

Relationship Between Vitamin D Concentrations and Body Mass Index in Menopausal Women in Kvemo-Kartli Region (Georgia)

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Abstract – The aim of the study was to study the level of vitamin D in menopausal women aged 47-54 living in Kvemo Kartli region; to determine the relationship between Body Mass Index and vitamin D level; to formulate recommendations about efficient preventive activities based on epidemiologic study results. Cross-sectional (prevalence) research was conducted in three different medical institutions in Kvemo Kartli region with a high number of patients. The interview with respondent was carried out by the doctor using a specially designed questionnaire, focused on place of residence, amount of food intake rich in vitamin D by the days of week, physical activity, and time spent outdoors in the fresh air. The survey data showed that 47% of respondents are overweight and 28% are obese, respectively, but none of the respondents is severe / morbidly obese. The results of the analytical study determined the correlation degree between the body mass index and the level of vitamin D deficiency among menopausal women. Bivariate analysis was used to determine association between the variables, revealing statistically significant correlation between body mass index, obesity and vitamin D deficiency (OR) = 7.8 95% CI (1.9-30.7). Obese patients suffer from array of severe problems associated with vitamin D deficiency, therefore, obese women should be included in a separate risk group for vitamin D deficiency; blood serum 25(OH)D should be determined and in case of insufficiency or deficiency higher doses of vitamin D should be prescribed.

Keywords – Menopausal Women, Vitamin D, Overweight, Obese, Body Mass Index.

I. INTRODUCTION

The quality of human life is determined by internal and external factors, among which distribution of some endemic or epidemiological pathologies in the population is given a serious role. Among the latters, overweight and obesity, as well as providing vitamin D supplements to the population, is of great importance. The recent data evidence the role of vitamin D in the pathogenesis of diseases such as cardiovascular, immune, oncological, and endocrine and so on. Prevalence of vitamin D deficiency was caused by geographical location as well as other relevant factors [4].

Obesity and overweight are considered as a major challenge to the public health in Georgia as well as throughout the world. According to the data on noncommunicable disease (NCD) risk factors suggested by the World Health Organization, the average Body Mass Index in population of Georgia, 18-69 years of age, was 28.1 (27.9-men and 28.3–women, respectively), 64.6% of respondents were overweight or obese, obesity was more common among women, and overweight - among men, respectively. Both indicators increase with age. A particular progressive increase was observed in women of menopausal age [7].

According to recent rating publications, menopause-related conditions are associated with vitamin D deficiency, which may be caused by various metabolic disorders related to hormonal processes the menopausal women go through as well as changes in body mass index. The scientific literature describes several mechanisms responsible for the decrease in vitamin D levels in people with a high body mass index. [1],[3]

In obese patients, physical inactivation maintains reducing insolation and consequently, vitamin D concentration. In addition, at obesity under the influence of solar exposure skin synthesis of vitamin D is reduced as obese people often wear the clothes (closed) showing less skin in outfit. In obese and overweight patients, vitamin D accumulates substantially in adipose tissue, followed by decrease in its concentration in blood serum. Obesity leads to fatty liver dystrophy (FLD) and a decrease in the rate of vitamin D metabolism in liver cells [2].

Based on international experience the decrease in 25(OH)D concentration was associated with increased adipose tissue size in healthy women. In light of the increase in BMI, the decrease in not only 25 (OH) D, but 1.25 (OH) 2D levels in blood serum was also observed. [5],[6]

According to the Spanish researchers, obese patients were 2-3 times more vitamin D users in comparison to normal weight groups, regardless of age, sex or physical activities. Since vitamin D is a fat-soluble substance, it is distributed in adipose tissue, leading to decrease in its plasma concentration.

For transforming the current international experience, to study the body mass index (BMI) and vitamin D levels in menopausal women on the example of regions with population of ethnically diverse nationalities, type of food intake, dress style or working activities is of great importance.

In view of the above, the attempt to study the prevalence of vitamin D deficiency in the blood, even among certain groups of the population, is useful and of particular importance to strengthen the lifestyle modification recommendations as well as the drug prevention strategy in the country.

