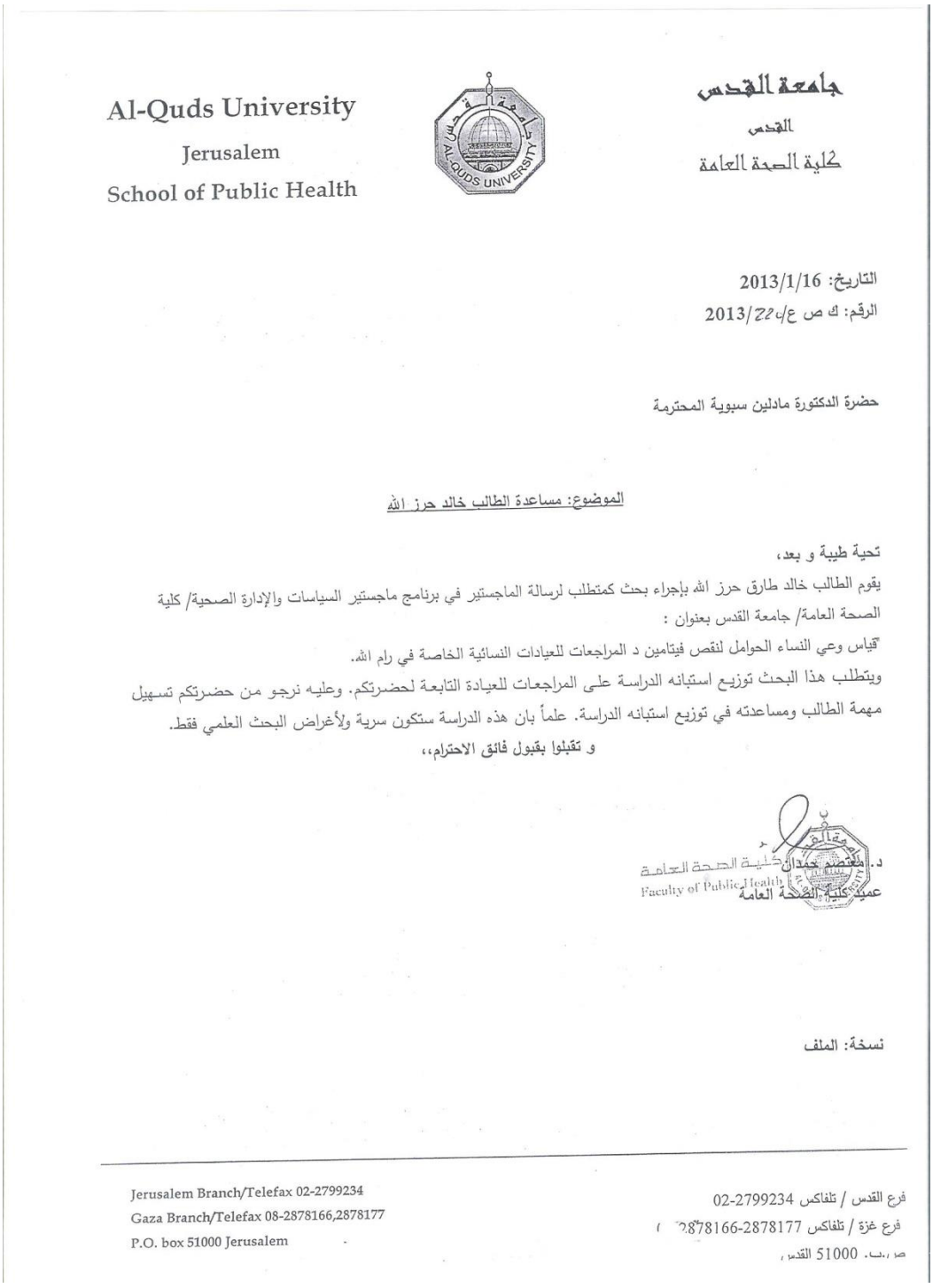
أ.د. معتصم حمدان
عميد كلية الصحة العامة
Faculty of Public Health

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب. 51000 القدس

Appendix 7: The College letters to the private clinics to facilitate the student's mission



