# STUDY OF VITAMIN D DEFICIENCY AMONG THE APPARENTLY HEALTHY POPULATION IN JESSORE, BANGLADESH

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# Background

Globally Vitamin D deficiency is a burning issue for the last two decades. Though the very high prevalence of Hypovitaminosis D is Worldwide even in the South-East Asia but there is very limited data in Bangladesh.

# World wide prevalence

- In USA, 79% population was serum 25(OH)D level <80nmol/L (32ng/dl).[1]
- Prevalence of hypovitaminosis D among the British population was 87.1%, where serum 25(OH)D level were <75nmol/L(30ng/dl).[2]
- A national population based study in Australia had shown the prevalence of Vitamin D deficiency was 73% where they had taken cut off serum 25(OH)D level <75nmol/l.[3]

# World Wide Prevalence

- The prevalence of Vitamin D deficncy among the adult Saudi Arabian female was 100%, where the deficiency - 79.1% (serum 25(OH) D < 25 nmol/L) and vitamin D insufficiency - 20.9% (serum 25(OH) D between 25–50 nmol/L).[4]
- In Singapore, 44.0% were vitamin D deficient (25OHD3 < 20 ng/mL) and 41.8% were vitamin D insufficient (25OHD3 21 to 29 ng/mL).[5]
- The overall 90% subjects had 25(OH) D levels <75 nmol/L in Punjab, India.[6]

# World wide prevalence

- In Nepal 78.2% participants were < 20 ng/dl and 10.9% were <30 ng/dl[7].
- A total of 84.3% respondents had low (<30 ng/dl) level of vitamin D in Pakistan[8].
- A recent study in Bangladesh had shown that 100% case of garment female workers and 17% female construction workers as control group were vitamin D deficiency, where 80% of control group was in insufficient vitamin D level[9].

# Objectives

To study the level of Vitamin D deficiency among the apparently healthy population in the district of Jessore(**THE CAPITAL CITY OF FLOWER IN BANGLADESH**), Bangladesh.

# Methodology

- Study design : Observational study.
- Place of study : Jessore, Bangladesh(**THE CAPITAL CITY OF FLOWER IN BANGLADESH**)
- Study population : Apparently healthy participants
- Sample size :160 participants
  male(n=69) and female(n=91)
- Sampling method : Non-probability purposive sampling.
- Study period : January to June, 2017

# Selection criteria

**Inclusion criteria:**

Both male and female clinically apparent healthy participants between the ages of 10 and 70 were included in the study who residing in Jossore for last 3 years.

# Selection criteria

**Exclusion Criteria:**

1. Those having renal or liver failure or any other chronic diseases were excluded.
2. Pregnant and lactating women.
3. Persons taking vitamin and mineral supplements or drugs (hormone replacement therapy, glucocorticoids, bisphosphonates, teriparatide, antiepileptic drugs) that affect bone metabolism.

# Analysis

- Preformed structured data collection sheets were used in every selected case.
- Informed written consent was taken from every subjects.
- Analysis carried out using SPSS version 23.
- Categorical data was grouped as % and numbers and mean with standard deviation measured from continuous data.
- Independent T-test, One way analysis of variance (ANOVA) used to extract *p*-value and Games- Howell Post Hoc test used to evaluate deference between different groups.

# Results

160 apparently healthy participants were divided into-

- Deficient : 63.7% had Vitamin $D_3$ level ≤20ng/dl
- Insufficient : 31.3% had Vitamin $D_3$ level >20-30ng/dl
- Sufficient : 05% had Vitamin $D_3$>30ng/dl

# Vitamin $D_3$ level according to age distribution

| Characteristics | | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Deficient | | Insufficient | | Sufficient | |
| Age in years | | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Groups | n (%) | Mean±SD | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| 11-20 | 07(04.4) | 15±3 | 18.04±3.83 | 05(03.1) | 16.28±2.90 | 02(01.3) | 22.44±0.14 | 00(0.0) | -- |
| 21-30 | 23(14.4) | 26±3 | 20.89±8.09 | 15(09.4) | 16.21±1.96 | 05(03.1) | 24.31±3.69 | 03(1.9) | 38.63±0.17 |
| 31-40 | 38(23.8) | 36±3 | 18.36±6.24 | 23(14.4) | 14.10±3.30 | 14(08.7) | 24.40±2.61 | 01(0.6) | 31.90 |
| 41-50 | 37(23.1) | 46±3 | 17.61±5.98 | 25(15.5) | 14.72±3.98 | 11(06.9) | 22.42±2.68 | 01(0.6) | 36.94 |
| 51-60 | 37(23.1) | 56±3 | 18.01±6.52 | 24(15.0) | 14.48±3.94 | 11(06.9) | 22.44±1.24 | 02(1.3) | 35.95±1.34 |
| >60 | 18(11.2) | 67±3 | 19.60±7.33 | 10(06.3) | 14.59±2.82 | 07(04.4) | 23.83±2.74 | 01(0.6) | 40.10 |
| **Total** | **160(100)** | **44±14** | **18.60±6.59** | **102(63.7)** | **14.81±3.43** | **50(31.3)** | **23.38±2.54** | **08(05.0)** | **37.09±2.61** |
| ***P-value*** | | | **$0.492^{ns}$** | | **$0.466^{ns}$** | | **$0.263^{ns}$** | | **$0.01^{s}$** |