II. MATERIAL AND METHODS

Cross-sectional (prevalence) research was conducted in three different medical institutions in Rustavi with a high number of patients. The study population involved women aged 47-54 years who had not received vitamin D supplements or other food supplements in the last 2 months. It was also taken into account that these women should not have had diseases that alter the metabolism of vitamin D, such as disease of liver and kidney, metabolic disorders of the bones, malabsorption, hypercortisolism, malignant tumors, sedentary lifestyle > 1 week, having history of taking drugs affecting bone marrow etc.

The Sampling frame is based on the General Population Census Data of Georgia. Sample Size: the study population consists of women aged 35-65 living in Kvemo Kartli region. The sampling frame is based on the Georgian Census Database. Considering that 85294 women in the indicated age group live in the Kvemo Kartli region and, according to the literature, the prevalence of breast cancer in the female population is 15%, the error in the formula used to determine the 95% reliability ($Z=1.96$) was set at 5% ($e=0.05$), the prevalence of the main indicators was considered to be 15% ($P=0.15$); Design effect – 1.5, response rate 80%. 194 respondents were defined as the required sample size ($n=Z^2 P(1-P)/e^2$). The sampling frame is based on the database of General Population Census of Georgia. Considering the fact that 25 500 women of indicated age category live in the Kvemo Kartli region and according to the literature data, 30-40% of them experience pathological menopause, Initially, sample survey data were entered into printed questionnaires. In parallel with the research, sample data were collected in the electronic database of the Epi Info 7 version of the statistical software package. The prevalence ratio for each variable was calculated by descriptive analysis taking into account the Missing data.

Secondary comparative database data analysis will be carried out using bivariate research methodology; the prevalence ratios between body mass index and the existing serum vitamin D concentration were calculated. A 95% Confidence Interval will be used to determine the statistical reliability of the association between the factors.

The interview with respondent was carried out by the doctor using a specially designed questionnaire, focused on place of residence, amount of food intake rich in vitamin D by the days of week, physical activity, and time spent outdoors in the fresh air. Since sun exposure is considered as major source of vitamin D synthesis, the study was conducted at particular time of year, namely in September 2020.

III. RESULTS

The survey data showed that 47% of respondents are overweight and 28% are obese, respectively, but none of the respondents is severe / morbidly obese. Body mass index (BMI) data were studied separately in two ethnic groups (Georgian and Azerbaijani women). Most of the interviewed women, both Georgians and Azerbaijanis, were overweight, most of them also had obesity and BMI (≥ 30) %; body mass index within the norm (BMI (18-24.9)%) was observed in the majority of Georgian women (32%) in comparison with Azerbaijanis (7%). This might be associated with nutritional/diet, religion and other related factors. In addition, it should be emphasized that the majority of Azerbaijani respondents lived in the village (83%), hence doing physical work.

diagram #1. Percentage distribution of respondents Body mass index (BMI) by nationality

