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Original Article

The Relationship between Occupation and Serum Vitamin D Levels in Females during Summer in Sindh, Pakistan

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ABSTRACT

Vitamin D deficiency is a considerable public health issue affecting predominantly South Asians. **Objective:** To determine the vitamin D levels in females related to different occupations during summer in Sindh, Pakistan. **Methods:** A comparative cross-sectional study was performed at Liaquat University of Medical and Health Sciences, Jamshoro. Healthy females (n = 236) were recruited according to different occupations into four groups: outdoor workers, office workers, students, and housewives. **Results:** Overall, 43.6% were vitamin D deficient, 28.9% were vitamin D insufficient, and 27.5% of females had sufficient vitamin D levels. Hypovitaminosis D was highly prevalent in housewives (62.7%) compared to outdoor workers (16.9%). In general, the mean vitamin D of all examined groups was found to be less than the optimal level, and significant differences were noted between occupational groups. **Conclusions:** The results showed that hypovitaminosis D is prevalent among Pakistani females. Moreover, occupations associated with reduced sun exposure may pose an added risk.

INTRODUCTION

Vitamin D deficiency is a considerable public health concern affecting predominantly South Asians, including Pakistan, affecting ~85% of the population [1, 2]. More than 90% of vitamin D is synthesized as cholecalciferol (D3) on skin exposure to solar ultraviolet (UV) B radiation. It is primarily responsible for calcium and phosphate homeostasis, which regulates bone metabolism [3]. Hypovitaminosis D can lead to osteomalacia, rickets, osteoporosis, and an increased risk of fracture [4]. Moreover, it has several extra skeletal functions, evidenced by the association of hypovitaminosis D with several diseases, including diabetes mellitus, inflammatory, and cardiovascular disorders [5]. Recent research has also linked hypovitaminosis D to an increased coronavirus disease-19 (COVID-19) risk [6]. The vitamin D status in an individual depends on seasonal variations, low UV intensity regions, duration of UV exposure, age, gender, obesity, lack of physical activity, occupation, skin complexion, diet, and increased requirements (pregnancy and lactation). Its production does not occur regularly owing to inadequate

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solar exposure and dietary intake, predisposing the population to vitamin D deficiency [5, 7]. Previous research has shown a high prevalence of vitamin D deficiency among females in Pakistan; however, there is a scarcity of statistics reporting variations in vitamin D levels among females related to occupational groups [8].

In the current study, serum 25(OH)D was determined and compared in four occupations: outdoor workers, who had the most exposure to sunlight; university students and office workers, who were moderately exposed; and housewives, who were relatively less exposed.

METHODS

A comparative cross-sectional study between 2016 and 2018 at the Physiology Department, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, was performed. Samples were collected during summer, i.e., from April to July. In this study, n = 236 females were recruited by non-probability consecutive sampling technique into four groups based on the level of sun exposure: Group A consisted of 59 outdoor workers (laborers, beggars, daily wagers); Group B consisted of 59 office workers; Group C consisted of 59 students; and Group D consisted of 59 housewives. The sample size of n = 236 was calculated from the findings that 85–98% of people in our region had lower vitamin D (<30 ng/mL) in previous studies [9]. Data on socio-demographic variables were obtained directly from participants on a pre-designed proforma. Sun exposure was defined as the exposure of participants to direct sunlight through the exposure of a minimum of 20% of the body involving the arms, hands and face [10]. Body mass index (BMI) was classified as per Asian and South Asian classification [11]. Adult females, residents of Sindh, Pakistan, between 18 and 40 years of age according to the selected occupations, were recruited. Medical history and investigations were evaluated and clinical examination performed. Women who had a history of osteoporosis or medical disorders including hepatic or renal disease, metabolic bone disorders, hormonal disorders, diabetes mellitus malabsorption, and malignancy, taking lipid-lowering drugs, supplements, or medicines that affect vitamin D levels, pregnant and lactating women were excluded. This project was approved by the Ethical Review Committee of Liaquat University of Medical and Health Sciences, Jamshoro (Reference No. LUMHS/REC/339). After written informed consent, participants' venous blood (5 mL) was collected from the antecubital vein under aseptic conditions. The serum vitamin D was measured by the Architect (Abbott Diagnostics, Lake Forest, IL, USA) 25 (OH) Vitamin D assay (product 3L52). Vitamin D deficiency was defined as 25 hydroxyvitamin D (25(OH) D) level < 20 ng/mL, insufficiency as ≥20 to 29.9 ng/mL, while 25(OH) D ≥30 ng/mL was considered as sufficient [9]. For data analysis SPSS v.23 and MedCalc software were used. The p-value ≤ 0.05 was considered significant. The mean and standard deviation (SD) for continuous variables were computed and a one-way analysis of variance (ANOVA) test was performed on mean vitamin D levels for comparing >2 parametric groups with a Tukey HSD means separation test. The odds ratio (OR) and 95% confidence interval (CI) were calculated for categorical variables in bivariate analysis i.e, BMI, type of dressing and daily intake of Vitamin D enriched foods.

