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Original Research

Assessment of gender related differences in vitamin D levels and dyslipidemia in urban and rural population

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ABSTRACT:
Vitamin D insufficiency affects almost 50% of the population in the world. An estimated 1 billion people worldwide, in all age groups, have a vitamin D deficiency. This pandemic of hypovitaminosis D can be caused due to lifestyle and environmental factors that reduce exposure of direct sunlight, which enhances vitamin D production in the skin. The aim of the study was to examine the levels of serum lipids of vitamin D deficient persons of rural and urban areas. The studies determined the prevalence of dyslipidemia (unhealthy lipid levels) and future risk of cardiovascular diseases (atherosclerosis) among the vitamin D deficient persons in urban/ rural areas. The study included a total of 40 subjects from Rural and Urban population. The samples were collected from various labs and diagnostic centers including Octagan lab, Satguru lab, Khalsa Diagnostic Lab and Jaish Ram Lab and tests were performed in Khalsa Diagnostic Lab, Amritsar. Out of 40 subjects, 20 blood samples belong to rural population and other 20 blood samples were from urban population. Samples were further analyzed for the determination of biochemical parameters such as Vitamin D, Total Cholesterol, HDL, LDL, Triglycerides and VLDL. Vitamin D levels of rural and urban patient's shows that 16% of rural population have low Vitamin D profile and 84% have normal levels of Vitamin D, whereas 74% urban population shows hypovitaminosis D and 26% normal levels of Vitamin D. The analysis of lipid profileon the basis of hypovitaminosis in the rural patients and urban patients were categorized at higher risk, borderline and no risk. The difference of rural and urban data, depends upon their life style and direct sun light intake, it also depends upon their different metabolic activities. The vitamin D deficiency can be ameliorated by exposure of direct sun light 7-dehydrocholesterol is converted into cholecalciferol and enhance the level of vitamin D, and reduces the level of cholesterol.
Keywords: Vitamin D, lipid profile, hypovitaminosis, dyslipidemia, sunlight.

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INTRODUCTION

Vitamin D insufficiency affects almost 50% of the population in the world. An estimated 1 billion people worldwide, in all age groups, have a vitamin D deficiency. This pandemic of hypovitaminosis D can be caused due to lifestyle and environmental factors such as reduced exposure to direct sunlight for vitamin D production in the skin (Holick 2007).Vitamin Dexists in two forms i.e. Ergocalciferol-Vitamin D2 & cholecalciferol-vitamin D3. Vitamin D2 is obtained by subjecting the sterol ergosterol found in yeast and plants to the UV irradiation (Askew et al.,2006) and is also found in naturally sun-exposed mushrooms. Human beings do not make vitamin D2. Vitamin D3 is synthesized in skin when UV light from the sun strikes the skin, so it is the most "natural" form. Most oil-rich fish such as salmon, mackerel, and herring contain vitamin D3. It also shows that, without exposure of sunlight, the 7 dehydrocholesterol cannot converts into cholicalciferol and converts into cholesterol by the enzyme called 7- dehydrocholesterol reductase.Vitamin D that comes from the skin or diet is biologically inert. It requires its first hydroxylation in the liver by the D-25- hydroxylase (25-OHase) to 25-hydroxyvitamin D [25(OH) D] also known as calcidiol.Vitamin D however, 25-(OH)-D requires a further hydroxylation in the kidneys by the 25(OH) D-1- OHase to form the biologically active form of vitamin D (1, 25-dihydroxyvitamin D).

