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Study on Vitamin D Deficiency and Its Associating Factors in Tertiary Care Center, Rajasthan

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Abstract

Introduction: *Vitamin D deficiency does indeed constitute an epidemic in many populations across the world. It is essential to bone health and is a major regulator of calcium homeostasis.*

Research Question*: prevalence and its associatong factors of Vitamin D Deficiency in persons Of 18-60 Age Group Attending SMS Hospital, Jaipur.*

Material Methods: *This cross-sectional study design conducted in 18-60 year age group visiting SMS Hospital, Jaipur during April 2015 to December 2016.The sample size is calculated to be 255 subjects assuming the prevalence of Vitamin D deficiency to be 24 % at 95 % confidence interval and 5.8% absolute allowable error.Statistical analysis was performed with the SPSS.The Categorical data were presented as numbers (percent) and were compared among groups using Chi-square and student T-Testor ANOVA .The significance level was set at P < 0.05.*

Result: *The Mean age of the cases were 35.45± 11.88years,withmale:female ratio 1.68:1.No significant difference was observed according to age, religion,occupation.The mean level of Vitamin D was significantly more in males (11.798 ±4.5463) as compared to females (9.605 ±5.0012) P=0.002S)*

Significantly lower mean sun exposure ,BMI was observed in Vitamin D deficient cases as compared to Vitamin D sufficient cases .Vitamin D deficiency was more in overweight cases (84.26%) as compared to normal weight subject (74.07%) (P=0.038S).In these smokers, 81.35% cases were observed Vitamin D deficient as compared to non-smokers(74.45%)(P=0.046S).Sedentary lifestyle was significantly associated with Vitamin D deficiency, where 88.71% (55/62 cases) were vitamin D deficient as compared to in heavy workers which were 60.34%(35/58 cases) Vitamin D deficient (P=0.003S).

Conclusion: *The mean sun exposure ,BMI ,Sedentary lifestyle were observed significant factors vit D deficiency.*

Keywords: *Vitamin D Deficiency , associating factors*

I. Introduction

Vitamin D deficiency does indeed constitute an epidemic in many populations across the world and has been reported in healthy population across all age groups and both genders [(1-2).] In India also, more than 90% of apparently healthy Indians have subnormal 25(OH)D levels. Low dietary vitamin D intake and poor exposure to sunlight are common causes of vitamin D deficiency in the general population. The serum levels of vitamin D are influenced by age, gender, race, obesity, diet, malabsorption, season, geographical latitude and altitude [(1,2)]. Exposure to sunlight, sunscreen lotion, skin pigmentation and skin covering clothes. A normal functioning calcium homeostasis is essential for most functions in the human body. The two main regulators of calcium homeostasis are PTH and vitamin D.

Before serum measurement of vitamin D metabolites (25-OHD, calcitriol etc.) became feasible, vitamin D deficiency was suspected in patients with symptoms of bone pain and muscle weakness and was diagnosed by low serum calcium and phosphate levels and elevated alkaline phosphatase activity [(3, 4).] In addition, urine calcium excretion in these patients was low. Clinical signs used in the screening of elderly people were those pointing to proximal muscle weakness, such as standing up from a chair.Measurement of 25OHD is a better indicator of vitamin D stores, whether obtained from sunlight (ultraviolet exposure) or dietary sources. A low serum 25(OH)D concentration is the hallmark of Vitamin D deficiency[5]. Chronic vitamin D deficiency leads to osteoporosis, osteomalacia, muscle weakness, osteoarthritis, non-specific backache, gout, ankylosing spondylitis, generalized body ache, increased risk of falls and fragility fracture etc. 5-6 Inadequate vitamin D intake and low blood levels of vitamin D metabolites are related to increased incidence of several autoimmune diseases involving the T helper type 1 lymphocyte, including multiple sclerosis, rheumatoid arthritis, type 1 diabetes, systemic lupus erythematosus and psoriasis.[6]

The purpose of this study is to characterize and quantify Vitamin D levels and assessment of its associatong factors of vitamin D deficiency and treatment strategy among the patientsin persons of 18-60 Age presenting to SMS Medical College and Hospital, Jaipur.