RESULTS

The mean age ± SD was 31.6±5.26 years. Table 1 shows socio-demographic variables. The mean serum 25 (OH)D concentration was 21.5±7.13 ng/mL (range = 3.7-60).

Table 1: Socio-demographic characteristics of the females related to different occupations

Characteristics	Outdoor workers (n=59)	Office workers (n=59)	Students (n=59)	Housewives (n=59)
Age				
18-23	10	07	28	03
24-29	01	01	24	8
30-35	22	40	05	15
36-40	26	11	02	33
Marital Status				
Single	33	31	51	0
Married	26	28	08	59
Level of Education				
Illiterate	59	0	0	02
Primary	0	0	0	22
Secondary	0	0	0	25
Intermediate	0	15	08	07
Under graduation, graduation & more	0	44	51	03
Family Income				
<50,000 Rupees /month (<220 USD /month)	59	30	31	19
>50,000 Rupees /month (>220 USD /month)	0	29	28	40

A total of 103 (43.6%) were deficient and 68 (28.9%) had insufficient vitamin D levels. Figure 1 shows vitamin D status among different occupations in female categories.

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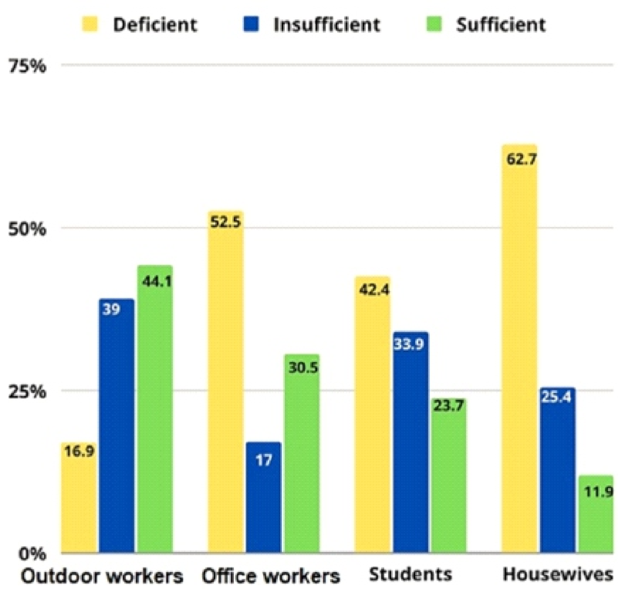

Figure 1: Vitamin D status in various female categories (n = 236)

A relatively low proportion of outdoor workers showed vitamin D deficiency, in comparison to other occupations. Mean levels in all the groups analyzed were less than the optimal levels, and displayed a significant difference (P <0.001)(table 2).

