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Research Article

Links between Leukemia, Obesity and Vitamin-D Deficiency in a Cross Sectional Study in the North of Saudi Arabia

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Abstract

Introduction: Vitamin D deficiency has recently been recognized as a worldwide concern and still linked to obesity. Despite its high prevalence, no previous community based studies have been conducted in Arar; northern border of Kingdom of Saudi Arabia (KSA), addressing this issue could be traced. This study was carried out to show the magnitude of the problem of vitamin D deficiency and how such a deficiency can eventually has associated with overweight and obesity in female Arar population, KSA.

Methods: A cross-sectional study was carried out during the period from1, November 2015 to 29, February 2016. A total of 185 female subjects aged 18–35 years, attending five randomly selected primary healthcare centers were selected using a systemic random sampling procedure. Data were collected by personal interview using a predesigned questionnaire including the relevant questions for obtaining the needed data. Anthropometric examination included height and weight measurements were obtained. Body Mass Index (BMI) was calculated. Serum levels of 25-OH vitamin D were measured by ELISA.

Results: Majority (58.9%) of the participants had deficient - lower than 12 ng/ml Vitamin Level, 18.9% had insufficient level (12-20 ng/ml) and about fifth (19.5%) only had normal level (20-50 ng/ml). More than one third (34.9) of cases of sever Vitamin D deficiency were severely obese, more than third 31.2% were obese, 14.7% were overweight and less than fifth (19.3%) were normal weight. Most (42.9%) of cases with Vitamin D level 12-20 were overweight, most (38.9) of normal Vitamin D level participants had normal body weight and only 16.7% of them were obese.

Conclusion: Vitamin D deficiency is a common problem in females in Arar, KSA and vitamin D deficiency is strongly associated with obesity. Nutritional education programs are needed.

Keywords: Vitamin D Overweight; Obesity; Females; Kingdom of Saudi Arabia

Introduction

Apparently, obesity is associated with a low-grade of white adipose tissue (WAT) resulting from chronic activation of the innate immune system. Excess fat is thought to stimulate white blood cells (WBCs) that produce molecules as a part of the normal immune response upon injury or infection. Obese adipose tissue mainly releases cytokines including: TNF-α, IL-6 and leptin. At biology level, it can be by a variety of complement components. As the common factor linking adipose tissue to the metabolic context of obesity, insulin resistance and atherosclerosis are associated with a low-grade chronic status, to which the complement system is an important contributor (Figure 1A and Figure 1B).

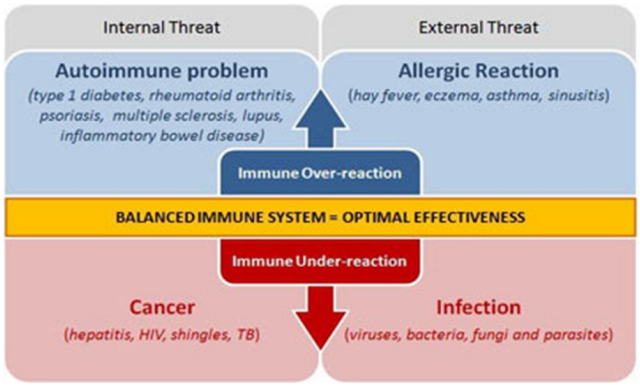

Figure 1A: Balanced immune system.

increasing prevalence of obesity [1] is turning type 2 diabetes into one of the most frequent causes of death [2]. Similarly, vitamin D has recently been recognized as a worldwide concern [3], still linked to obesity. Approximately 1 billion people worldwide from vitamin D [4], which may result from limited exposure to sunlight, long-term wearing of covering clothes, use of sunscreen, age as well as low consumption of food containing ergocalciferol, and mal-absorption syndrome [5].

Several studies have found an association between vitamin D and a cluster of metabolic abnormalities called the 'metabolic syndrome', including abdominal obesity, insulin resistance, dyslipidemia, and hypertension, with the consequent risk of developing cardiovascular diseases and/or type 2 diabetes [6].

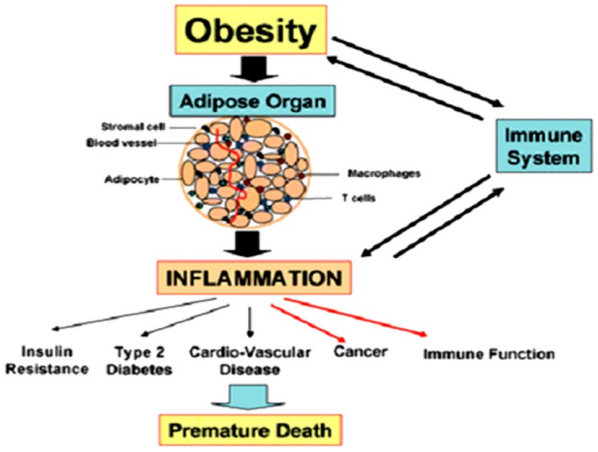

Figure 1B: Obesity, insulin resistance and atherosclerosis are associated with a low-grade chronic status.