II. Material And Methods

This cross-sectional study design was include apparently healthy individuals in 18-60 year age group visiting SMS Hospital, Jaipur during April 2015 to December 2016.The sample size is calculated to be 255 subjects of 18-60 year age assuming the prevalence of Vitamin D deficiency to be 24 % (as per seed article) at 95 % confidence interval and 5.8% absolute allowable error. Hence for study purpose 255 subjects was taken. Pregnant And Lactating Women.,Drugs Affecting Bone Mineral Metabolism Like Steroid, ATT, HRT, Thyroxine, Anti-Epileptic etc, Persons With History Of Surgery, Hospitalisation And Major Medical Illness Within Past One Year, Cancer, Hepatic, Renal, Skin Disease patient were excluded. The US Endocrine Society and US Institute of Medicine (IOM, 2011) classified the serum vitamin D level (ng/ml) in following categories **Vitamin D >30ng/ml** (normal or sufficient level) ,**20 to 30 ng/ml** (insufficient or borderline levels), **10 to 20 ng/ml** (mild deficient level) **5 to 10 ng/ml** (moderately deficient levels) and **<5 ng/ml** (severe hypovitaminosis D).

Statistical analysis was performed with the SPSS, trial version 23 for Windows statistical software package (SPSS inc., Chicago, il, USA) and primer.The Categorical data were presented as numbers (percent) and were compared among groups using Chi-square test. The quantitative data was expressed as mean ± SD (Standard Deviation). Differences among the groups were analyzed using the student T-Test for two group and ANOVA for more than Two groups.The significance level was set at $P < 0.05$.

III. Result And Observation

The Mean age of the cases were 35.45± 11.88(range 18 to 60years).Most of the subjects belonged to 31-40 year of age group(29.02%), followed by age group 21 to 30 years(25.88%) and least subjects were in extreme of age groups like ≤20 and 51 to 60 years(12.16%).Males were more (62.75%)as compared to females (37.25%) amongst study group withmale :female ratio was 1.68:1.Hindus were more (88.63%)as compared to Muslims (11.37%) amongst study group.According to occupation,most of the cases(27.45%) were housewives followed by farmers (21.18%) and shopkeepersamongst study groups.APLwas more (83.53%)as compared to BPL (16.47%) amongst study group.The mean duration of sun exposure was 2.42±1.378 hours per day amongst study group.Most of thecases (52.94%) were in thenormal range of BMI followed by overweight subject (42.35%) amongst study group. Amongst our study group, 46.27%cases are asmoker.52.94% cases belonged to moderate lifestyle followed by 24.31 % cases, which were belonged to sedentary lifestyle amongst all study group.

Out of total 255 no. of cases, mean age of the study population was 35.45 ±11.88 (18 to 60 years).Mean Sun exposure of the study population was 2.42 ±1.378 (1 to 6) (hrs/day)Mean Height was 170.58 ± 7.29 (149 to 186 cm), BMI was 23.40± 2.827 (15 to 31 Kg/m2)Mean Vitamin Dwas 14.589±9.277 (3.9 to 76.7 ng/ml) Mean S.Calcium was 9.03 ± 0.7207 mg/dl

As evident from above table the mean±SD serum Vitamin D levels amongst all cases were 14.589 ± 9.277 (3.9 to 76.7).Vitamin D >30ng/ml (normal or sufficient level) was observed in 5.49% of the cases.Vitamin D 20 to 30 ng/ml (insufficient or borderline levels) observed in 16.86 % cases.Vitamin D 10 to 20 ng/ml (mild deficient level) observed in 43.14% of cases.Vitamin D 5 to 10 ng/ml (moderately deficient levels) found in 22.35% cases.Vitamin D <5 ng/ml (severe hypovitaminosis D) was found in 12.16%cases.

No significant difference was observed according to age (P=0.47NS) religion (0.094NS).The mean level of Vitamin D was significantly more in males (11.798 ±4.5463) as compared to females (9.605 ±5.0012) P=0.002S) but no significant difference was observed in insufficiency and Sufficiency status of the Vitamin D (P=0.244NS and P= 0.73NS) respectively.(**Table No 2)**No significant association was observed according to occupation except in farmers where cases were more in Vitamin D sufficient status(P<0.001S) and in govt. employees where the proportion of the cases were more in Vitamin D deficient status(P=0.03S).

