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Exploration of Vitamin D deficiency in school aged children of the local area of District Mardan

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ABSTRACT

Malnutrition contributes directly or indirectly to more than 60% of 10 million child deaths each year. Vitamin D deficiency is a worldwide phenomenon. Therefore the study aims to explore gender and age-wise deficiency of vitamin D in school-aged children of the local area of District Mardan. A total of 400 children between the ages of 4-15 years were studied. A systematic random sampling technique was applied for sample collection. In the current research work, 400 samples were estimated for the exploration of vitamin D deficiency in school-aged children. A high percentage of Vitamin D deficiency was found in males 45(22.5%) while a very low ratio was found in females 25(12.5%). The ratios of insufficiency in the school-aged children were also high in male 55(27.5%) children as compared to female 25(12.5%) students were respectively. Aged-wise exploration of vitamin D deficiency shows that very low frequency was showed in low aged group 4-7 years(20) 10%, similarly in 8-11 years the frequency of vitamin D deficiency was 30(15%) while in the aged group 12-15 years the frequency of Vitamin D deficiency were found very high 40(20%). Residency-wise results show that the frequency ratio of urban children was high 40(20%) as compared to rural area children 30(15%) respectively. This emerging health problem of Vitamin D deficiency and its connection with the academic career of school-going children has long-term health impacts. The present study highlighted the association between vitamin D deficiency in different age groups, genders, and socioeconomic status-wise exploration of vitamin D deficiency.

Keywords; Vitamins D. Health. Deficiency .Exploration.

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INTRODUCTION

Vitamin D deficiency is an important public health problem in both developed and developing countries, with a reported worldwide prevalence of 30-80% in children and adults. The role of vitamin D in bone mineralization is well-documented **Calvo et al 2005**.Vitamin D [25(OH) D] started to gain importance worldwide for its important role in healthy bone structure and calcium and phosphate metabolism. There are many studies showing 25(OH) D deficiency and insufficiency in children worldwide **(Cediel 2018)**. In the presence of 25(OH) D deficiency and insufficiency, absorbtion of both calcium and phosphorus is impaired resulting in reduced bone mineral density (**Adam et al 2010**). Low levels of 25(OH) D affects an individual's present and future health status, triggering multiple systemic responses reducing bone density and the level of immune response since there are 25(OH) D receptors in a wide range of tissues, and are related with retarded growth, skeletal deformities and secondary hyperthyroidism in the childhood, whereas hip fracture in the elderly is observed in individuals with impaired bone structure **(DeLuca et al 2004)**. Also, there are increasing data explaining the relationship between low levels of 25(OH) D and different types of non-skeletal diseases including some types of cancer, autoimmune, infectious, cardiovascular and psychiatric diseases (**Holick et al 2007**). Risk factors for 25(OH)D deficiency in children were defined as obesity, intestinal malabsorbtion syndromes, usage of anticonvulsant agents such as Phenytoin, phenobarbital, and carbamazepine, low levels of sun exposure, clothing habits, climatization and seasonality, nutritional choices, dark skin color (**Autier et al 2010**). In order to determine an individual's vitamin D status, serum 25 (OH) D levels is measured. There are different threshold points used to determine 25 (OH) D statuses of individuals as suggested by different organizations and in guidelines (**Alyahya 2017**). Regular measurement of 25(OH) D levels in the childhood and replace the low levels with vitamin D fortification or supplementation is essential and a public health matter in order to acquire healthy generations with robust bone structure. The aim of our study was to assess serum 25(OH)D levels in elementary school children aged between 6-9 years old within a year duration and determine 25(OH)D status between different seasons(**Mansbach et al 2009**)

AMIS OF THE STUDY

The aims of the study to explore gender and aged wise deficiency of vitamin D in school aged children of the local area of District Mardan

MATERIALS AND METHODS

This study was undertaken for the Exploration of vitamin D deficiency in school aged children of the local area of District Mardan. We retrospectively studied the records of a total of 400 children of aged between 4-15 June 2023 to December 2023. All patients were subjected to a careful physical examination. Weights were measured using a calibrated digital scale. Height measurements were done intriplicate to the nearest millimeter using a calibrated stadiometer. Body mass index (BMI) were calculated according to the formula [weight (kg)/height (m)2]. Patients with a history of a chronic disorder or on any medication that may alter vitamin D metabolism were excluded from the study. Serum calcium (Ca), phosphorus (P), magnesium (Mg), alkaline phosphatase (ALP) and glucose levels were measured using the enzymatic colorimetric method (Roche Integra 800), while serum 25 hydroxy vitamin D [25(OH) D] levels were measured by highperformance liquid chromatography (Shimadzu UFLC).

