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Relationship between muscle weakness and vitamin D deficiency

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ABSTRACT

Muscle weakness is one of most problem in worldwide and is defined as the loss of muscle ability to cause contraction. Determination the causes of muscle weakness is important to relieve the problem with appropriate diagnosis and treatment. Vitamin D is very important vitamin and can be obtained endogenously and exogenously. The deficiency of vitamin D has been associated with numerous health outcomes, including risk of rickets in children or osteomalacia in adults, increased risk of fractures, falls, cancer, autoimmune disease, infectious disease, type 1 and type 2 diabetes, hypertension and heart disease, and other diseases such as multiple sclerosis. The aim of this study is measure level of vitamin D in muscle weakness patients and to evaluate the association between muscle weakness and 25-hydroxyvitamin D deficiency. The current study is a cross-sectional study, involved 100 participants (40 male and 60 female) that visit orthopedic clinic and they suffer from fatigue, muscle pain and bone pain. They aged between 18-70 years old and collected during time between the start of September to the end of November 2020 from Karbala Governorate, Iraq. Many of information were collected from each participant such as, age, gender, height, weight, blood groups and vitamin D levels. The results of current study revealed, that from this100 participant, there is 61 persons have vitamin D deficiency, were 31 have vitamin D insufficiency, were 8 have vitamin D sufficiency. In deficiency group, there is 50 females (81.9%), were 11males (22%). Also, there is a significant association between muscle weakness and vitamin D deficiency. The results of the current study revealed, that from 100 participants, there is, 43 persons having obesity. Also, there is a significant difference in the distribution of body mass index (BMI) and vitamin D deficiency among study population.

Keywords: Vitamin D, Muscle weakness, Hydroxyvitamin D deficiency.

I. INTRODUCTION

Muscle weakness is described as a loss of muscle strength caused by the body's inability to produce muscle contractions. In most cases the muscle weakness may be generalized, but the muscle weakness also can be not generalized and it categorized as symmetric or asymmetric. The asymmetric type often refers to disease of the central or peripheral nervous system, while the symmetric divided into distal, proximal and specific distribution [1]. Determination the causes of muscle weakness is very important to relieve the problem with appropriate diagnosis and treatment [2]. The causes of muscle weakness divided into many categories: Genetic causes, such as distal myopathies [1], Inflammatory causes, such as dermatomycositis [2], Metabolic causes [3], Electrolyte causes, such as hypokalemia and hypercalcemia [4]. Infectious causes, such as viral infection [5]. Drugs, such as amiodarone and corticosteroid and NSAIDS [6-7]. Miscellaneous causes, such as Amyloidosis [8].Rheumatologic causes [9]. Endocrine disorders, such as primary hyperparathyroidism and vitamin d deficiency [10]. Vitamin D is a fat soluble vitamin and act as steroid hormone, this vitamin can be obtained from different sources like diet, eggs, fatty fish and dairy products [11].

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In addition, from exposure to ultra-violet B (UVB) light and it can synthesize endogenously and photo chemically from dehydrocholesterol by the skin [12] and as a supplement form [13]. The supplement of vitamin D may be as vitamin D2 (ergocalciferol) or vitamin D3 (cholecalciferol) in the plant of fungal form. As vitamin D2, it taken orally and binds to vitamin D binding protein (DBP), then transported to the liver, where it is synthesized by the skin pathway [14].

Vitamin D has a role in muscular function, it has a role in hemostasis of phosphorus and calcium. Vitamin D is a pre-hormone have important role in many systems like, extra-skeletal, cardiovascular and regulation of blood pressure, inflammation, proliferation cell and improve the body sensitivity for insulin [15]. Also, the vitamin D has paracrine and autocrine functions outside of bone health, is found in many extra renal tissues, including the brain [16] prostate[17] breast [18] vasculature, immune cells [19] and it is important for kidney function [20] .

Deficiency of vitamin D is considered as common disorder, the deficiency of the vitamin D level is multifactorial and which result from many factors like, increasing in fiber diet that effect on vitamin D absorption, limited intake of fish that decrease the oral vitamin D intake, reduction in synthesis vitamin D due to restricted exposure to sun as in indoor occupation, also dark skin, obesity, diseases and genetic factors lead to depletion in level of vitamin D [21]. Also, many of the studies found that deficiency of vitamin D is associated with many diseases such as atherosclerosis [22] obesity [23] hypertension [24] myocardial infarction [25] and diabetes [26].