Significantly lower mean sun exposure was observed in Vitamin D deficient cases as compared to Vitamin D sufficient cases (2.42±1.378 vs 3.14±1.6) (P<0.001S). A significant difference was observed according to BMI range with vitamin D deficiency. Vitamin D deficiency was more in overweight cases (84.26%) as compared to normal weight subject (74.07%) (P=0.038S).

Amongst 255 cases, forty six percent (46.27%) cases were smokers. In these smokers, 81.35% cases were observed Vitamin D deficient as compared to non-smokers(74.45%)(P=0.046S).

Sedentary lifestyle was significantly associated with Vitamin D deficiency, where 88.71% (55/62 cases) were vitamin D deficient as compared to in heavy workers which were 60.34%(35/58 cases) Vitamin D deficient (P=0.003S).**(Table No 3)**

IV. Discussion

This cross-sectionalstudy included apparently healthy individuals in 18-60 year age group visiting SMS Hospital, Jaipur during April 2015 to December 2016 with the aim to determine the prevalence of Vitamin D deficiency and its risk factors. **In our study**, the percentage of subjects according to different cut-off points for serum Vitamin D level were:

Vitamin D**>30ng/ml** which is normal or sufficient levels were observed in 5.49% of the cases, Vitamin D **20 to 30 ng/ml** which is insufficient or borderline levels were observed in 16.86 % cases, Vitamin D **10 to 20 ng/ml** which is mild deficiency of vitamin D were observed in 43.14% of cases , Vitamin D **5 to 10 ng/ml** which is moderately deficient levels of vitamin D were found in 28.13% cases and 9.38% ,the percentage of patients with severe hypovitaminosis D **(<5 ng/ml**) among cases was 12.16 % . The mean serum 25(OH)D (mean±SD)level was 14.589±9.277 (3.9 to 76.7ng/ml). A similar study in was conducted at AIIMS New Delhi, in which Indian orthopaedic patients with non-traumatic fractures revealed very high prevalence (96.7%) of vitamin D deficiency.

Sarita Bajaj,et al(2014) studied Vitamin D deficiency (<20 ng/ml) was present in 59.49% of the cases and 34.61% of controls. Only 6.33% cases had vitamin D level >30 ng/ml, while 35.39% of controls were found to be have sufficient (>30 ng/ml) levels of vitamin D. Overall vitamin D was found to be inadequate (vitamin D deficiency with insufficiency, or in other words levels <30 ng/ml) in 93.67% of cases and 64.61% of non-diabetics (controls).

Maier S, Gerrit et al (2011) estimated vitamin D level in 1119 orthopedic surgery patients. Overall, 84% of patients had insufficient levels of vitamin D and 60% were vitamin D deficient. Only 15% were in thetarget range of 30-60ng/ml.

Schiling S. et al (2012) estimated the prevalence of vitamin D deficiency among patients in an elderly care rehabilitation facility. 89% of the patients had 25-OH-vitamin D deficiency (defined as a level below 20 ng/mL), and 67% had a severe deficiency (below 10 ng/mL). Only 4% had levels in the target range (30-60 ng/mL); none had a level above100 ng/mL. Many of these patients were deficient in vitamin D. Persons of very advanced age need a better supply of vitamin D not only to keep their bones healthy but also to lessen the risk of falls and fractures.

Elamin IE Abdelgadir et al.(2013) observed that most of the patients (63.9%) had vitamin D deficiency (25(OH) D levels <20ng/ml), 17.9% had vitamin D insufficiency, whereas vitamin D sufficiency was evident in 18.1% of the studied sample.

Maier Steffen Maier et al observed that univariate and multivariate analysis were used to assess risk factors for insufficient vitamin D levels. Results Overall, 84% of patients had insufficient levels of vitamin D and among insufficient 60% cases were vitamin D deficient. Only 16% were in the target range of 30 to 60ng/ml.

Zeliner BS observed that (2014),86.2% of subjects were insufficient in 25hydroxyvitamin D (<30 ng/mL)and among insufficient cases 53.2% were Vitamin D deficient (<20 ng/mL).

In our study, it is observed that Mean±SD age of the cases is 35.45 ±11.88(range 18 to 60 years).Most of the subjects (29.02%) belonged to 31-40 year of age group, 25.88% subjects were in 21 to 30 years age group and least subject (12.16%)were in extreme of age groups like ≤20 and 51 to 60 years.No significant difference was observed according to age (P=0.47NS) in our study.