# Results

***No significant difference observed in Vitamin $D_3$ Level among different age groups.***

# Vitamin $D_3$ level distribution according to gender

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Gender | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| Male | 69(43.1) | 19.72±7.10 | 38(23.8) | 14.98±3.64 | 25(15.6) | 22.88±1.77 | 06(3.8) | 36.61±2.90 |
| Female | 91(56.9) | 17.74±6.07 | 64(40.0) | 14.70±3.33 | 25(15.6) | 23.85±3.10 | 02(1.3) | 38.53±0.03 |
| M: F= 0.76 | P-value | $0.059^{ns}$ | | $0.700^{ns}$ | | $0.181^{ns}$ | | $0.409^{ns}$ |

# Results

***No significant difference observed in vitamin $D_3$ level among male and female.***

# Vitamin $D_3$ level distribution according to locality

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Locality | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| Rural | 64(40.0) | 20.33±7.40 | 32(20.0) | 14.64±3.22 | 26(16.3) | 23.58±2.68 | 6(3.8) | 36.61±2.90 |
| Urban | 96(60.0) | 17.44±5.74 | 70(43.8) | 14.88±3.55 | 24(15.0) | 23.14±2.42 | 2(1.3) | 38.53±0.03 |
| P-value | | 0.009$^{s}$ | | 0.739$^{ns}$ | | 0.542$^{ns}$ | | 0.409$^{ns}$ |

# Results

***Subjects resides in urban area had lower vitamin $D_3$ level than rural subjects significantly probably due to lower sun exposure which is a barrier to reach UVR.***

# Vitamin $D_3$ level distribution according to educational status

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Education | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| Primary | 25(15.6) | 20.18±5.49 | 13(08.1) | 16.51±3.27 | 11(06.9) | 23.01±2.31 | 01(0.6) | 36.90 |
| Secondary | 60(37.5) | 18.59±7.10 | 39(24.4) | 14.55±3.57 | 17(10.6) | 23.78±3.03 | 04(2.5) | 35.99±3.44 |
| Graduation | 38(23.8) | 18.04±5.54 | 26(16.3) | 15.26±3.10 | 11(06.9) | 22.72±1.47 | 01(0.6) | 38.83 |
| Post-graduation | 37(23.1) | 18.10±7.12 | 24(15.0) | 13.81±3.41 | 11(06.9) | 23.74±2.54 | 02(1.3) | 38.53±0.03 |
| P-value | | **0.589$^{ns}$** | | **0.114$^{ns}$** | | **0.665$^{ns}$** | | **0.729$^{ns}$** |

# Results

***No significant difference observed in Vitamin $D_3$ Level among different education level.***

# Vitamin $D_3$ level distribution according to occupation

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Occupation | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| Physician | 27(16.9) | 17.54±3.57 | 19(11.9) | 15.60±2.09 | 08(05.0) | 22.16±1.20 | 00(0.0) | -- |
| House wife | 61(38.1) | 17.17±5.56 | 43(26.9) | 14.41±3.68 | 18(11.3) | 23.77±3.23 | 00(0.0) | -- |
| Service & Business | 48(30.0) | 17.40±5.61 | 33(20.6) | 14.41±3.73 | 15(09.4) | 23.96±2.59 | 00(0.0) | -- |
| Farmer | 11(06.9) | 30.49±7.38 | 00(00.0) | -- | 05(03.1) | 23.15±1.46 | 06(3.8) | 36.61±2.90 |
| Student | 13(08.1) | 21.83±8.01 | 07(04.4) | 16.93±2.68 | 04(02.5) | 22.05±0.47 | 02(1.3) | 38.53±0.03 |
| P-value | | <0.001$^{s}$ | | 0.196$^{ns}$ | | 0.393$^{ns}$ | | 0.409$^{ns}$ |

# Results

***Farmers had significantly higher Vitamin $D_3$ level than others probably due to more sun exposure.***

# Vitamin $D_3$ level distribution according to BMI

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| BMI | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| <18.5 (Underweight) | 09(05.6) | 21.48±6.46 | 04(02.5) | 17.21±2.21 | 04(02.5) | 21.88±1.54 | 01(0.6) | 36.94 |
| 18.5-24.0 (Normal) | 57(35.6) | 19.22±7.22 | 37(23.1) | 15.28±3.67 | 16(10.0) | 23.64±2.80 | 04(2.5) | 38.04±2.16 |
| 24.1-29.9 (Overweight) | 72(45.0) | 18.68±5.99 | 44(27.5) | 14.93±2.91 | 25(15.6) | 23.21±2.42 | 03(1.9) | 35.88±3.58 |
| ≥30.0 (Obese) | 22(13.8) | 15.51±6.12 | 17(10.6) | 12.87±3.80 | 05(03.1) | 24.47±2.94 | -- | -- |
| P-value | 0.067$^{ns}$ | | 0.041$^{s}$ | | 0.472$^{ns}$ | | 0.629$^{ns}$ | |