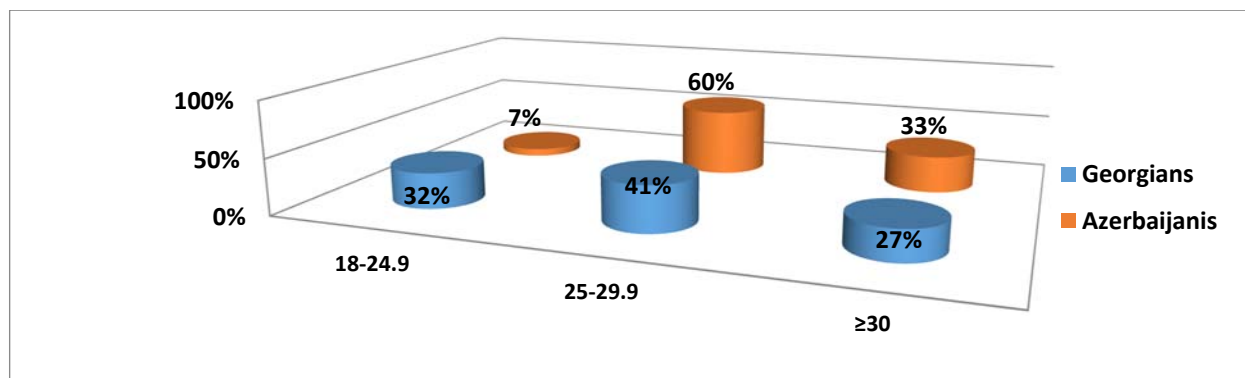
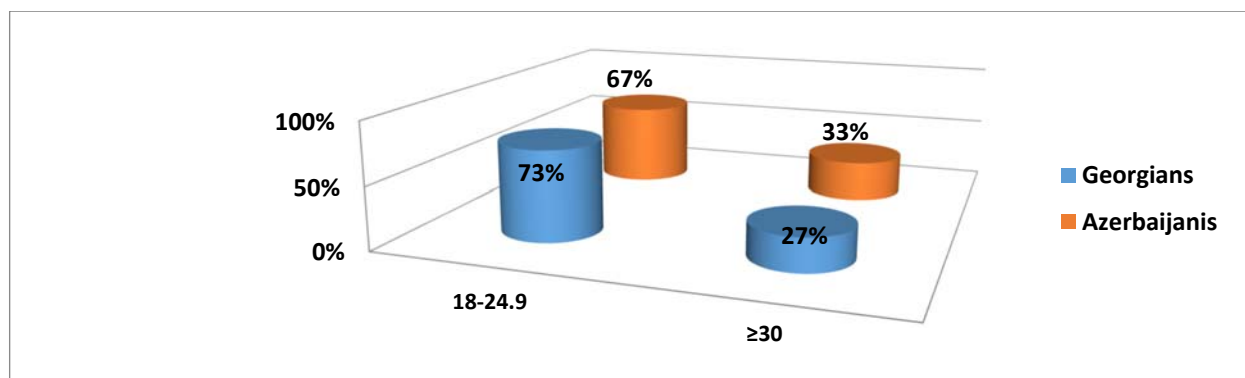


diagram #2. Percentage distribution of respondents with obese by nationality



70% of respondents involved in the study had vitamin D deficiency, 6% - deficiency, and only 24% had adequate vitamin D levels. As for the obese respondents, very low level of vitamin D was revealed in 8 patients (73%), that was 8 times higher in comparison with patients of normal weight and 4 times higher than in overweight patients.

Vitamin D levels in 25% of patients of the above weight were 10.9-29.9 ng/ml, nearly equal to vitamin D levels in patients of normal weight and overweight. 27% of obese patients had normal levels of vitamin D, almost 2 times less in comparison with overweight ones. Vitamin D levels in most patients of normal weight (29%) was within the range of 10.9-29.9 ng/ml, normal level - only 17%, very low level was observed in only 1 respondent.

Table #1. Percentage distribution of respondents by Body mass index (BMI) and nationality

BMI	Vitamin D level- 1-10ng//δml (%)	Vitamin D level- 10.9-29.9ng//δml (%)	Vitamin D level- ≥30ng//δml (%)
BMI (18-29.9)	3 (2%)	103 (73%)	35 (25%)

BMI (≥ 30)	8 (14%)	34 (62%)	13 (24%)
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BMI	Vitamin D level- 1-10ng/8ml (%)	Vitamin D level- 10.9-29.9ng/ml (%)	Vitamin D level- ≥ 30ng/ml (%)
BMI (18-24.9)	1 (9%)	40 (29%)	8 (17%)
BMI (25-29.9)	2 (18%)	63 (46%)	27 (56%)
BMI (≥ 30)	8 (73%)	34 (25%)	13 (27%)

Prior to enrollment in the research, blood vitamin D levels were measured in 14% of patients, however, neither weight nor vitamin D levels were significantly changed in these patients over the study period.