Table 2: Mean vitamin D levels in various female categories (n=236)

Groups	Outdoor workers (n=59)	Office workers (n=59)	Students (n=59)	Housewives (n=59)	p-value
Vitamin D levels (Mean, SD)	24.4±9.4	20.6±5.6	22.6±8.4	17.6±8.2	**<0.001**

On performing Tukey HSD Post-hoc test between the two groups, differences were found between outdoor workers versus housewives (P <0.001) and students versus housewives (P=0.005) as shown in table 3.

Table 3: Post hoc Tukey test results for comparing between two categories based vitamin D levels

Between two categories	Mean differences	P	95% CI
Outdoor workers versus office workers	-3.80	0.05	-7.62, 0.02
Outdoor workers versus students	-1.80	0.62	-5.62, 2.02
Outdoor workers versus housewives	-6.80	<0.001	-10.62, -2.97
Office workers versus students	2.00	0.53	-1.82, 5.82
Office workers versus housewives	-3.00	0.18	-6.82, 0.82
Students versus housewives	-5.00	0.005	-8.82, -1.17

CI: Confidence interval; SD: Standard deviation

P calculated by one-way analysis of variance (ANOVA)

The majority of the females (50.5%) had normal weight, whereas 23.7% were overweight and 22% were obese. Deficiency of vitamin D increased more than 3-fold (P = 0.002) in the overweight group, whereas obesity increased the risk of deficiency by more than 4-fold (P=0.0009)(Table 4). No association was noted between vitamin D status and dressing type or diet.

Table 4: Bivariate analysis showing unadjusted odds ratio and 95% CI between body mass index, type of dressing and intake of vitamin D enriched diet with vitamin D status in females

Characteristics	Total n (%)	Vitamin D status		OR (95% CI)	p-value
		*Deficient (n=171) n (%)	Sufficient (n=65) n (%)		
BMI					
Underweight	09 (3.8)	4 (2.3)	5 (7.7)	0.50 (0.13-1.98)	0.33
Normal weight	119 (50.5)	73 (42.7)	46 (70.8)	Reference	
Overweight	56 (23.7)	48 (28.1)	08 (12.3)	3.78 (1.64-8.71)	0.002
Obesity	52 (22)	46 (26.9)	06 (9.2)	4.83 (1.91-12.21)	0.0009
Type of dressing					
Hijab/Head cover	92 (39%)	64 (37.4%)	28 (43%)	1.21 (0.58-2.54)	0.61
Abaya/Veiled	95 (40.3%)	75 (43.9%)	20 (30.8%)	1.99 (0.92-4.29)	0.08
Unveiled	49 (20.7%)	32 (18.7%)	17 (26.2%)	Reference	
Daily intake of Vitamin D enriched foods					
Yes	72 (30.5%)	50 (29.2%)	22 (33.8%)	0.81 (0.44-1.49)	0.49
No	164 (69.5%)	121 (70.8%)	43 (66.2%)	Reference	

Body mass index (BMI); CI: Confidence interval; OR: Odds ratio

*Deficient and insufficient categories are combined for analysis

DISCUSSION

Hypovitaminosis D is a challenging problem globally and despite Pakistan's location in the sun belt it is highly prevalent, which is attributed to less sun exposure and lifestyle changes [12-14]. Though previous studies have documented vitamin D status in Pakistan, our study has added a distinct criterion to identify the occupational-related association of vitamin D status among females of Sindh, Pakistan [15]. Due to the fact that the present investigation was done during the summer, the vitamin D levels detected in this study possibly denote the greatest seasonal levels. The annual sun graphs for Hyderabad and Jamshoro cities in Sindh Province are shown in Figure 2.