II. METHODS AND MATERIAL

The current study is a cross-sectional study, involved 100 subjects (40 as males and 60 as females) that visit orthopedic clinic and they suffer from fatigue, muscle pain and bone pain. They aged between 18-70 years old and collected during time between the start of September to the end of December 2020 from Karbala Governorate, Iraq.

Many of the information were taken from each subject in this study, like age, sex, also for all participants weight and height were calculated by using a sensitive balance after removing excessive things (e.g. shoes, bags, coats and jackets). After that the BMI is calculated by using this equation: BMI= weight (Kg)/ height (m2). According to their body mass index, the participants were divided into four categories: Underweight (BMI< 18.5 kg/m2), Normal (18.5-24.9 kg/m2), Overweight (25-29.9 kg/m2) and Obese (≥30 kg/m2) and blood sample was collected for each subject to test the test vitamin D by MINI VIDAS method which is a compact automated immunoassay system based on Enzyme linked Fluorescent Assay (ELFA) principles. According to serum level of vitamin D, these subjects were categorized into 3 groups: (< 10 ng/ml as deficient group, 10-30 ng/ml as insufficient group and 30-100 ng/ml as sufficient group).

Statistical analysis

Statistical analysis was performed using SPSS version 18 (Statistical Package for the Social Sciences). Using Frequency, chi-square test and P value. When P value was < 0.05 it was considered as significant.

III. RESULTS AND DISCUSSION

Gender statistics:

The results of the study showed that the number of women was 60 out of 100(60%), while number of men was 40 out of 100 participants (40%).

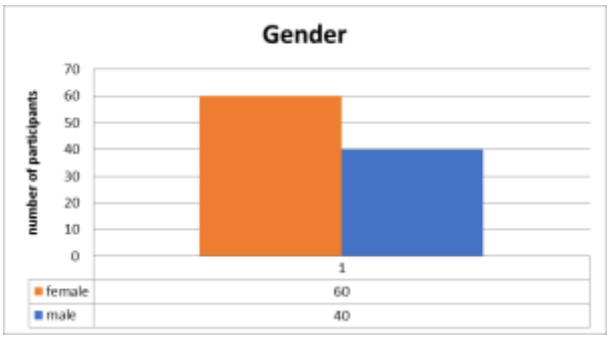

Fig 1: Gender Distribution among study population.

Age statistics:

According to the age of participants, the results showed that age group from (18-28 years) was the most common group, followed by (29-39years) group then (40-50 years, 51-61 years, 62-72 years) respectively as in table (1).

TABLE I: AGE DISTRIBUTION AMONG STUDY POPULATION

Age range	Number	Percent %
18-28 years	32	32
29-39 years	26	26
40-50 years	23	23
51-61 years	13	13

Body Mass index statistics:

According to the World Health Organization's (WHO) recommended body weight based on BMI , the results showed that obese group was the most common group (43 person), followed by overweight group (36 person) then normal weight and underweight respectively.

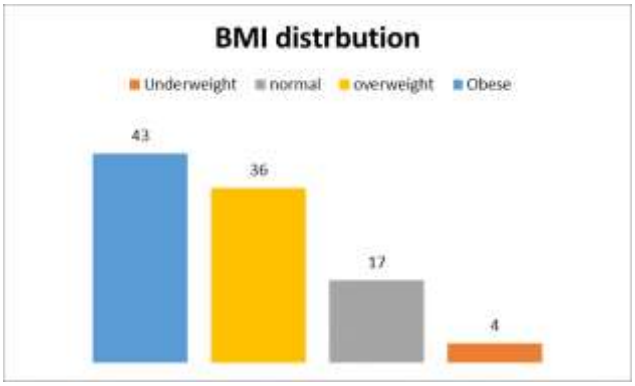

Fig 2: Distribution of Body Mass Index (BMI) among study population.

According to the vitamin D status, the results indicated that 8% of participant have sufficient level of vitamin D, while 31% have insufficient level and 61% have deficiency of vitamin D.