# Results

***No significant difference observed in Vitamin $D_3$ Level among different BMI groups but obese deficient subjects had significant lower vitamin $D_3$ level.***

# Vitamin $D_3$ level distribution according to Sun exposure

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| Sun exposure | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD | n (%) | Mean±SD |
| 0- ½ hour | 54(33.7) | 14.18±4.36 | 49(30.6) | 13.43±3.83 | 05(03.1) | 21.56±0.48 | 00(0.0) | -- |
| ½-1 hour | 45(28.1) | 18.42±3.71 | 28(17.5) | 16.02±2.28 | 17(10.6) | 22.38±1.51 | 00(0.0) | -- |
| 1-2 hour | 31(19.4) | 22.47±7.28 | 13(08.1) | 16.12±2.74 | 15(09.4) | 24.76±2.83 | 03(1.9) | 38.63±0.17 |
| >2 hour | 30(18.8) | 22.79±7.54 | 12(07.5) | 16.18±2.62 | 13(08.1) | 23.75±2.94 | 05(3.1) | 36.17± |
| P-value | | <0.001$^{s}$ | | 0.001$^{s}$ | | 0.015$^{s}$ | | 0.219$^{ns}$ |

# Results

***Significant difference in vitamin $D_3$ level observed in different duration of sun exposed groups.*** *From Games- Howell Post Hoc test it was observed that 0- ½ hour/day and ½-1 hour/day sun exposed groups had significantly lower vitamin $D_3$ level than other groups but between 1-2/ hours/day and >2 hours/day groups had no significant difference in vitamin $D_3$ level; which concludes that* ***1-2 hours/day sun exposure is sufficient for normal vitamin $D_3$ level.***

# Vitamin $D_3$ level distribution according to skin complexion and dressing in female

| Characteristics | | 25(OH) D Level | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Deficient | | Insufficient | | Sufficient | |
| | | Total | ≤20ngm/dl | | >20ngm/dl-30ng/dl | | >30ngm/dl | |
| **Skin complexion** | **n (%)** | **Mean±SD** | **n (%)** | **Mean±SD** | **n (%)** | **Mean±SD** | **n (%)** | **Mean±SD** |
| **Black** | 35(21.9) | 18.43±8.97 | 23(14.4) | 13.47±4.23 | 07(04.4) | 21.79±1.70 | 05(3.1) | 36.55±3.24 |
| **Brown** | 59(36.9) | 18.63±5.02 | 36(22.5) | 15.36±2.47 | 22(13.8) | 23.15±1.89 | 01(0.6) | 36.94 |
| **Fair** | 66(41.2) | 18.65±6.59 | 43(26.9) | 15.06±3.55 | 21(13.1) | 24.12±3.12 | 02(1.3) | 37.09±2.61 |
| **P-value** | | $0.987^{ns}$ | | $0.099^{ns}$ | | $0.094^{ns}$ | | $0.729^{ns}$ |
| **Dressing in female (n=91)** | | | | | | | | |
| **Veil** | 44(27.5) | 15.21±4.40 | 40(25.0) | 14.46±3.71 | 04(02.5) | 22.73±3.93 | 00(0.0) | -- |
| **Non-veil** | 47(29.4) | 20.11±6.50 | 24(15.0) | 15.11±2.60 | 21(13.1) | 24.07±2.98 | 02(1.3) | 38.53±0.03 |
| **P-value** | | **$<0.001^{s}$** | | **$0.460^{ns}$** | | **$0.438^{ns}$** | | **--** |

# Results

***Female who used veil had significant lower vitamin $D_3$ level than who did not used veil indicates lack of sun exposure.***

# Limitation of this study

- Study conducted in limited area with limited number of cases.
- Randomization in sampling was not done.
- Dietary habit was not considered.
- Associated comorbidity was not evaluated extensively.

# Recommendations

**Randomized trial including larger number of cases involving whole country recommended.**

# Conclusion

- **Sun exposure play** a vital role in vitamin $D_3$ deficiency and **only 1-2 hours/day sun exposure is sufficient for normal of vitamin $D_3$ level.**
- Farmers had more or less normal **vitamin $D_3$ level** probably due to adequate sun exposure.
- Female who used veil had lower level of vitamin $D_3$ due to lack of adequate sun exposure.
- Urban subjects also had significant low of vitamin $D_3$ level due to same reason.
- Obese subjects had significant lower vitamin $D_3$ level.
- No significant variation observed in vitamin $D_3$ level among different age, sex, education level, and skin complexion.

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