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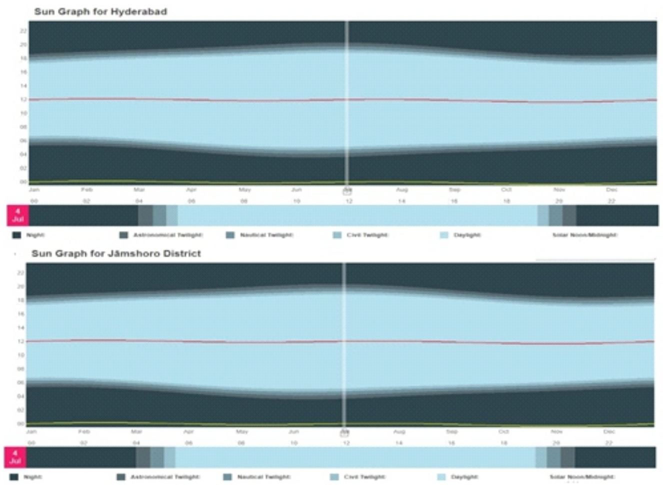

Figure 2. Yearly sun graphs for Hyderabad and Jamshoro cities of Sindh province of Pakistan (https://www.timeanddate.com/sun/)

We observed the high prevalence of vitamin D insufficiency and deficiency (72.5%) among healthy adult females related to different occupations living in Sindh, Pakistan. Another study reported 74.7% of the Rawalpindi and Islamabad residents of Pakistan as vitamin D deficient, with females contributing 79.7% [16]. Avoidance of sun exposure, diet, and lower calcium intake were the main factors associated with it [17, 18]. Vitamin D has a crucial role in females, since its inadequacy might have adverse health effects in addition to affecting prenatal and postnatal growth [19]. The present study has shown significant differences in vitamin D levels among outdoor workers, office workers, students, and housewives. Previous studies have identified the high prevalence of vitamin D deficiency in office workers and housewives, as the majority of them are restricted to indoors or in offices with insufficient exposure to sunlight, that coincides with present study findings [20]. Occupational related sun exposure is associated with higher vitamin D levels. Outdoor employees had 4-8 times higher 25(OH)D levels than their indoor counterparts [21]. In a recent Korean research, wage earners who worked outdoor had greater 25(OH)D levels than indoor workers [22]. Another Korean study showed higher 25(OH)D levels in fisherman (23.74 ± 8.88 ng/mL) who have highest sunlight exposure compared to the general occupational group (13.60 ± 6.43 ng/mL) [23]. Sowah et al., in systemic review reported that, indoor workers had lower vitamin D levels (40.6 ± 13.3 vs. 66.7 ± 16.7 nmol/L; $p < 0.0001$) compared to outdoor workers. The prevalence of vitamin D deficiency was higher among shift workers (80%) and indoor workers (78%) in contrast to outdoor workers (48%). Within the healthcare professionals, residents and students exhibited the lowest levels at 44.0 ± 8.3 nmol/L and 45.2 ± 5.5 nmol/L, respectively. Similar to these findings, we also found that across all examined groups, there were markedly high rates of vitamin D deficiency or insufficiency [24]. We found that females with minimum sunlight contact were at an increased risk for vitamin D deficiency. Avoiding sun exposure is a frequent practice in Pakistan, particularly among females. This is due to various factors, including modern and sedentary lifestyles; hot climates; fairer skin obsession with the preferred use of sunscreen and religious and cultural aspects in the dressing of women to cover the entire body [18, 25, 26]. A national strategy must be developed due to the significant prevalence of hypovitaminosis D in the Pakistani population, particularly among females. Accessibility of vitamin D supplements at the primary health care for high-risk group (pregnant women, breast-feeding mothers, children, and adults), raising public awareness and community education for the prevention of vitamin D deficiency by adjusting appropriate lifestyle practices, sufficient sun exposure, and increasing dietary vitamin D fortified foods must be an important goal of this strategy [27]. Our research has a number of limitations. It is a cross-sectional study. Due to the small sample sizes in individual occupational categories, the body mass index, type of clothing, and dietary vitamin D intake could not be analyzed by occupational group. As our primary objective was to analyze vitamin D concentrations in females in relation to different occupations, we did not include males in our study. However, future research is required to address these gaps.

CONCLUSIONS

The study results suggested that, there is high prevalence of vitamin D deficiency in females of Sindh, Pakistan. The study indicated that females with less sun exposure were at greater risk of developing vitamin D deficiency.

