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Treatment of vitamin B12 deficiency in elderly decreases the high levels of lipid parameters: A retrospective study

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ABSTRACT

The majority of people around the world experience the effects of the inadequacy of vitamin B12. A cross-sectional study was carried out at the beginning of April to end of December 2019, to examine the impact of vitamin B12 inadequacy and its treatment in improving total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglyceride (TG). The data that contains the levels of vitamin B12, lipid parameters (total cholesterol, LDL, HDL and TG) were gathered from 400 patients (n =400) from various clinical research centres situated in the capital of Jordan, Amman. The patient's samples were classified into multiple age groups. The data of both total cholesterol and LDL levels were gathered from thirty-five (n=35) patients, their age group is between 55-66 and have begun treatment of vitamin B12 deficiency by intramuscular infusion (1.0 mg) of vitamin B12. Almost 20.5% of the studied individuals (n=400) are found to be vitamin B12 deficient, as the level of vitamin B12 was equal to (<190 ng/ml). The age group (56 - 66) years old was found to have a significant decrease in vitamin B 12 ($p< 0.01$) and this results was associated with a critical increment in the levels of both total cholesterols ($p < 0.01$) and LDL $p< 0.02$) on contrast with other age groups. Our results did not reveal any significant changes in the levels of other lipid parameters in all age groups. Intramuscular injection treatment for thirty days reduces significantly ($p< 0.01$) the level of vitamin B12. This treatment strategy leads to a decrease in both total cholesterols ($p< 0.01$) and LDL levels ($p< 0.01$) substantially.

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INTRODUCTION

Individuals in several nations have experienced the effects of Vitamin B12 deficiency as this health issue considered as one of the primary famous prevalent diseases worldwide. Generally, malabsorption affects the rate of vitamin B12 absorption. Pancreatic inadequacy, iron deficiency and other digestive system conditions, e.g. recurrent inflammation of the stomach lining (gastritis) mostly affect the production of intrinsic proteins which is associated with the reduction of the absorption of vitamin B12 (Gholam *et al.*, 2018). Vitamin B12 deficiency affects myelin sheath of the nerves through Its direct influence on the methylation process, and this may lead to a defect in methylation and aggregation of

homocysteine, which cause severe side effects to the vascular integrity (Jayashri *et al.*, 2018; Yılmaz and Sinan, 2019). As vitamin B12 decreased, the level of total cholesterol profoundly increased. This finding concludes that Vitamin B12 is an essential catalyst of the enzymes that involve in the catabolism of unsaturated fats (Mahalle *et al.*, 2013).

People with vitamin B12 deficiency suffer from obesity, and as a result, they have a higher incidence of heart diseases as well as myocardial infarction (Mendonça *et al.*, 2018). Previous studies demonstrated the relationship between the deficiency of vitamin B12 and lipid parameters. They revealed that individuals with vitamin B12 deficiency had increased levels of total cholesterol (Wong, 2015; Morón and Garcés, 2005). However, recent findings showed that deficiency in vitamin B12 causes a significant elevation in the levels of triglycerides, total cholesterol and LDL (Yılmaz and Sinan, 2019; Zhao and Schooling, 2017). Increased level of HDL was found in people with vitamin B 12 deficiency (Glueck *et al.*, 2016). It has been reported that low levels of vitamin B12 play a role in adipocyte dysfunction, which may lead to elevating the levels of lipid parameters (Kumar *et al.*, 2013).

In diabetic patients, a comparison between hyperglycemia and vitamin B12 level showed that there is no relation between these two parameters (Nervo *et al.*, 2011; Silva *et al.*, 2019). One of the main potential risk factors for vitamin B12 deficiency is ageing since the elderly are commonly suffering from vitamin B12 deficiency compared with young people and most likely have the propensity to develop other complications such as pernicious anaemia (Saila *et al.*, 2007). In the United States, 6% of the patients with vitamin B12 deficiency are over 60 years old, which confirm that the incidences of vitamin B12 deficiency increased with age (Lindsay, 2009). It was reported that males have a higher prevalence of vitamin B12 deficiency than female (Mendonça *et al.*, 2018). It was reported that the optimum daily treatment dose of vitamin B12 deficiency is 1000 μg injected intramuscularly for seven days. The dose adjusted to one injection every four days for thirty days (Ahmed and Rohman, 2016). Also, oral medication can be achieved at a rate of 1000 μg of vitamin B12 for a month (Adaikalakoteswari *et al.*, 2014). The level of vitamin B12 can be improved when the oral dose duplicated to 2000 μg for four months, as this treatment strategy has the same effect as an intramuscular injection (Ingles *et al.*, 2020; Homan *et al.*, 2018).