concomitant association of vitamin D with insulin resistance, impaired insulin secretion, and their important metabolic consequences has generated the hypothesis of a possible role of vitamin D in the pathogenesis of type 2 diabetes [7].

prevalence of vitamin D was 35% higher in obese subjects compared to the eutrophic group and 24% higher than in the overweight group. results indicate that the prevalence of vitamin D was more elevated in obese subjects [8].

is a link between 25(OH)D levels and insulin responsiveness of tissues as well as between glucose levels and glycosylated hemoglobin in people without diabetes mellitus type 2 [9].

However, data from other authors controvert the relation of vitamin D and metabolic syndrome factors [10,11]. Given these contradicting data, we sought to determine whether serum 25(OH)D concentration in late reproductive age healthy women is associated with body composition and glucose metabolism.

In a study conducted in St. Petersburg (North-West region of Russia), to show if the glucose metabolism and body fat content depend on serum levels of 25-hydroxyvitamin D [25(OH)D], it was considered that, 25(OH)D levels were from 19.4 to 134.0 nMol/L (mean 52.9 ± 22.7). Vitamin D (lower than 50 nMol/L) and (50-75 nMol/L) was revealed in 59.1% and 27.8% of women, respectively. study showed also that low 25(OH)D levels were associated with obesity [12]. study was carried out to show the magnitude of the problem of vitamin D and how such a can eventually has associated with overweight and obesity in female Arar population, KSA.

Methods

Study sitting

present study was conducted in Arar. Arar is the regional headquarter of the Northern Border Province of Saudi Arabia.

Study type

A cross-sectional study was carried out during the period from1, November 2015 to 29, February 2016.

Sampling

Total of185 female subjects aged 18–35 years attending randomly selected primary healthcare centers in Arar city. were selected using a systemic random sampling procedure. Each woman was interviewed separately, and was assured. Health centers provide healthy and sick women with healthcare services in an acceptable atmosphere of both privacy and

Data collection methods

Data were collected by means of personal interview with the sampled women using a predesigned questionnaire covering the following items:

Socio-demographic characteristics of the woman, including age, educational and marital status.

Data related to Vitamin D level and body weight as physical activity, exposure to sunlight, and consumption of milk, dairy products and egg, performing muscular exercise, history of consumption of fatty meals, consumption of fruits and vegetables and family history of obesity was obtained.

exclusion criteria were, Menopause, Diabetes millets, liver or kidneys disease and mal-absorption syndrome. Anthropometric examination included height and weight measurements with the use of a calibrated balance beam scale and a wall-mounted stadiometer and calculation of body mass index (BMI). Normal weight was as BMI<25 kg/m^2, overweight as 25 ≤ BMI<30 kg/m^2 and obesity as BMI ≥ 30 kg/m^2 [13].

Serum levels of 25-OH vitamin D were measured by ELISA. Status of vitamin D was as: normal - 25(OH)D levels higher than 50(ng/ml); - 20 to <50(ng/ml); and - low than 20(ng/ml) and severely if <12(ng/ml)[5].

Ethical considerations

study was reviewed and approved by the Research Ethics Committee of Faculty of Medicine, Northern Border University. Participants were informed that participation is completely voluntary, and written consent was obtained from each participant before being subjected to the questionnaire and discussing the objective with the participants. No names were recorded on the questionnaires. Adequate training of data collectors took place to ensure protection of and all questionnaires were kept safe.

Statistical analysis

Collected data were coded and analyzed using statistical package for the social sciences (SPSS, version 15). w2-test was used as a test of and were considered at P value 0.05 or less.

Results

Table 1 illustrates some socio-demographic characteristics, Vitamin D level and BMI of the studied women. majority of women participating in the study were between 18 and 28 years of age, and

only 35% were between 28 and 35 years of age. As regards the educational status of the participants, most of participants (82.1%) had university graduates and about one quarter (17.8%) had lower educational levels. As marital status, about two-thirds (66.4%) of the were single, nearly one-third (29.2%) were married. As regards Vitamin D level, unfortunately, the majority (58.9%) of the participants had - lower than 12 ng/ml Vitamin D level, 18.9% had level (12-20 ng/ml); about (19.5%) only had normal level (20-50 ng/ml) and 2.7% had level >50 ng/ml. As regards the BMI, only 26.5% of the participants had normal body weight, more than (23.2) were overweight, about quarter (23.8%) were obese, nearly quarter (24.9%) were very obese with BMI>35 and only 1.6% of participants were underweight.