According to WHO formula $\mathbf{BMI = \frac{weight}{Hight(M^2)}}$

s. no	status	Student BMI	Normal BMI	HB level
1	Anemia	20BMI	18.5-24.9	>12,>14 g/dL
2	Underweight	18BMI	18.5-24.9	<12,14g/ dL
3	Malnutrition	17.3BMI	18.5-24.9	<12,14g/ dL
4	Stunting	11.2BMI	18.5-24.9	<12,14g/ dL
5	wasting	9.5BMI	18.5-24.9	<12,14g/ dL

Study Area and Period

The study was conducted in Takht Bhai Mardan, which is located Khyber Pakhtunkhwa.

Study Design

Institutional based cross-sectional study designs were used.

Study Population

All secondary and primary school students (age group wise the source population, whereas sampled or selected students were the study population of this study.

Sample Size Determination

A Total of 400 children between the ages of 4-15 years were studied. A systematic random sampling technique was applied for sample collection.

Lab investigations and Tests: All patients were subjected to:

Complete Blood count and reticulocyte count. Patients with microcytosis underwent the following:

• Serum Iron and ferritin

An automatic hematological analyzer and Biochemistry analyzer were used for

Clinical Examination

Routine blood tests

This is done to assess anemia and other vitamin and mineral deficiencies. There may be dehydration, low blood sugar and signs of severe infection as is evident by raised while blood cell counts.

Diagnosis of malnutrition in children

In children weight and height is measured and compared with the charts showing the expected average height and weight for a child of that age. Some children are persistently smaller for age and may be genetically so.

Blood tests in children

Routine blood tests in children include those for blood glucose, blood counts, urine for routine examination.

Levels of iron in blood, folic acid and vitamin B 12 are also done. For protein estimation other tests including

Normal ranges of ferritin 10 to 150 ng/mL for children 4^{th} years to14 years.

MCV normal range is 80 to 95 for children

ANALYSIS & INTERPRETATION

Analysis and Interpretation of data

Data will analyze and interpret by using M word, Origin8 and Excel. Frequency and Percentage were calculated for all quantitative variables.

5. ETHICAL CONSIDERATION

- The subjects were briefed about the study.
- Consent was taken from the subjects after explaining the purpose of study for the collection of data.

Questionnaire form

Demographics information:	**General information**	**Dietary Habits**
Child's Name: _____	Do you have breakfast every day before going to school? (Yes/No)	What is your favorite healthy food?
Age: _____Gender: _____	How many meals do you typically eat in a day?	How often do you drink water in a day?
Grade/Class: _____	Do you eat fruits and vegetables daily? (Yes/No)	Less than 3 glasses
School Name: _____	How often do you consume fast food? (Yes/No)	3-5 glasses
Family background:	**Anthropometric Measurements**	6-8 glasses
How many people live in the child's household.?	Height (cm): __	More than 8 glasses
Male and female ratio in child's household.?	Weight (kg): __	Are you aware of the importance of a balanced diet? (Yes/No)
Family income status?	BMI (Body Mass Index): __	Do you receive any nutrition education at school? (Yes/No)
Hereditary diseases in family?		

S.no	Serum 25(OH)D	Status
1	Serum 25(OH)D	**Deficient < 50nmol/L**
		Insufficient 50-75nmol/L
		Sufficient <75nmol/L
2	**Mean Serum 25(OH)D**	**55± 6nmol/L**

Statistical Analysis

Statistical analysis was performed by using Origin8 and MS office word 2010.

RESULTS AND DISCUSSION

RESULTS

In the current research work 400 samples were estimated for the exploration of vitamin D deficiency in school aged children. Out of 400 samples 200 from male students while 200 were taken from the females' student. The high percentage of Vitamin D deficiency were found in male 45(22.5%) while very low ration were found in female 25(12.5%) Figure.1. while the ratios of insufficiency in the school aged children were also high in male 55(27.5%) children as

compare to female 25(12.5%) students were respectively.

