ORIGINAL ARTICLE

Vitamin D Deficiency as Etiological Factor for Breast Cancer

MALEEHA TAHIR BUTT[1], AMBER SHAMI[2], WAQAS QARSHI[3], RAHEELA SHAHEEN[4], ZARRIN KHALIQ CHAUDARI[5], MEHAK SHAFIQ[6]
[1]Senior Demonstrator, Department of biochemistry, Abwa medical college Faisalabad, Pakistan.
[2]Assiatant Professor, Department of Anatomy, Central Park medical college Lahore, Pakistan.
[3]Assiatant Professor, Department of Physiology, Abwa medical college Faisalabaad, Pakistan
[4]Senior Lecturer, Department of biochemistry, Abwa medical college Faisalabaad, Pakistan
[5]Assiatant Professor, Department of biochemistry, Abwa medical college Faisalabaad, Pakistan
[6]Senior Demonstrator, Department of Anatomy, Central Park medical college Faisalabad, Pakistan
Correspondence to: Maleeha Tahir butt, Email: maleehatahirbutt@gmail.com, Cell: 03046611104

ABSTRACT

Aim: To determine the association between vitamin D deficiency and breast cancer.
Material and methods: This study was conducted on 72 participants, 36 cases and 36 healthy controls were enrolled. Basic demographic information was recorded. Vitamins D deficiency was assessed between both groups. Serum Vitamin D level < 20 ng/ml was considered as vitamin D deficient.
Results: Mean age in the cases was 34.64±9.14 years and 36.22±8.78 years in controls. Significant association was found between vitamins D deficiency and breast cancer. In cases there 28 (77.7%) patients with vitamin D deficient and in controls 15 (41.7%) patients.
Conclusion: Vitamin D deficiency is a major risk factor for breast cancer.

INTRODUCTION

With more than 1 in 10 new cancer cases diagnosed annually, breast cancer is the most common cancer among women. It is the second-most common cancer-related mortality among women across the globe [1]. The breast's milk-producing glands are found in front of the chest wall anatomically. They are sustained by ligaments that link the breast to the chest wall and lay on the pectoralis major muscle. The breast is constituted of 15–20 lobes that are aligned in a circle. The size and form of the breasts are governed by the fat enveloping the lobes. Each lobe is made up of lobules that contain the glands that produce milk when hormones are stimulated. Breast cancer arises gradually and silently. The vast majority of individuals learn they have their condition during routine screenings. Others could indicate a breast lump that was detected accidentally, a change in the size or appearance of the breasts, or nipple discharge [2, 3].

One of the many causes of cancer is considered to be a vitamin D deficiency. The two primary sources of vitamin D are sunlight and diet. Underneath the epidermis, ultraviolet light stimulates the vitamin D precursor molecules [4, 5]. It then proceeds into the liver, with the kidneys performing the culminating activation. The primary function of vitamin D in the bones is to maintain the proper balance of minerals and bones [6]. Moreover, it has anti-carcinogenic characteristics that include the ability to prevent cancer cells' angiogenesis, and cell proliferation [7]. A study reported the prevalence of vitamin D deficiency of 70.5% among women with breast cancer [8].

The notion that vitamin D plays a key factor in breast cancer originated from studies that demonstrated extended sun exposure to be associated with a decreased incidence of breast cancer [9, 10].

Even within the general population, vitamin D deficiency seems to be quite common in Pakistan. Due to the rising occurrence of breast cancer among Pakistani women, it is reasonable to speculate that a vitamin D deficiency might be blame for Pakistani women's higher incidence of breast cancer. The goal of this research is to ascertain the association between vitamin D deficiency and breast cancer in Pakistani female patients.

MATERIAL AND METHODS

This case control study was conducted at ABC hospital from January 2022 to July 2022. After taking ethical approval from the hospital's ethical review board the study participants were enrolled. 36 participants diagnosed with breast cancer having age between 20 to 50 years were selected from the surgical OPD as cases and 36 participants falling in the similar age group without breast cancer were selected as controls. Patients on chemotherapy or having grade IV tumor and those unwilling to partake in the study were excluded. Blood samples were drawn from the participants and were sent to the laboratory for serum vitamin D levels. Participants having < 20 ng/ml serum vitamin D level were considered as vitamin D deficient. Basic demographics were recorded for each participant.

The sample size was calculated using openepi web based sample size calculator. Using the previous frequencies of vitamin D deficiency in cases and controls (55.8% and 85.7%)[12], 80% power of test and 95% confidence interval, the sample size calculated was 72.

For data analysis IBM SPSS version 25 was used. Numerical data like age and BMI were presented as mean and SD. Categorical data like menopause, education status, socioeconomic status, sun exposure and vitamin D deficiency were presented as frequencies and percentages. Age and BMI were compared between both groups using Independent samples T test, keeping P value < 0.05 as statistically significant. For comparing categorical data between both groups Chi Square/Fisher's exact test was used keeping P value < 0.05 as statistically significant.