MATERIALS & METHODS

Patients sample

The data from 400 patients (n=400) were gathered from several medical research centres situated in the capital of Jordan (Amman) to track the level of vitamin B12 and lipids parameters that include, total cholesterol, Low-density lipoprotein (LDL), High-density lipoprotein (HDL) and Triglyceride (TG) of both genders their ages are between 23 to 66 years old. The patient's sample used in this study (n=400) were categorized into four groups based on age; 23-33, 34-44, 45-55 and 56-66. The normal ranges of the studied parameters are as follows: vitamin B12= 190–850 ng/ml, total cholesterol < 200mg/dl, LDL < 100mg/dl, HDL= 38 – 60 mg/dl and TG < 150 mg/dl. Data of lipid parameters gathered from thirty-five patients (n=35) of (56 – 66) years old. Those selected patients have begun protocol of treatment of vitamin B12 deficiency. As they received an injection intramuscularly (1.0 mg/day) for seven days, then the same dose was taken once a week for thirty days under regular coordination, and direction by a physician. A comparison was performed between the levels of gathered lipid parameters before and after treatment when the level of vitamin B12 is < 190 ng/ml, this considered as vitamin B12 deficiency (Yılmaz and Sinan, 2019), it is important to mention that a group of patients was excluded from the study who are under treatments for hyperlipidemia, diabetes and obesity.

RESULTS

All data collected for vitamin B12 and lipid parameters are listed in Table 1.

The results for the patients between 56-66 years old were suggested that vitamin B12 concentration was remarkably reduced (183.6 $\pm$ 18.4 ng/ml; p<0.01), whereas a significant increase in the concentrations of total cholesterol (286.6 $\pm$ 21.8; (p < 0.01) and LDL levels (142.7 $\pm$ 16.2 mg/dl; p< 0.05) as reported in Table 1. Moreover, the other age groups (23- 33, 34 – 44, 45 – 55 years) did not show any significant changes (P > 0.02). The results collected from the comparison of vitamin B12, total cholesterol and LDL levels between both sexes are not included in the current study, as there were no significant findings among all of these values. Incidence (%) of vitamin B12 deficiency amongst different age groups is summarized in Table 2.

The levels of vitamin B12 are below normal in 17 volunteers between 109 volunteers (15.5%) their age group are 23 -33. The same findings detected

Table 1: The levels of vitamin B12, lipid parameters for each age category

Age groups (year)	No. of volunteers	Vitamin B12 (ng/ml)		Total Cholesterol (mg/dl)		LDL (mg/dl)		HDL (mg/dl)		TG (mg/dl)	
		Mean ± SD									
		Before	After	Before	After	Before	After	Before	After	Before	After
23 - 33	109	405.5	22.3	158.5	12.1	86.2	18.6	51.4	10.4	105.2	21.3
34 - 44	87	416.3	33.4	161.3	18.8	95.1	15.7	54.6	11.3	128.5	23.4
45 - 55	112	370.4	45.7	177.4	21.4	104.5	19.7	48.4	12.5	148.3	16.7
56 - 66	92	183.6**	18.4	286.6**	21.8	142.7*	16.2	49.6	8.4	125.7	29.6

Two tailed paired t-test was performed for the statistical analysis between the different parameters, Significant statistical difference was expressed as:*p< 0.05; ** p< 0.01. Data presented as mean ± standard deviation (SD)

Table 2: Incidence (%) of vitamin B12 deficiency in the age groups

Age group (year)	No. of patients	No. of patients deficient in vitamin B12	% incidence of vitamin B12 deficiency
23 - 33	109	17	15.5
34 - 44	87	13	14.9
45 - 55	112	19	16.9
56 - 66	92	33	35.8
Total no. of volunteers	400	82	20.5

Table 3: The concentrations of total Cholesterol and LDL before and after treatment of vitamin B12 deficiency

Test	Before treatment ± SD	After treatment ± SD	P
Vit.B12 (ng/ml)	187.1 (15.9)	314.2** (20.8)	< 0.01
Cholesterol (mg/dl)	278.1 (27.7)	206.2** (16.2)	< 0.01
LDL (mg/dl)	144.2 (20.2)	103.2** (13.3)	< 0.01

Two tailed paired t-test was performed for the statistical analysis between the different parameters, Significant statistical difference was expressed as: ** p< 0.01. Data presented as mean ± standard deviation(SD)

in 13 cases out of 87 patients (14.9%) their age group between 34 – 44 have low levels of vitamin B12. Also, vitamin B12 deficiency was observed in 19 patients among 112 patients (16.9%) their age group is between 45 – 55. However, the percentage of cases in the age group 56-66 with vitamin B12 deficiency is the highest (35.8%). The changes in the levels of total cholesterol and LDL after the treatment of vitamin B12 deficiency are shown in Table 3.

The use of intramuscular dosage (1000μg/day) of vitamin B12 for 30 days has notably elevated the vitamin B12 level from 187.1 ±15.9 ng/ml to 314.2 ±20.8 ng/ml; (p< 0.01).