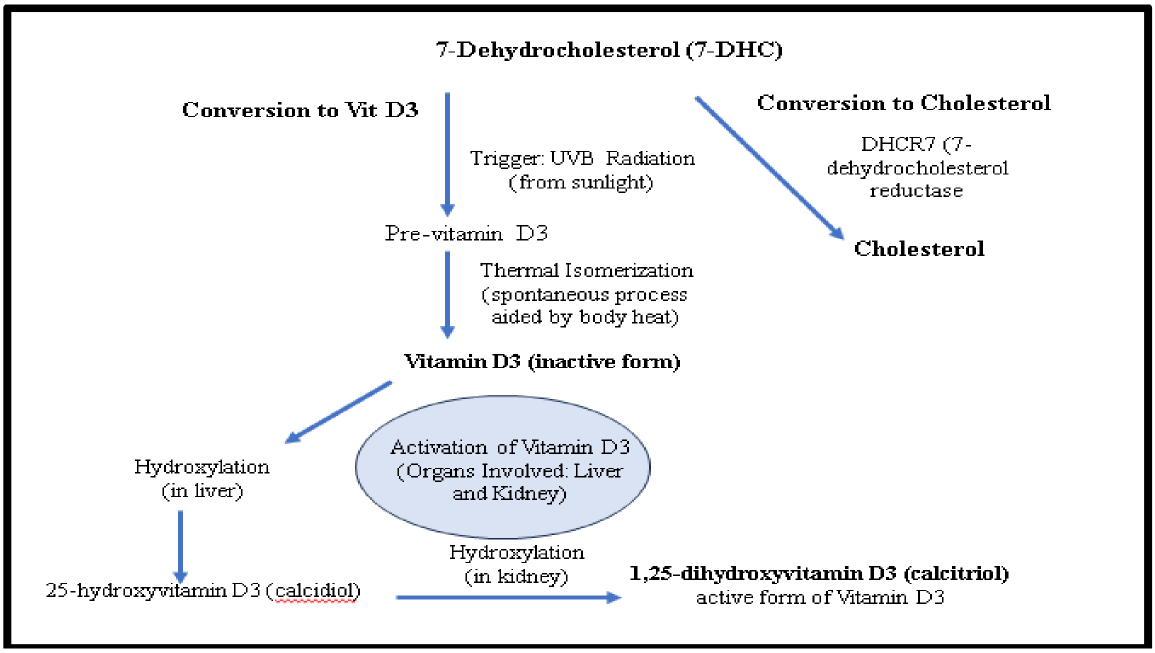


Figure 1. Schematic representation of calcitriol synthesis in humans (Emmanuel *et al.*, 2002; Eyles*et al.*, 2005; El-Atifi*et al.*, 2015).

Vitamin D deficiency has been suggested to be associated with some cardiovascular health problems. A low level of 25 (OH) D is independently associated with increased mortality in subjects with cardiovascular disease (CVD) (Dobnig*et al.*, 2005). A meta-analysis of observational studies has shown that decreases in 25 (OH) D by 16 ng/dL confer a 16% greater risk for hypertension (Burgaz*et al.*, 2011). A multitude of observations suggest that raising blood levels of 25 (OH) D reduces the risk of hypertension, stroke and myocardial infarction (Lee *et al.*, 2008). A lipid/lipoprotein abnormality which refers to raised levels of TC, TG and LDL-C and decreased levels of HDL-C have been identified to be important risk factors of atherosclerosis and CVD (Polkowska*et al.*, 2015).

MATERIAL AND METHODS

Study Population: One hundred asymptomatic subjects were consecutively enrolled from rural and urban areas of Amritsar, Punjab. The study period was from January 2019 to May 2019. Data was collected through face-to-face interviews of all subjects and medical recordreview by physicians. Standardized questions were adapted from the behavioural risk factor surveillance system, by theCentresfor Disease Control and Prevention regarding the following conditions: hypertension, diabetes, hypercholesterolemia, peripheral vascular disease, cigarette smoking, and cardiac conditions such as myocardial infarction and coronary artery disease. Subject with prior history of cardiovascular diseases, cerebrovascular disorders, osteomalacia, any other bone diseases, bonepains, muscle weakness, and vitamin D deficiency or those who were on calcium, vitamin D supplements, and lipid lowering medications were excluded.

Laboratory assessment: Following an 8-hour overnight fast, blood samples were extracted from the antecubital vein. All subjects underwent fasting serum lipid panel (including total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, very low density lipoprotein (VLDL) cholesterol, and triglycerides). In lipid panel, total cholesterol, VLDL cholesterol, HDL cholesterol, and triglyceride levels were measured directly. LDL cholesterol levels were calculated by the Friedewald formula. Vitamin D was estimated by ELISA.

Statistical Analysis: The data was calculated and analysed as Mean of observation ± Standard Error of Mean. The results so obtained were statistically examined using Sigma stat®Software. Analysis of data was done using one way ANNOVA employing Tukey’s test for post hoc analysis p.