DG et alobservedVitamin D deficiency occurred in disabled, housebound older people despite optimal climatic condition.

Maier S, Gerrit et al (2011) observed that Vitamin D levels did not vary according to age, sex, and disease.

In our study, Males were more (62.75%)as compared to females (37.25%) subject.The mean level of Vitamin D was significantly more in males (11.798 ±4.5463) as compared to females (9.605 ±5.0012)(P=0.002S) but no significant difference was observed in insufficiency and Sufficiency status of the Vitamin D (P=0.244NS and P= 0.73NS) respectively.

Bogunovic L. et al (2009) the prevalence of low vitamin-D levels was significantly higher in men (p = 0.006). **Elamin IE Abdelgadir et al(2013)** observed that the vitamin D deficiency tended to be more marked in males; mean 25(OH) D was 18.6+12.4 ng/ml and in females vitamin D level was 20.6±16.5ng/ml, but the difference did not quite reach statistical significance.

Mithal A. et al(2009) observed that older age, female sex, higher latitude, winter season, darker skin pigmentation, less sunlight exposure, dietary habits, and absence of vitamin D fortification are the main factors that are significantly associated with lower 25(OH)D levels.

In our study, Hindus were more (88.63%)as compared to Muslims (11.37%)subjects. No significant difference was observed according to religion with Vitamin D status.

Diamond TH[1], Levy S, Smith A, Day Pobserved there were 68.1% muslim women with vitamin D deficiency (serum 25OHD levels < 30 nmol/L) among 600 subjects.

In our study, according to occupation most of the cases(27.45%) were housewives followed by thefarmer (21.18%) and shopkeeper among subjects. No significant association was observed according to occupation except in farmers where cases were more in Vitamin D sufficient status(P<0.001S) and in govt. employees where theproportion of the cases were more in Vitamin D deficient (P=0.03S)status.

Harin Jeong,(2014) observed that Among the male subjects, a significant correlation between vitamin D deficiency and working conditions was observed among shift workers, office workers, and permanent workers. No significant correlation with any type of working condition was observed among female subjects.

In the study,APL subjects were more (83.53%) as compared to BPL (16.47%) subjects. No significant difference was observed between Vitamin D deficiency and Socioeconomic status (P=0.467NS).

Behrouz GF(2013) also found no strong association between socioeconomic status and serum levels of 25OHD3, although serum levels of 25OHD3 were slightly higher in women with a non-manual vs. a manual employment.

Davis (2003)Observed in their study that the relationship between Socioeconomic status and vitamin D levels was weak but consistent. No other measure of Socioeconomic status was related to vitamin D level.

The review of literature discussed many conditions associated with low Socioeconomic status, capable of limiting vitamin D intake and production and not all of these elements were included in the covariate analysis. Vitamin D levels ultimately were not well explained by any measure of Socioeconomic status. SES does not predict vitamin D level.

The mean duration of sun exposure was 2.88±1.58 hours per day among all subjects in this study. A significant difference was observed according to sun exposure with Vitamin D Deficiency. Significantly lower mean sun exposure was observed in Vitamin D deficient subject as compared to sufficient subjects with sufficient Vitamin D level (2.42±1.378 vs 3.14±1.6) P<0.001S.

Maier S, Gerrit et al (2011) noted that the prevalence of low vitamin D levels was greater during winter and months with fewer sunshine hours.

Mario Olivieri, Carlolberto Biscardo, Dario Valenza, Giuseppe Verlato Observed thatvitamin D level was significantly lower in night workers (15.1 ng/mL, range 4.9-26.3) than in daytime workers (27.1 ng/mL, range
17.8-41.7).

In our study, most of the cases (52.94%) were in thenormal range of BMI followed by overweight (42.35%) subjects.A significant difference was observed according to BMI range with Vitamin D deficiency. Vitamin D deficiency was more observed in overweight cases (84.26%) as compared to normal weight subjects(74.07%) P=0.038S. Individuals with obesity, hypertension, and osteoporosis were more likely to have low Vitamin D levels compared with their healthy counterparts.