جامعة القدس
القدس
كلية الصحة العامة

Al-Quds University
Jerusalem
School of Public Health

التاريخ: 2013/1/16
الرقم: ك ص ع/ 2013/22

حضرة الدكتورة مادلين سبوية المحترمة

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

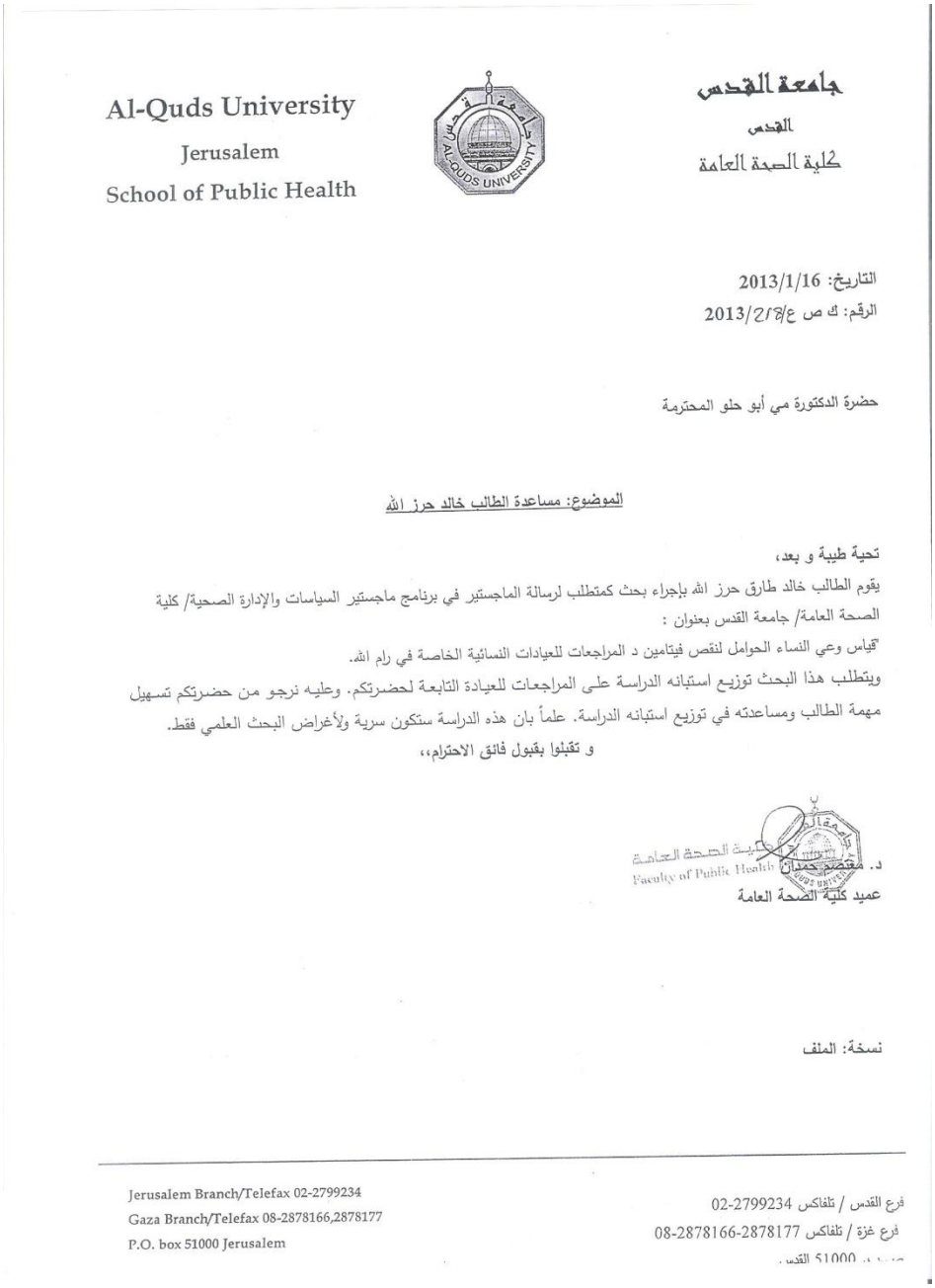
د. مقتضى حمدان
عميد كلية الصحة العامة
كلية الصحة العامة
Faculty of Public Health

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب. 51000 القدس

Appendix 8: The College letters to the private clinics to facilitate the student's mission



جامعة القدس
القدس
كلية الصحة العامة

Al-Quds University
Jerusalem
School of Public Health

التاريخ: 2013/1/16
الرقم: ك ص ع/218/2013

حضرة الدكتورة مي أبو حلو المحترمة

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

كلية الصحة العامة
Faculty of Public Health
د. معتصم حمدان
عميد كلية الصحة العامة

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب 51000 القدس

Appendix 9: The College letters to the private clinics to facilitate the student's mission

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2013/1/16
الرقم: ك ص ع/217/2013

حضرة الدكتور عدوان البرغوثي المحترم
الرعاية العربية

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

كلية الصحة العامة
Faculty of Public Health

د. [illegible]
عميد كلية الصحة العامة

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب 51000 القدس

Appendix 10: The College letters to the private clinics to facilitate the student's mission

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2013/1/16
الرقم: ك ص ع/٦/٢/2013