RESULTS

In this study, amongst 100 subjects, Vitamin D deficiency was noted in 8 (16%) persons out of 50 rural subjects and in 37 (74%) urban subjects out of 50. The results indicates that mean± SD of vitamin D were normal in rural population (41.24 ±2.35) ($P<.005$), as compared to urban population (21.61±2.70) ($P<.005$). The results of present study showed that mean±SD of cholesterol levels were higher in Urban population (236.25±50.23) (P<.005), as compared to rural population (207.89±45.93) (P<.005), whereas, levels of HDL, LDL triglycerides and VLDL were higher in Rural population as compared to the urban populations with (P<0.005) level of significance. The Vitamin D levels were lower in females as compared with males in both populations. The mean±SD of vitamin D of Urban males were lower than normal range (24.8±4.0) and showed significantly higher levels of Cholesterol(250.0±38.0) (P<.005), whereas in rural males mean±SD of vitamin D was normal (43.3±8.0) with raised cholesterol level (213.1±31.0) lower than urban males.The mean±SD of vitamin D of Urban females were significantly lower than normal range (16.5±5.00) and showed significantly higher levels of Cholesterol (214.7±28.0) (P<.005), whereas in rural females mean±SD of vitamin D was normal (37.2±8.0) with normal cholesterol level (197.7±26.0) lower than urban males. The mean±SD of TG, VLDL HDL and LDL of both rural males and females were higher than urban males and females respectively with (P<0.005) level of significance as shown in table 1. The data obtain as per the performa was in relevance to the results obtained as rural population of this geographical region was found relaying more on milk and milk products and also have more exposure to the sunlight than the urban population.

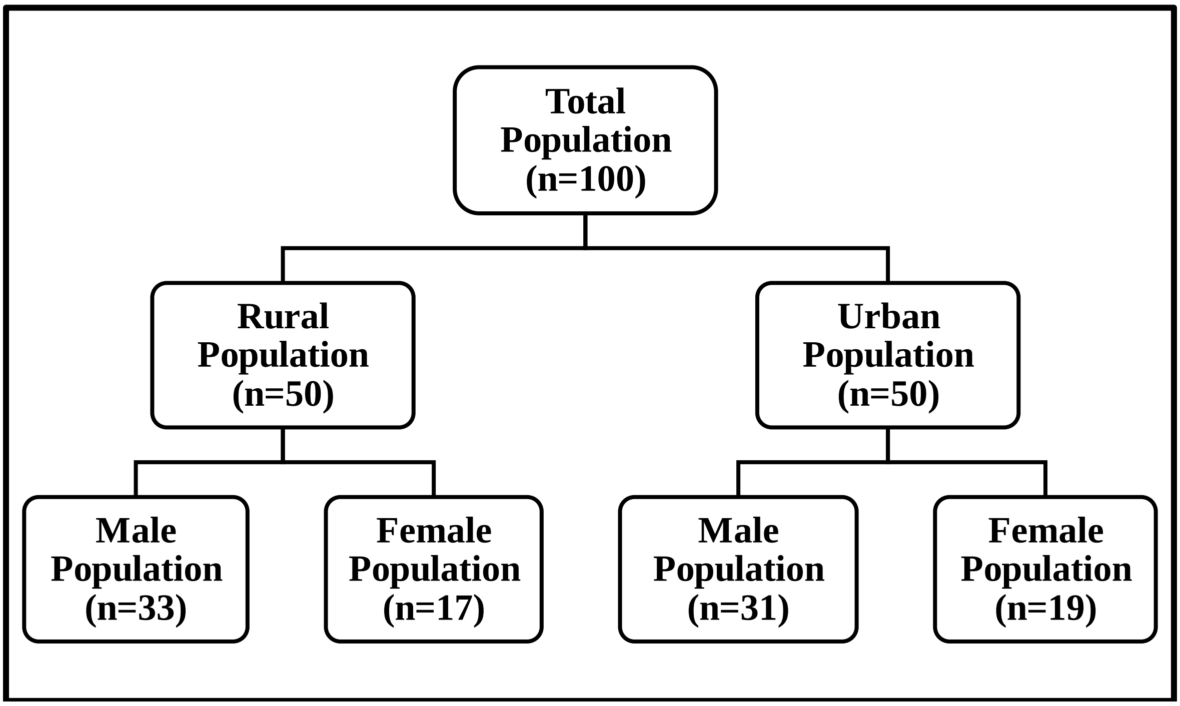
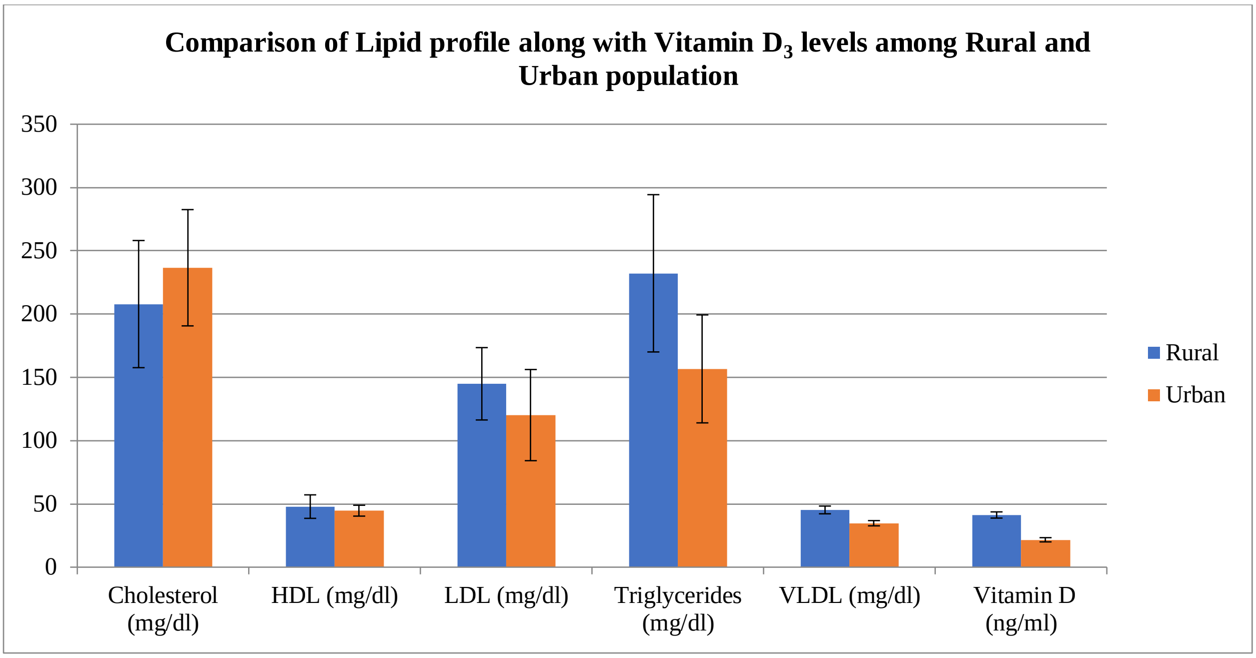