Parameter	No. (%)
Age group	
18-	120 (64.8)
28-35	65 (35.0)
Mean±SD	27±4.3
Educational level	
University education	152 (82.1)
Others	33 (17.8)
Marital status	
Single	123 (66.4)
Married	54 (29.2)
Divorced	5 (2.7)
Widowed	3 (1.6)
Vitamin D level (ng/ml)	
<12	109 (58.9)
(12-20)	35 (18.9)
(20-50)	36 (19.5)
>50	5 (2.7)
Mean ± SD	19.55 ± 11.28
Body mass index (BMI) kg/m^2	
<18.5	3 (1.6)
18.5-24.9	49 (26.5)
25-29.9	43 (23.2)
30-34.9	44 (23.8)
>35	46 (24.9)
Mean ± SD	27.8 ± 10.24

Table 1: Some socio-demographic characteristics, Vitamin D level and BMI of the studied women, Arar, KSA (n=185).

Table 2 illustrates the relationship between Vitamin D level and age group and educational level of the studied population. study revealed that severe Vitamin D was most common in the age group 18-28 years (58.7%) compared with age group 28-35 years, with a statistically (Po 0.05). majority of the studied population (75.2%) with sever Vitamin D (<12) completed their university education, and so most of the participants (97.1%) with Vitamin D level 12-20 with a statistically

Parameter	Vitamin D level (ng/ml)				Total(n=185)	P value
	< 12 (n=109)	(12-20) (n=35)	(20-50) (n=36)	>50 (n=5)		
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Age group						
18-	64 (58.7)	29 (82.9)	23 (63.9)	4 (80.0)	120 (64.8)	0.049
28-35	45 (41.3)	6 (17.1)	13 (36.1)	1 (20.0)	65 (35.0)	
Educational level						
University education	82 (75.2)	34 (97.1)	32 (88.9)	4 (80.0)	152-82.1	0.156
Others	27 (24.7)	1 (2.9)	4 (11.1)	1 (20.0)	33-17.8	

Table 2: Relationship between Vitamin D level and age group and educational level of the studied women, Arar, KSA.

Table 3 illustrates the relationship between Vitamin D level and BMI, Exposure to sunlight, Consumption of milk, dairy products and egg, Performing muscular exercise, Consumption of fruits and vegetables, Preferring fatty meals in the studied women. More than one third (34.9) of cases of sever Vitamin D were severely obese, more than third 31.2% were obese, 14.7% were overweight and less than (19.3%) were normal weight. Most (42.9%) of cases with Vitamin D level 12-20 were overweight, most (38.9) of normal Vitamin D level participants had normal body weight and only 16.7% of them were obese, most (57.8%) of sever Vitamin D and 71.4 of 12-20 serum level, don't exposed to sunlight with a statistically (Po0.05).More than half (55.6%) of participants with normal Vitamin D level consumed milk and dairy products and egg daily compared with 43.1% of sever Vitamin D with a

statistically More than half (52.8%) of participants with normal Vitamin D level were performing muscular exercise compared with 40% of cases of Vitamin D level 12-20. 49.6% of sever Vitamin D cases rarely consume fruits and vegetables compared with 41.7% of participants with normal Vitamin D level with a statistically Most of (61.1%) of participants with normal Vitamin D level don't like fatty meals compared with 50.4% of case of sever Vitamin D and 40% of cases of Vitamin D level 12-20 with a statistically

Parameters	Vitamin D level (ng/ml)				Total (n=185)	P value
	<12 (n=109)	(12-20) (n=35)	(20-50) (n=36)	>50 (n=5)		
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
BMI						
<18.5	0(0.0)	1(2.9)	2(5.6)	0(0.0)	3(1.6)	
18.5-24.9	21(19.3)	12(34.3)	14(38.9)	2(40.0)	49(26.5)	
25-29.9	16(14.7)	15(42.9)	10(27.8)	2(40.0)	43(23.2)	*NA
30-34.9	34(31.2)	4(11.4)	6(16.7)	0(0.0)	44(23.8)	
>35	38(34.9)	3(8.6)	4(11.1)	1(20.0)	46(24.9)	
Exposure to sunlight						
No	63(57.8)	25(71.4)	18(50.0)	3(60.0)	109(58.9)	0.000
Yes	46(42.2)	10(28.6)	18(50.0)	2(40.0)	76(41.1)	
Consumption of milk, dairy products and egg						
Daily	47(43.1)	22(62.9)	20(55.6)	1(20.0)	90(48.6)	
Weekly	32(29.4)	7(20.0)	7(19.4)	2(40.0)	48(25.9)	0.769
Rare	30(25.5)	6(17.1)	9(25.0)	2(40.0)	47(25.1)	
Performing muscular exercise for keeping Vitamin D level						
Yes	40(63.3)	14(40.0)	19(52.8)	3(60.0)	76(41.1)	0.607
No	69(36.7)	21(60.0)	17(47.2)	2(40.0)	109(58.9)	
Consumption of fruits and vegetables						
Yes daily	22(20.2)	8(22.9)	10(27.8)	1(20.0)	40(21.6)	
Weekly	33(30.3)	17(48.6)	11(30.6)	2(40.0)	64(34.6)	0.253
Rarely	54(49.6)	10(28.6)	15(41.7)	2(40.0)	81(43.8)	
Preferring fatty meals						
Yes	54(49.6)	16(45.7)	14(38.9)	1(20.0)	85(45.9)	0.857
No	55(50.4)	17(48.6)	22(61.1)	4(80.0)	80(43.3)	