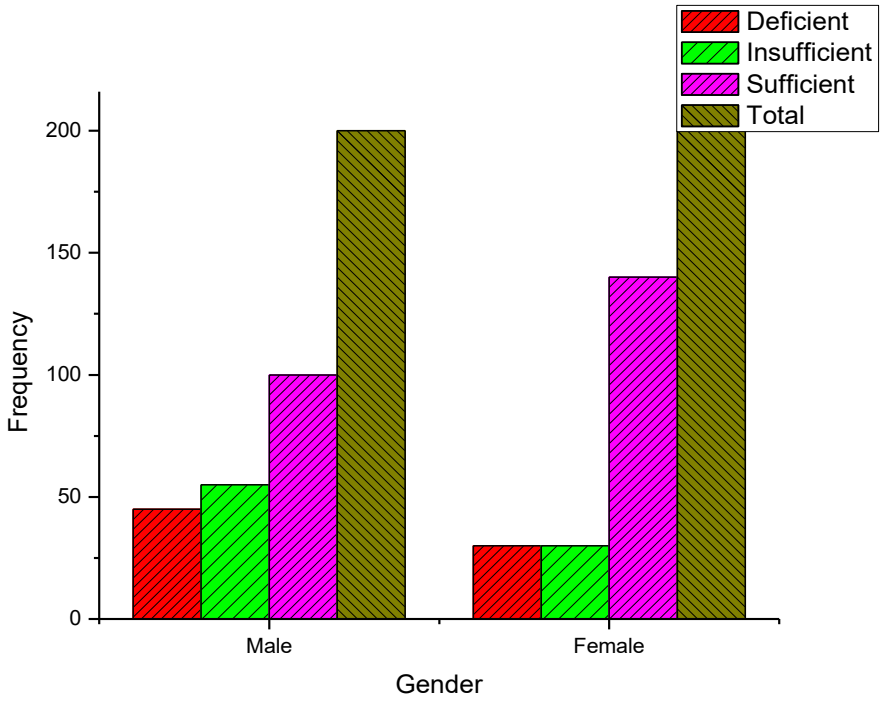

Figure.1 Gender wise Vitamin D deficiency in School Children

Aged wise exploration of vitamin D deficiency shows that very low frequency were showed in low aged group 4-7 years(20) 10%, similarly in 8-11 years the frequency of vitamin D deficiency were 30(15%) while in aged group 12-15 years the frequency of Vitamin D deficiency were found very high 40(20%) shown in Figure.2

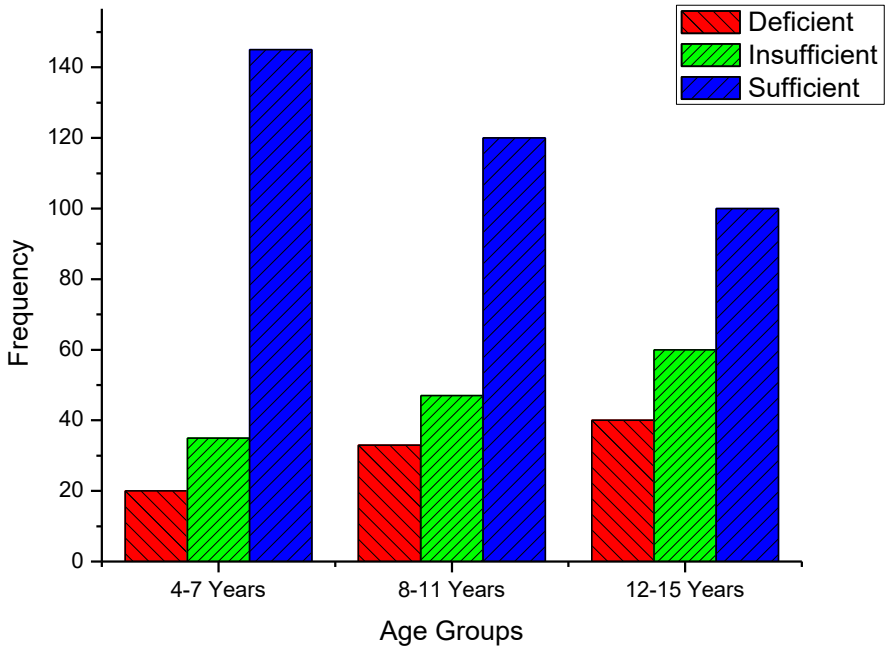

Figure.2 Aged group wise Vitamin D deficiency in School Children

Residency wise results shows that the frequency ration of urban children were high 40(20%) as compare to rural area children 30(15%) respectively figure.3