Davis (2013) observedthatBMI is a strong predictor of vitamin D level. Body mass index, on the other hand, was shown to explain significant variance in the vitamin D level independently, even withVitamin D supplement use.

In thisstudy, 46.27% cases were smoker amongst 255 subjects. We observed that smokers had significantly reduced levels of serum 25OHD (P=0.046 S). This finding corresponds with the finding to**E C Brot ,Ugenia Cutillas-Marco**(2012).

Eva N. Kassi,(2012)alsoobservedthat Smoking is a significant determinant of serum 25(OH)D, it increases significantly the likelihood of having vitamin D deficiency.Smoking has a significant effect on calcium and vitamin D metabolism, which is not likely to be explained by other confounding lifestyle factors. The depression of the vitamin D-PTH system seen among smokers may represent another potential mechanism for the deleterious effects of smoking on the skeleton and may contribute to the reported risk of osteoporosis among smokers.

In this study, 52.94% cases belonged to moderate lifestyle followed by 24.31 %cases belonged to sedentary lifestyle. Sedentary lifestyle was significantly associated with Vitamin D Deficiency, where 88.71% (55/62 cases) subjects were Vitamin D deficient as compared to in heavy workers it was 60.34%(35/58 cases)were vitamin D deficient (P=0.003S).

Recommendation

To avoid vitamin D deficiency among Indian population, we must revise our public health policy. Further research with large-scale population is required to determine the correlation between vitamin D and bone histology, myopathy, and specific alkaline phosphatase.

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Table No1 : Charactorstics of study population

Variables		Number255(100)
Age Groups (year)	≤20	31(12.16)
	21 to 30	66(25.88)
	31 to 40	74(29.02)
	41 to 50	53(20.78)
	51 to 60	31(12.16)
Sex	Female	95(37.25)
	Male	160(62.75)
Religion	Hindu	226(88.63)
	Muslim	29(11.37)
Occupation	B S F	1(0.39)
	Businessman	5(1.96)
	Driver	12(4.71)
	Farmer	54(21.18)
	Gardner	2(0.78)
	Govt.employee	7(2.75)
	Housewife	70(27.45)
	Nurse	2(0.78)
	Painter	1(0.39)

	Servant	4(1.57)
	Shopkeeper	53(20.78)
	Sportsman	1(0.39)
	Student	38(14.9)
	Teacher	3(1.18)
	Trainee	2(0.78)
Economic Status	APL	213(83.53)
	BPL	42(16.47)
Sun exposure (hrs/day)	1	68(26.67)
	2	104(40.78)
	3	31(12.16)
	4	19(7.45)
	5	25(9.8)
	6	8(3.14)
BMI	Normal	135(52.94)
	Overweight	108(42.35)
	Underweight	12(4.71)
Smoking		118(46.27)
Lifestyle	Heavy	58(22.75)
	Moderate	135(52.94)
	Sedentary	62(24.31)