Authors Contribution

Conceptualization: KR
Methodology: KR, HR
Formal analysis: KR, FFK, SL, HL, AHK
Writing-review and editing: FFK, HR, SL, HL, AHK
All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Tariq A, Khan SR, Basharat A. Assessment of knowledge, attitudes and practice towards Vitamin D among university students in Pakistan. BMC Public

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Health. 2020 Dec; 20: 1-0. doi: 10.1186/s12889-020-8453-y.

[2] Mubashir M, Anwar S, Tareen AK, Mehboobali N, Iqbal K, Iqbal MP. Association of vitamin D deficiency and VDBP gene polymorphism with the risk of AMI in a Pakistani population. Pakistan Journal of Medical Sciences. 2017 Nov; 33(6): 1349. doi: 10.12669/pjms.336.13379.

[3] Smith M. Seasonal, ethnic and gender variations in serum vitamin D3 levels in the local population of Peterborough. Bioscience Horizons. 2010 Jun; 3(2): 124-31. doi: 10.1093/biohorizons/hzq016.

[4] Levis S, Gomez A, Jimenez C, Veras L, Ma F, Lai S et al. Vitamin D deficiency and seasonal variation in an adult South Florida population. The Journal of Clinical Endocrinology and Metabolism. 2005 Mar 1;90(3):1557-62. doi: 10.1210/jc.2004-0746.

[5] Heidari B and Mirghassemi MB. Seasonal variations in serum vitamin D according to age and sex. Caspian Journal of Internal Medicine. 2012; 3(4): 535.

[6] Demir M, Demir F, Aygun H. Vitamin D deficiency is associated with COVID-19 positivity and severity of the disease. Journal of Medical Virology. 2021 May; 93(5): 2992-9. doi: 10.1002/jmv.26832.

[7] Visser J, Knight K, Philips L, Visser W, Wallace M, Nel DG et al. Determinants of serum 25-hydroxyvitamin D levels in healthy young adults living in the Western Cape, South Africa. South African Family Practice. 2019 Jul; 61(4): 150-8. doi: 10.1080/20786190.2019.1621047.

[8] Riaz H, Finlayson AE, Bashir S, Hussain S, Mahmood S, Malik F et al. Prevalence of Vitamin D deficiency in Pakistan and implications for the future. Expert Review of Clinical Pharmacology. 2016 Feb; 9(2): 329-38. doi: 10.1586/17512433.2016.1122519.

[9] Sheikh A, Saeed Z, Jafri SA, Yazdani I, Hussain SA. Vitamin D levels in asymptomatic adults-a population survey in Karachi, Pakistan. PloS One. 2012 Mar 23; 7(3): e33452. doi: 10.1371/journal.pone.0033452.

[10] AlFaris NA, AlKehayez NM, AlMushawah FI, AlNaeem AN, AlAmri ND, AlMudawah ES. Vitamin D deficiency and associated risk factors in women from Riyadh, Saudi Arabia. Scientific Reports. 2019 Dec; 9(1): 20371. doi: 10.1038/s41598-019-56830-z.

[11] World Health Organization. Regional office for the western pacific, international association for the study of obesity, international obesity task force. The Asia pacific prospective: redefining obesity and its treatment. Health communication Australia. 2000. [Last cite: 28th Dec 2023]. Available at: https://www.vepachedu.org/TSJ/BMI-Guidelines.pdf

[12] Zhou D, Shah T, Jebran K, Ali S, Ali A. Acceptance and willingness to pay for solar home system: Survey evidence from northern area of Pakistan. Energy Reports. 2017 Nov; 3: 54-60. doi: 10.1016/j.egyr.2017.03.002.

[13] Raza W, Hammad S, Shams U, Maryam A, Mahmood S, Nadeem R. Renewable energy resources current status and barriers in their adaptation for Pakistan. Journal of Bioprocessing and Chemical Engineering. 2015; 3(3): 1-9.