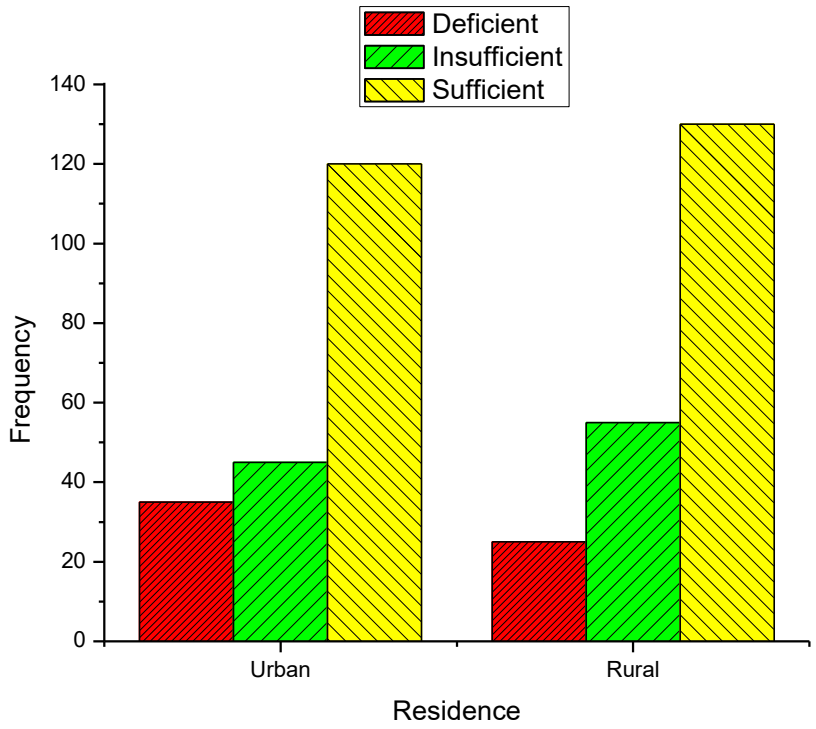

Figure.3 Residence wise Vitamin D deficiency in School Children

Our study also reveal that the vitamin D deficiency related with that of socioeconomic status which shows that the high frequency were found in children of high socioeconomic status as compare to that of the children of low socioeconomic status. In conclusion the vitamin D deficiency was found to be dependent on sunlight, diet and the other factors are socioeconomic status, residency of schoolchildren. The results explore that the need for behavior change communiqué on the significance of exposure to sunlight to create appropriate vitamin D in the schoolchildren of the local area of Mardan. This emerging health problem of Vitamin D deficiency and its connection with the academic carrier of school going children long term health consequences. As the present study only highlighted the association between vitamin D deficiency in different aged group, gender and socioeconomic status wise exploration of vitamin D deficiency.