As is known, person's body can make vitamin D from exposure to the sunlight as well as consumption of vitamin D-fortified foods, however, this amount is much less than the amount synthesized in the skin as a result of exposure to sunlight. The best vitamin D-rich foods are: fatty herring, eel, mackerel, tuna, salmon, liver, veal, avocado, eggs, mushrooms and so on. The aim of our research was also to determine whether the diet of women living in Kvemo Kartli contains vitamin D-rich foods, food consumption frequency as well as food type they eat, namely mixed, vegetarian, vegan and so on.

IV. DISCUSSION

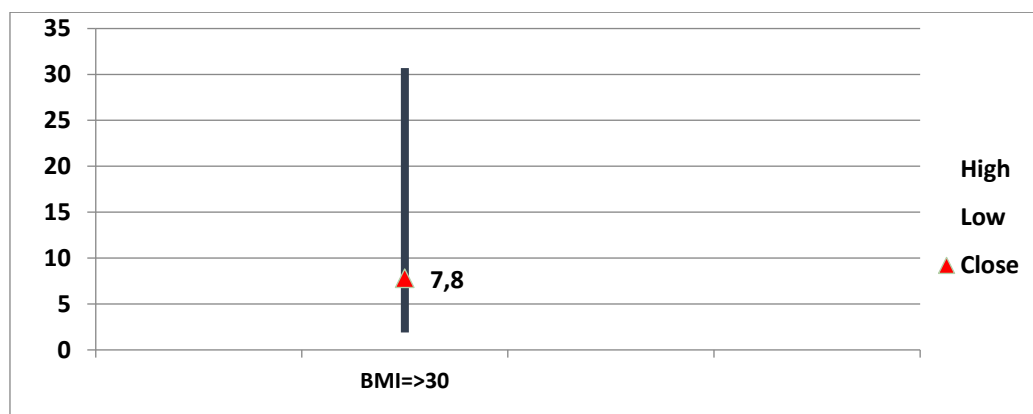
Despite the fact that the respondents belonged to diverse traditions, religious and ethnic groups, no significant changes were observed in their diet, especially in terms of consuming vitamin D-fortified foods. It is also noteworthy to emphasize that most food products throughout Georgia (including Kvemo Kartli region) are not fortified with vitamin D. From the above-mentioned it was found out that 47% of menopausal women living in Kvemo Kartli were overweight and 28% - obese, respectively, which is in line with other research. [5],[6]

The obtained data partially coincides with the data obtained after studying the risk factors for non-communicable diseases (carried out throughout the regions of Georgia), according to which women, 45 to 59 years of age appeared to be one of the most overweight and obese respondents. [7]

As for the surveyed respondents (27% Georgians and 33% Azerbaijanis), they had quite expressed problems in terms of vitamin D deficiency, however, the same cannot be said of main group of women surveyed, BMI (25-29.9) (41% Georgian and 60% Azerbaijani), no significant changes were revealed in vitamin D levels compared to other study groups. There were no different data regarding vitamin D levels among the women surveyed experiencing diverse diets and of different nationalities, over again underlining the impact of metabolic disorders on vitamin D levels.

Consequently, the results of the analytical study determined the correlation degree between the body mass index (BMI) and the level of vitamin D deficiency among menopausal (climacteric) women. Bivariate analysis was used to determine association between the variables, revealing statistically significant correlation between body mass index, obesity and vitamin D deficiency (OR) = 7.8 95% CI (1.9-30.7).

Fig. # 3. Prevalence of the odds ratio (OR) between body mass index (BMI) and the deficiency of vitamin D;



V. CONCLUSION

As it is evident from the example of menopausal women living in Kvemo Kartli the correlation between vitamin D deficiency and metabolic disorders has been shown; moreover, the influence of nutritional habits and physical activity on vitamin D levels could not be fully outlined.

Obese patients suffer from array of severe problems associated with vitamin D deficiency, therefore, obese women should be included in a separate risk group for vitamin D deficiency; blood serum 25(OH)D should be determined and in case of insufficiency or deficiency higher doses of vitamin D should be prescribed. At the same time, a decrease in body mass index compared to initial levels while taking vitamin D supplements may independently affect the changes in vitamin D levels in menopausal women.

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