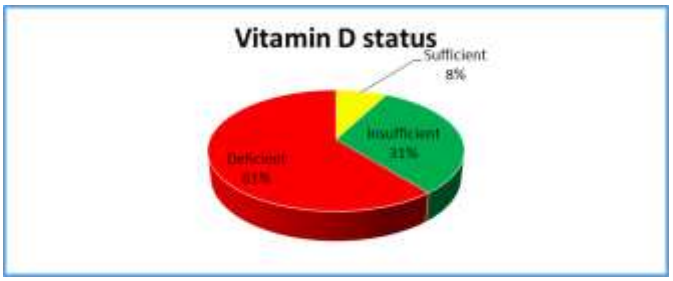

Fig 3: Distribution of vitamin D status among the study population.

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Vitamin D is one of essential fat soluble vitamin, which can perform many of functions in the human body. Metabolism of bone and calcium regulation are the important physiological functions of vitamin D [27]. Vitamin D exhibit its effect on many types of cells through nuclear vitamin D receptors (VDRs) that regulate gene expression and cell membrane and mediate no genomic rapid responses [28].

In the current study, the deficiency of vitamin D group had the highest numbers of participants followed by insufficient serum vitamin D level and sufficient group respectively, these findings are compatible with many studies. Also, there is a significant relationship between the vitamin d deficiency with weakness and muscle pain [31]. From total 100 participants, there were 61 persons (61%) have vitamin d deficiency.

Vitamin D affect muscle and bones through different mechanism; the pain sensory neurons are respond to active vitamin D metabolites, so the deficiency of vitamin D contributes to muscle hypersensitivity through direct effects on sensory nociceptor neurons and reduced vitamin D dietary intake can induce persistent vitamin D deficiency.

Also, the deficiency of vitamin D cause musculoskeletal pain, and inadequate levels of this secosteroid may contribute to the etiology of musculoskeletal pain [34]. In addition, vitamin D deficiency results in major bone pathology, a proposed origin of musculoskeletal pain. The most reason for this deficiency that most of people avoid exposed to sunlight, because weather in Iraq is very hot and this clarify the large percent of deficiency in our country, these results are compatible with the other studies. Also, Vitamin D has anti-inflammatory properties, so deficiency of this hormone could make tissues more susceptible to inflammation.

According to gender, the study showed that there is a relationship between vitamin D deficiency and gender. Deficiency of vitamin D in women is more than men, this results may be attributed to many factors like, the women's are less exposed to sunlight from men according to the social and environmental factors, low physical activity and difference in clothing between male and female in addition to lifestyle difference. Woman clothing style due to religious or cultural factors, their level of vitamin D production will be diminished. Indoor worker women had much lower levels of [25(OH) D] than outdoor workers women. Here, indoor women at higher risk to develop VDD. Women is more susceptible to vitamin D deficiency because of The lower 25(OH)D levels observed in females, as compared to males Because Women with gestational diabetes mellitus had significantly lower 25-hydroxyvitamin D levels, this results are agree with study done in Malaysia.

According to age, the groups of (18-28 & 19-39 years) the most common groups had muscle weakness and vitamin d deficiency and there is a relationship between the age and risk of developing vitamin d deficiency. These results occur because the difference in life style and food habits because at this age most of people prefer fast food and soda drinks than healthy food and drinks in addition to low physical activity and insufficient sun exposure time result in reduction in the ability to synthesize vitamin D.

Finally, the results also showed that there is a relationship between vitamin D deficiency and obesity. Although, there is no consensus as to why calcifediol levels are

decreased in obese individuals. But, there are many of hypothesis explained these results; first (and most popular) point of view is that adipose tissue absorbs the fat-soluble vitamin D [29, 30].

IV. CONCLUSION

Muscle weakness and vitamin D deficiency are more common in female gender and vitamin D deficiency have association with muscle weakness, and can be considered as a risk factor for muscle weakness. In this study, that from this100 participant, there is 61 persons have vitamin D deficiency, were 31 have vitamin D insufficiency, were 8 have vitamin D sufficiency. In deficiency group, there is 50 females (81.9%), were 11males (22%). Also, there is a significant association between muscle weakness and vitamin D deficiency. The results of the current study revealed, that from 100 participants, there is, 43 persons having obesity. Also, there is a significant difference in the distribution of body mass index (BMI) and vitamin D deficiency among study population.

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