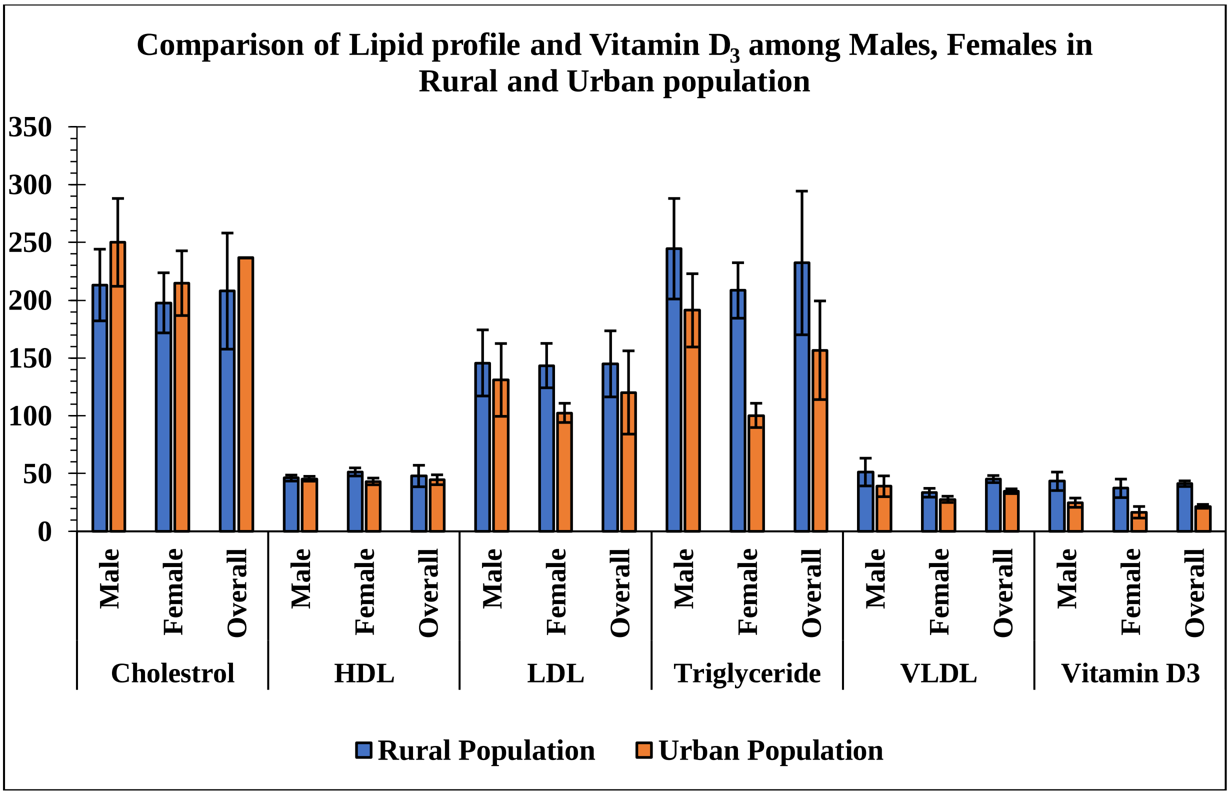
Figure 2: Participant enrolment flow diagram