حضرة الدكتور عودة أبو نحلة المحترم
الهلال الاحمر

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

د. معتصم أحمدان
عميد كلية الصحة العامة

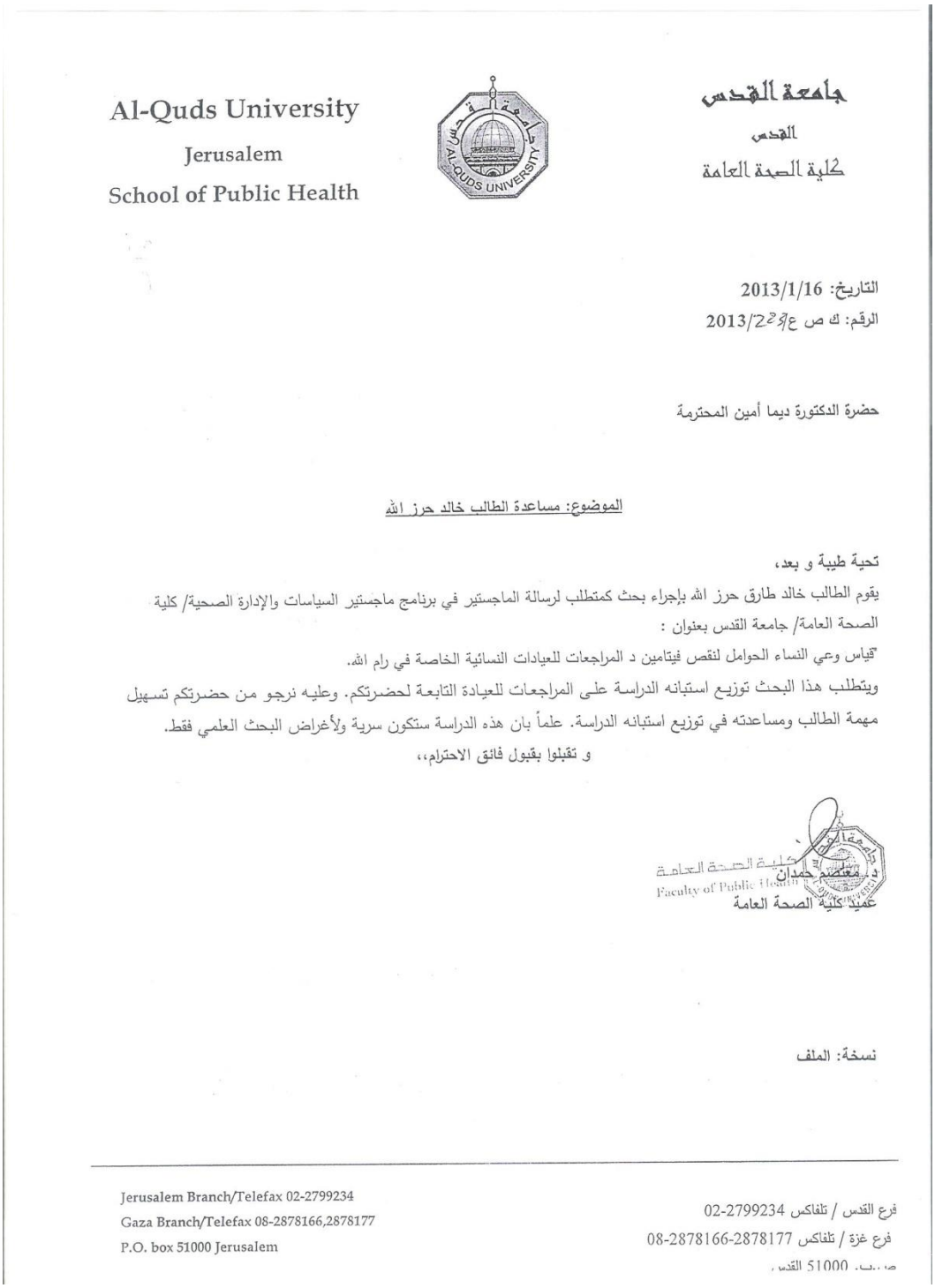
كلية الصحة العامة
Faculty of Public Health

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب. 51000 القدس

Appendix 11: The College letters to the private clinics to facilitate the student's mission



Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2013/1/16
الرقم: ك ص ع/223/2013

حضرة الدكتورة ديما أمين المحترمة

الموضوع: مساعدة الطالب خالد حرز الله

تحية طيبة و بعد،

يقوم الطالب خالد طارق حرز الله بإجراء بحث كمتطلب لرسالة الماجستير في برنامج ماجستير السياسات والإدارة الصحية/ كلية الصحة العامة/ جامعة القدس بعنوان :

"قياس وعي النساء الحوامل لنقص فيتامين د المراجعات للعيادات النسائية الخاصة في رام الله.

ويتطلب هذا البحث توزيع استبانه الدراسة على المراجعات للعيادة التابعة لحضرتكم. وعليه نرجو من حضرتكم تسهيل مهمة الطالب ومساعدته في توزيع استبانه الدراسة. علماً بان هذه الدراسة ستكون سرية ولأغراض البحث العلمي فقط.

و تقبلوا بقبول فائق الاحترام،،

كلية الصحة العامة
Faculty of Public Health

د. معتصم حمدان
عميد كلية الصحة العامة

نسخة: الملف

Jerusalem Branch/Telefax 02-2799234
Gaza Branch/Telefax 08-2878166,2878177
P.O. box 51000 Jerusalem

فرع القدس / تلفاكس 02-2799234
فرع غزة / تلفاكس 08-2878166-2878177
ص.ب. 51000 القدس