The improvement of vitamin B 12 levels is directly associated with a significant decrease in the levels of cholesterol from 278.1 ± 27.7 mg/dl to 206.2 ±16.2 mg/dl (p< 0.01) before and after treatment respectively.

High level of vitamin B12 contributes to lowering the level of LDL from 144.2 ±20.2 mg/dl to 103.2 ±13.3 mg/dl (p< 0.01) before and after treatment, respectively. Two-tailed paired t-test was used for the statistical analysis.

DISCUSSION

The main objective of the current research observes the influence of the vitamin B12 reduction and the impact of using vitamin B12 therapy to alter the lipid profile of samples (n = 400) collected from Jordanians people stayed in the capital of Jordan/ Amman. The clinical history of 400 patients was provided by different medical centres suited in Amman city. The clinical data of the patients involved in this study

contain the levels of vitamin B12, cholesterol, LDL, HDL and TG. This study upraised some important findings as there are no previous attempts focused on investigating the relationship between the deficiency of vitamin B12 and the levels of lipid profile in Amman. Recently published studies were performed in different regions of Jordan other than capital Amman to investigate the levels of vitamin B12 (Vidal-Alaball *et al.*, 2005; Mohammed *et al.*, 2014).

This study has shown that 20.5% of the population staying in Amman has a vitamin B12 deficiency. However, another study focused on the north region of Jordan demonstrated that the percentage of cases with vitamin B12 deficiency is between 24% (Mohammed et al., 2014) to 32.2% (Vidal-Alaball *et al.*, 2005). Several factors play a role in the reduction the number of patients with vitamin B12 deficiency in Amman compared with the area located North of Jordan starting from the health awareness campaigns that focused on all age groups in the capital of Jordan Amman that accomplished by the Ministry of Health. Besides, diet and eating style has also improved the levels of vitamin B12.

Also, this study proved the relationship between ageing and the induction of vitamin B12 deficiency cases, and this finding is matched with the literature, particularly in the age group between 56-66 years old (Saila *et al.*, 2007; Lindsay, 2009). The deficient cases in vitamin B12 increased dramatically in the age group between 60-69 and became equal to 51.7% (Adaikalakoteswari *et al.*, 2014).

A study established in Jordan showed different findings of an increase in the vitamin B12 deficiency in young ages without providing a proper clarification of this result (Zoubi *et al.*, 2019). However, the current data profound the relation between the deficiency in vitamin B12 and the elevated levels of cholesterol and LDL, whereas other lipid tests were not affected by the decrease in vitamin B12 such as; TG and HDL. These results disagree with previous studies that showed an increase of triglycerides in patients who have a deficiency in vitamin B12 (Mahalle *et al.*, 2013). As the number of studies cases is equal to 400, we believe that this number is enough to reflect the obvious increase in vitamin B12 deficiency of the population of the capital of Jordan, particularly the samples were collected from different areas in Amman.

It is recommended to increase the end number of patient samples in future studies to improve and support the accuracy of the findings observed in the current study. It is important to mention that there were no previous studies investigated the impact of the treatment with vitamin B12 on reducing the amounts of both cholesterol and LDL except one study that addressed the relationship between the deficiency in vitamin B12 and the levels of cholesterol and Triglyceride (Yılmaz, 2019).

As previously discussed the effective vitamin B12 treatment strategy is based on using of intramuscular injection contains cyanocobalamin daily for seven days, followed by (1.0 mg) /week for a thirty days (El-Qudah *et al.*, 2013; Tavares *et al.*, 2019). This treatment profound a clear decrease in the concentrations of both cholesterol and LDL in patients with vitamin B12 deficiency. The findings of our study are strongly suggested to utilize this treatment in patients with vitamin B12 deficiency, especially for those who their age is between 56-66 years old. Besides, frequently measuring the amount of cholesterol and LDL is necessary for the diagnosis of vitamin B12 deficiency also can be used as a test for following up and observe the response towards vitamin B12 treatment.

CONCLUSION

Deficiency of vitamin B12 leads to increased levels of cholesterol and LDL. However, other lipid parameters were investigated and showed that vitamin B12 deficiency is not altering the concentrations of TG as well as HDL. The level of vitamin B12 deficiency was improved after using an intramuscular injection of vitamin B12 treatment. The high concentrations of cholesterol and LDL were significantly reduced after following the same treatment procedure. As there are several diseases associated with the vitamin B12 deficiency such as; megaloblastic anaemia and peripheral neuropathy damage, this reason encouraging to establish further studies to investigate the efficacy of using vitamin B12 treatment. Critical health issues, handle the treatment carefully, lifelong dose and follow-up of the patients are necessary for better treatment outcomes. However, early diagnosis is important to start the parenteral replacement therapy as soon as possible to avoid irreversible damage of neurons.

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Competing Interest

The author declares that there are no competing interests and that this work has not been published or submitted concurrently for publication

elsewhere.

Conflict of interest

Authors declare no conflict of interest.

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