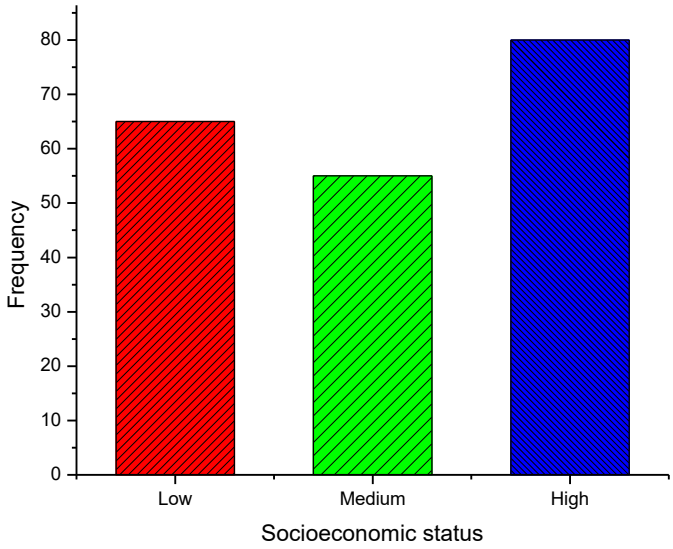

Figure.4 Socioeconomic status wise Vitamin D deficiency in School Childre

DISCUSSION

In the current research work 400 samples were estimated for the exploration of vitamin D deficiency in school aged children. Out of 400 samples 200 from male students while 200 were taken from the females' student. The high percentage of Vitamin D deficiency were found in male 45(22.5%) while very low ration were found in female 25(12.5%) Figure.1. while the ratios of insufficiency in the school aged children were also high in male 55(27.5%) children as compare to female 25(12.5%) students were respectively. Same study were also conducted by **(Zhu et al 2012**) a total of 6,008 children aged 1 month to 16 years partaken in this cross-sectional study. All the subjects were divided into subgroups according to their age: 0-1y, 2-5y, 6-11y and 12-16y representative infancy, preschool, school age and adolescence stages respectively. The highest mean level of serum 25(OH)D was found in the 0-1y stage (99 nmol/L) and the lowest one was found in 12-16y stage (52 nmol/L). Accordingly, the prevalence of serum 25(OH)D levels of < 75 nmol/L and < 50 nmol/L were at the lowest among infants (33.6% and 5.4% respectively) and rose to the highest among adolescents (89.6% and 46.4% respectively). The mean levels of serum 25(OH)D and the prevalence of vitamin D deficiency changed according to seasons. In winter and spring, more than 50% of school age children and adolescents had a 25(OH)D level at < 50 nmol/L. If the threshold is changed to < 75 nmol/L, all of the adolescents (100%) had low 25(OH)D levels in winter and 93.7% school age children as well.

Aged wise exploration of vitamin D deficiency shows that very low frequency were showed in low aged group 4-7 years(20) 10%, similarly in 8-11 years the frequency of vitamin D deficiency were 30(15%) while in aged group 12-15 years the frequency of Vitamin D deficiency were found very high 40(20%).smilerly a research work also performed by (**Hocaoğlu et al 2019**) Serum 25(OH)D levels ranged from 3.90 to 64.60 ng/mL, the median value was 25.95 ng/mL for all subjects. Of all the primary school children, 485 (75.78%) had adequate levels of 25(OH)D. Vitamin D deficiency was observed in 36 of children (5.62%), whereas insufficient levels of 25(OH)D were found in 119 children (18.60%). The ratio of vitamin D insufficiency and deficiency together was highest in spring (31.87%) and lowest in summer (13.12%).

Residency wise results shows that the frequency ration of urban children were high 40(20%) as compare to rural area children 30(15%) respectively. Residency wise study also conducted by **(Manios et al 2017)** a sample of 2386 schoolchildren (9–13 years old) from four distinct prefectures was examined. The prevalence of 25-hydroxyvitamin D (25(OH) D) concentration <30 and <50 nmol/l (vitamin D deficiency and insufficiency respectively) was 5·2 and 52·5 %, respectively. Girls had a higher prevalence of 25(OH) D <30 (7·2 v. 3·2 %) and 50 nmol/l (57·0 v. 48·0 %) than boys (P<0·001). The highest prevalence rates of 25(OH) D <30 and 50 nmol/l (9·1 and 73·1 %, respectively) were observed during spring (April to June), whereas the lowest (1·5 and 31·9 %, respectively) during autumn (October to December). The prevalence of 25(OH) D <50 nmol/l was higher in urban/semi-urban than rural regions, particularly during spring months (74·6 v. 47·2 %; P<0·001). Female sex, urban/semi-urban region of residence and spring months were found to increase the likelihood of vitamin D deficiency and insufficiency, with the highest OR observed for spring months (7·47; 95 % CI 3·23, 17·3 and 5·14; 95 % CI 3·84, 6·89 for 25(OH)D <30 and 50 nmol/l respectively).

CONCLUSION

The results explore that the need for behavior change communiqué on the significance of exposure to sunlight to create appropriate vitamin D in the schoolchildren of the local area of Mardan. This emerging health problem of Vitamin D deficiency and its connection with the academic carrier of school going children long term health significances. As the present study only highlighted the association between vitamin D deficiency in different aged group, gender and socioeconomic status wise exploration of vitamin D deficiency.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

All authors equally contributed in the designing, experiments and wrote the manuscript. All authors read and approved the final manuscript.

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