Figure No1: Prevalence of Vitamin D deficiency

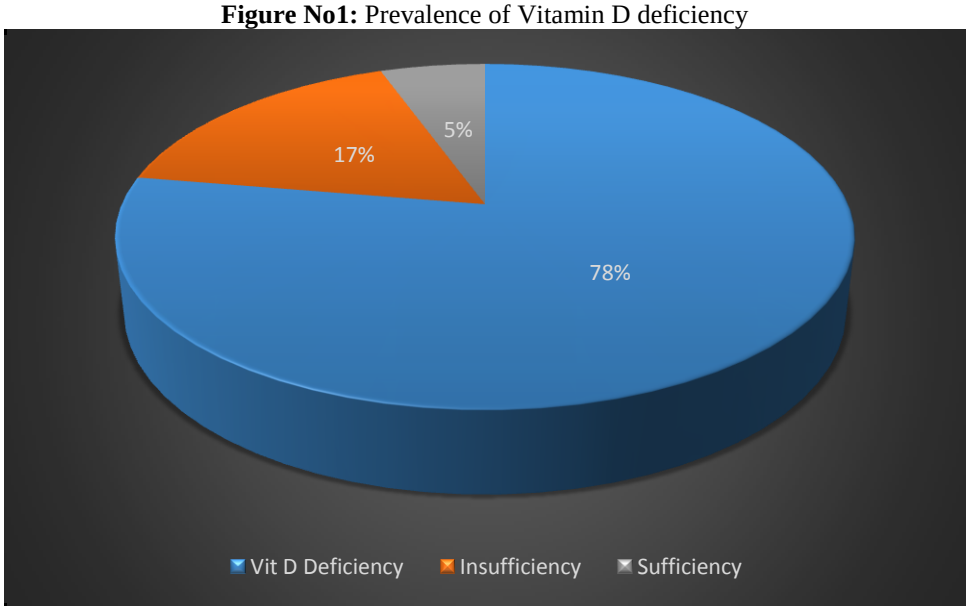

Table No2 Association of the gender with mean level of Vitamin D (ng/ml)

Vitamin D (ng/ml)	Sex	Number	Mean	Std. Deviation	P Value LS
Vit D Deficiency (N=198)	F	73 (36.87%)	9.605	5.0012	0.002S
	M	125(63.13%)	11.798	4.5463	
	Total	198	10.989	4.8245	
Insufficiency (N=43)	F	14.(32.59%)	23.613	2.9677	0.244NS
	M	29(67.44%)	22.660	2.2107	
	Total	43	22.970	2.4876	
Sufficiency	F	8(57.14%)	40.944	15.4826	0.73NS

(N=14)	M	6(42.86%)	38.185	13.0679	
	Total	14	39.761	14.0272	

Table No 3: Association of Vit D status with associating factors

Vitamin D		**Total**	**Deficiency (N=198) no(%)**	**Insufficiency (N=43) no(%)**	**Sufficiency (N=14) no(%)**	**PValue LS**
Age Gp.	≤20	31	26(83.87)	5(16.13)	0(0)	0.467 NS
	21 to 30	66	51(77.27)	10(15.15)	5(7.58)	
	31 to 40	74	58(78.38)	13(17.57)	3(4.05)	
	41 to 50	53	43(81.13)	8(15.09)	2(3.77)	
	51 to 60	31	20(64.52)	7(22.58)	4(12.9)	
Age	Mean ±SD		35.01±11.74	36.56±12.26	38.36±12.85	0.45NS
Religion	Hindu	226	171(75.66)	41(18.14)	14(6.19)	0.094NS
	Muslim	29	27(93.1)	2(6.9)	0(0)	
Occupation	B S F	1	1(100)	0(0)	0(0)	0.86NS
	Businessman	5	4(80)	1(20)	0(0)	0.88NS
	Driver	12	12(100)	0(0)	0(0)	0.16NS
	Farmer	54	5(9.26)	20(37.04)	29(53.7)	<0.001S
	Gardner	2	2(100)	0(0)	0(0)	0.74NS
	Govt.employee	7	3(42.86)	2(28.57)	2(28.57)	0.03S
	Housewife	70	58(82.86)	9(12.86)	3(4.29)	0.47NS
	Nurse	2	2(100)	0(0)	0(0)	0.74NS
	Painter	1	1(100)	0(0)	0(0)	0.86NS
	Servant	4	3(75)	1(25)	0(0)	0.82NS
	Sportsman	1	1(100)	0(0)	0(0)	0.86NS
	Shopkeeper	53	47(86.68)	4(7.55)	2(3.77)	0.08NS
	Student	38	31(81.58)	6(15.79)	1(2.63)	0.67NS
	Teacher	3	2(66.67)	0(0)	1	0.08NS
	Trainee	2	2(100)	0(0)	0(0)	0.74NS
Socioeconomic status	APL	213	166(77.93)	34(15.96)	13(6.1)	
	BPL	42	32(76.19)	9(21.43)	1(2.38)	
BMI	Normal	135	100(74.07)	27(20)	8(5.93)	
	Overweight	108	91(84.26)	11(10.19)	6(5.56)	
	Underweight	12	7(58.33)	5(41.67)		
	Smoking	118	96(81.36)	24(19.83)	4(3.31)	
Lifestyle	Heavy	58	35(60.34)	19(32.76)	4(6.9)	
	Moderate	135	108(80)	19(14.07)	8(5.93)	
	Sedentary	62	55(88.71)	5(8.06)	2(3.23	
Sun exposure (hrs/day)			2.42±1.378	3.40±1.59	3.14±1.61	<0.001S