RESULTS

This study was conducted on 72 women. A total 36 women were presenting with breast cancer (cases) and 36 were healthy women (controls). The mean age in the cases group was 34.64±9.14 years and 36.22±8.78 years in control group. The mean BMI in cases was 25.83±2.40 kg/m^2 and 25.91±2.21 kg/m^2 in controls. Comparison of menopause, exposure to sun, education status and socioeconomic status between both groups can be seen in table 1. In our study we found a significant association between vitamins D deficiency and breast cancer between both groups. (Table 2)

Table 1: Baselines characteristics comparison between both groups

Variables		Cases	Controls	P Value
Menopause	Pre-menopause	30 (83.3%)	29 (80.6%)	0.75
	Menopause	6 (16.7%)	7 (19.4%)	
Sun exposure	10 to 20 mins	22 (61.1%)	12 (33.3%)	0.01
	> 20 mins	14 (38.9%)	24 (66.7%)	
Education	Illiterate	12 (33.3%)	7 (19.4%)	0.31
	Primary	13 (36.1%)	12 (33.3%)	
	Intermediate	9 (25%)	11 (30.6%)	
	Bachelors & above	2 (5.6%)	6 (16.7%)	

Socioeconomic status (Monthly income)	10000 to 20000 Rs	10 (27.8%)	6 (16.7%)	0.52
	20000 to 50000 Rs	10 (27.8%)	12 (33.3%)	
	> 50000 Rs	16 (44.4%)	18 (50%)	

Table 2: Comparison of vitamin D deficiency between both groups

		Groups		Total	P value
		Cases	Control		
Vitamin D deficiency	Yes	28	15	43	0.002
		77.8%	41.7%	59.7%	
	No	8	21	29	
		22.2%	58.3%	40.3%	
Total		36	36	72	
		100.0%	100.0%	100.0%	

DISCUSSION

Due to its increasing incidence and fatality rates globally, female breast cancer continues to be a significant public health concern. Its prevalence has significantly increased recently according to statistical trends, making up 11.7% of all cancer cases worldwide[11]. With a total of 25,928 cases recorded countrywide in 2020, female breast cancer incidence is the highest of all malignancies in Pakistan. Age, a family history of breast and reproductive tract cancers, early menarche, nulliparity, late menopause, a high-fat diet, drinking alcohol, and many more are risk factors for breast cancer[12]. A study found that vitamin D insufficiency may increase the risk of breast cancer. Compared to patients with adequate serum vitamin D levels >30ng/ml, women with low serum vitamin D levels 20ng/ml had a higher chance of having breast cancer according to the findings of a case-control research carried out in Karachi, Pakistan[13].

In our study we enrolled 36 women with breast cancer (cases) and 36 normal women (control). The prevalence of vitamin D deficiency was 77.8% in cases and 41.7% in controls. We found that the association of vitamin D deficiency with breast cancer was statistically significant between both groups. In agreement with our results, several studies have been conducted to find an association between vitamin D deficiencies with breast cancer. Breast cancer is a common cancer type in women in Pakistan[15, 14].

Studies carried out around the nation revealed a strong correlation between vitamin D status and the prevalence of breast cancer. In a study, 42 people with newly discovered breast cancer were found to be vitamin D deficient [16]. In a different study, vitamin D insufficiency and the size of breast cancer tumours were positively correlated in 300 newly diagnosed pre- and post-menopausal women from various regions of the Punjab province[17]. In the aforementioned study, vitamin D levels were not linked to tumor grade or stage.

A study including newly diagnosed breast cancer patients revealed a link between breast cancer and low vitamin D levels[18]. Low levels of vitamin D were found in the participants in a cross-sectional study to assess BMI, bone markers, and vitamin D status in newly identified patients of breast cancer[19]. According to a study carried out in Multan 90% of breast cancer patients were vitamin D deficient[20].

In our study we found that > 20 mins of exposure to the sun was more prevalent in control group as compared to the cases group. Hence we safely assume that sun exposure time is associated with increased levels of vitamin D. A multicenter study[13] conducted in Karachi has showed breast cancer risk was higher in women who wore clothing that covered their heads, necks, full legs, and full arms and who avoided the sun more frequently. Due to Pakistan's subtropical climate, women are more likely to develop vitamin D deficiency despite plenty of sun light. The main cause of this contradiction can be attributed to the poor air quality ratings in several of the nation's largest cities. The densely populated communities and closely constructed flats and houses minimizing the sun light to fall on the roof tops and balconies also play a vital role in preventing Pakistani women from getting enough sun exposure. Furthermore, South Asian society has a long history of flawed beauty ideals that forbid women from spending time outside in the sun. Through commercials that exhibit fair-skinned model, the cosmetics business significantly contributes to the continuation of this notion. Additionally, there is a lack of knowledge about balanced meals among women, particularly those from lower socioeconomic backgrounds.

BMI, Age, menopause, socioeconomic status and education background did not show any significant association with breast cancer. Contrary to our findings, a Pakistani Study[18] showed that vitamin D deficiency was significantly higher in cases as compared to controls.

According to a study evaluating the impact of vitamin D supplementation on breast cancer risk, participants who did not take vitamin D supplements had higher probabilities of developing the disease[13]. We therefore suggest that proper awareness campaigns must be conducted to inform the female population about the value of vitamin D in their daily diet. NGOs and healthcare organizations need to promote breast cancer awareness with special focus on vitamin D deficiency as a major cause of breast cancer hence convincing the female population to take vitamin D and spend more time in the sunlight.

CONCLUSION

Vitamin D deficiency was seen in 77.8% in cases and 41.7% in controls. Our findings suggest that vitamin D deficiency is a major risk factor of breast cancer.

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