Table 1: The association between serum 25(OH)D concentrations and serum lipids in males and females of urban and rural populations

S. No.	Subject	Cholesterol	HDL	LDL	Triglycerides	VLDL	Vitamin D_3
	Rural	207.86±50.23	47.87±9.28	144.90±28.58	232.20±62.14	45.24±3.07	41.24±2.45
	Urban	236.60±45.93	44.64±4.29	120.16±36.02	156.68±42.66	34.72±2.06	21.64±1.67
	Rural Female	197.7±26.0	51.4±3.5	143.4±19.2	208.4±24.0	33.4±3.8	37.2±8.0
	Rural Male	213.1±31.0	46.1±2.6	145.7±28.6	244.5±43.5	51.3±12.0	43.3±8.0
	Urban Female	214.7±28.0	43.2±2.9	102.5±8.3	100.3±10.5	27.7±2.7	16.5±5.0
	Urban Male	250.0±38.0	45.5±2.1	131.0±31.5	191.2±31.7	39.0±9.0	24.8±4.0



Graph 1: Comparison of lipid profile along with Vitamin D_3levels among Rural and Urban population.



Graph 2: Comparison of lipid profile between males and females of rural and urban population with vitamin D_3 levels.

DISCUSSION

Vitamin D insufficiency affects almost 50% of population in the world. An estimated 1 billion people worldwide, across all ethnicities and age groups, have a Vitamin D deficiency (VDD). This pandemic of hypovitaminosis D can mainly be attributed to lifestyle (for example, reduced outdoor activities) and environmental (for example, air pollution) factors that reduce exposure to sunlight, which is required for ultraviolet-B (UVB)-induced vitamin D_3 production in the skin. High prevalence of vitamin D insufficiency is a particularly important public health issue because hypovitaminosis D is an independent risk factor for total mortality in the general population. The vitamin D deficiency results to dyslipidemia in population under study. The lowering of vitamin D level raised total serum cholesterol (both groups), TG (rural mainly), and VLDL (rural prominently) levels significantly, but its effect on HDL and LDL not so prominent in the population under study (both groups).Analysis of biochemical parameters of population under study shows that 70% rural population is Vitamin D deficient, whereas its deficiency is more prominent in urban population (80%). Which could be due to the poor availability of direct sun light in urban population? The inverse effect of Vitamin D deficiency (VDD) on total serum cholesterol, TG and VLDL (dyslipidemia) is more pronounced in rural than in urban population .This could be due to more preference of rural population for saturated fats like cheese, butter, Vanaspati ghee as compared to urban population which prefer PUFA rich diet (Diet awareness).Whereas the inverse effect of VDD on HDL and LDL (dyslipidemia) are more prominent in urban population than in rural population. This could be attributed to their leisure physical work life style of unbans as compare to the tough physical working life style of rural population. The VDD results to dyslipidemia in population under study. The lowering of VDD raised total serum cholesterol (both groups), TG (rural mainly), and VLDL (rural prominently) levels significantly, but its effect on HDL and LDL not so prominent in the population under study (both groups). Vitamin D levels of females are relatively lower than the males in both populations respectively. This could be due to calcium insufficiency or indoor work practices or poor dietary habits.

CONCLUSION

Vitamin D deficiency is becoming increasingly common across various age groups. As the global prevalence of deficiency rises, there is growing recognition of its potential role in health and disease prevention, including its impact on cardiovascular health. The study highlighted that Vitamin D_3 deficiency is emerging as a significant risk factor for cardiovascular disease (CVD). As more people are found to have insufficient Vitamin D levels its supplementationand adequate sunlight exposure, may help to reduce the incidence of cardiovascular problems.

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