[14] Hribar M, Hristov H, Gregorič M, Blaznik U, Zaletel K, Oblak A et al. Nutrihealth study: seasonal variation in vitamin D status among the Slovenian adult and elderly population. Nutrients. 2020 Jun; 12(6): 1838. doi: 10.3390/nu12061838.

[15] Junaid K, Rehman A, Jolliffe DA, Wood K, Martineau AR. High prevalence of vitamin D deficiency among women of child-bearing age in Lahore Pakistan, associating with lack of sun exposure and illiteracy. BMC Women's Health. 2015 Dec; 15: 1-8. doi: 10.1186/s12905-015-0242-x

[16] Chaudhary B, Afzal A, Khan MA, Anwar B, Rehman A, Shahzad MF. Vitamin D deficiency in Rawalpindi–Islamabad region. Journal of Rawalpindi Medical College. 2017 Jun; 21(2).

[17] Nasir JA, Imran M, Zaidi SA. Pattern of vitamin D among Pakistani pregnant women. Journal of College of Physicians Surgeons Pakistan. 2018 Mar; 28(3): 233-7. doi: 10.29271/jcpsp.2018.03.233.

[18] Siddique MT, Hafeez A, Mearaj S, Abbas S. Overview of Vitamin D, its status and consequences: Challenges and prospects for Pakistani population: A Review. Biomedical Letters. 2021; 7(1): 1-1. doi: 10.47262/BL/7.1.20201114.

[19] Dror DK and Allen LH. Vitamin D inadequacy in pregnancy: biology, outcomes, and interventions. Nutrition Reviews. 2010 Aug; 68(8): 465-77. doi: 10.1111/j.1753-4887.2010.00306.x.

[20] Jamil NA, Shahudin NN, Abdul Aziz NS, Jia Qi C, Wan Aminuddin WA, Mat Ludin AF et al. Knowledge, attitude and practice related to vitamin D and its relationship with vitamin D status among Malay female office workers. International Journal of Environmental Research and Public Health. 2019 Dec; 16(23): 4735. doi: 10.3390/ijerph16234735.

[21] Devgun MS, Paterson CR, Johnson BE, Cohen C. Vitamin D nutrition in relation to season and occupation. The American Journal of Clinical Nutrition. 1981 Aug; 34(8): 1501-4. doi: 10.1093/ajcn/34.8.1501.

[22] Jeong H, Hong S, Heo Y, Chun H, Kim D, Park J et al. Vitamin D status and associated occupational factors in Korean wage workers: data from the 5th Korea

DOI: https://doi.org/10.54393/df.v4i03.85

national health and nutrition examination survey (KNHANES 2010–2012). Annals of Occupational and Environmental Medicine. 2014 Dec; 26: 1-0. doi: 10.1186/s40557-014-0028-x.

[23] Lee DH, Park KS, Cho MC. Laboratory confirmation of the effect of occupational sun exposure on serum 25-hydroxyvitamin D concentration. Medicine. 2018 Jul; 97(27). doi: 10.1097%2FMD.0000000000011419.

[24] Sowah D, Fan X, Dennett L, Hagtvedt R, Straube S. Vitamin D levels and deficiency with different occupations: a systematic review. BMC Public Health. 2017 Dec; 17: 1-25. doi: 10.1186/s12889-017-4436-z. doi: 10.1186/s12889-017-4436-z.

[25] Masood I, Majid Z, Sohail S, Zia A, Raza S. The deadly heat wave of Pakistan, June 2015. The International Journal of Occupational and Environmental Medicine. 2015 Oct; 6(4): 247. doi: 10.15171/ijoem.2015.672.

[26] Impact of Advertisements on Demand for Fairness Products Among University Students in Pakistan. Rehman TU, Parveen S, Jawaid K, Khan MA. Encyclopedia of Organizational Knowledge, Administration, and Technology. IGI Global. 2020.

[27] Aparna P, Muthathal S, Nongkynrih B, Gupta SK. Vitamin D deficiency in India. Journal of Family Medicine and Primary Care. 2018 Mar; 7(2): 324. doi: 10.4103/jfmpc.jfmpc_78_18.