Table 3: Relationship between Vitamin D level and BMI, exposure to sunlight, consumption of milk, dairy products and egg, performing muscular exercise, consumption of fruits and vegetables and preferring fatty meals in the studied women, Arar, KSA

Discussion

Accumulating evidence suggests vitamin D plays a role in the development of obesity. People usually do not used to supplementing vitamin D, since vitamin D can be produced when their skin is exposed to the sunlight. Nevertheless, even in highly sunny regions, vitamin D exists; suggesting vitamin D is a global problem. cross sectional study was conducted in Arar city, the capital of the Northern Province of Saudi Arabia, we aimed to determine the association between vitamin D and overweight and obesity. A total of 185 female subjects with mean age (± SD) 27 years (±4.3), were included in the study. 25-hydroxy vitamin D (25(OH)D), was measured in blood samples. Body mass index (BMI) was calculated. majority (58.9%) of the participants had (lower than 12 ng/ml) Vitamin D level, 18.9% had level (12-20 ng/ml) and 19.5% only had normal level (20-50 ng/ml),

with Mean level (±SD) were 19.55 ± 11.28 ng/dL. are in accordance with of Russian study which reported that, vitamin D (lower than 50 nMol/L) and (50-75 nMol/L) was revealed in 59.1% and 27.8% of women, respectively. study showed also that low 25(OH)D levels were associated with obesity [12]. Our are also in accordance with Kavadar et al. [13] who found that, decreased physical activity (PA) and obesity have been associated with the low vitamin D levels. Mean ± SD Vitamin D level in the non-diabetic population in his study were 17.62 ± 10.47 ng/dL [13].

As regards the BMI, only 26.5% of the participants had normal body weight, 23.2% were overweight, 23.8% were obese, nearly quarter (24.9%) were very obese with BMI >35 and only 1.6% of participants were underweight with Mean (± SD) of BMI was 27.8 ± 10.24. is in accordance with Kavadar et al. [14] who found Mean (± SD) of BMI in non-diabetic population were 28.2 ± 3.16 kg/m².

In the current study, (34.9) of cases of sever Vitamin D were severely obese, 31.2% were obese, 14.7% were overweight and (19.3%) were normal weight. 42.9% of cases with Vitamin D level 12-20 were overweight, 38.9 of normal Vitamin D level participants had normal body weight and only 16.7% of them were obese. are supported with of systematic review of Santos M et al. [8] who reported that, the prevalence of vitamin D was 35% higher in obese subjects compared to the eutrophic group and 24% higher than in the overweight group. are also supported by other epidemiological studies which demonstrated that vitamin D is closely related to obesity [15]. are again supported by of Karlsson et al. [14] free 25(OH)D was 13.3 ± 5.5 (obese) and 23.7 ± 10.7 (normal-weight). obese women had a 20.1 nmol/L lower mean 25(HO)D concentration compared to normal-weight women. 56 % of obese women and 12 % of normal-weight women had 25(OH)D concentrations ≤50 nmol/L [16]. Moreover, Meta-analysis results showed that the prevalence of vitamin D was between obesity group and control group, and the prevalence of vitamin D was associated with obesity in Asians and European-Americans [17].

Several cross-sectional studies revealed a strong correlation between the low vitamin D levels and obesity, which is also commonly associated with insulin resistance [18-20]. It was found that the combination of vitamin D and obesity had an impact on the risk of insulin resistance [21]. In adolescents with mean age (± SD) was 14.9 ± 1.4 Ys; the mean (± SD) body mass index (in kg/m^2) was 36 ± 5. Seventeen of the adolescents were vitamin D [22]. In the PCOS patients, 97.2% were obese and vitamin D was noted among 62.2% them. mean serum 25(OH)D level was 18.4 and 21.6 ng/mL in PCOS and control groups respectively. in mean 25(OH)D levels between the 2 groups was not statistically [23].

In conclusion, there are and immune system responses in overweight and obese individuals unique opportunities for intervention strategies to help ameliorate the risk of obesity-associated disease such as hypertension and DM.

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