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No correlation exists between vitamin B12 and quality of life in healthy young adult population

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Abstract. – *Background and Objectives:* **Vitamin B12 (B12) is essential for well-being and healthy life, since it plays a critical role in DNA synthesis, hematopoiesis and neurologic function. B12 deficiency remains one of the most common nutrition deficiencies in the world and is associated with increasing risk of cardiovascular disease, cancer, mental health problem, osteoporosis, and defect-birth outcomes. The main objective of this study is to determine the impact of B12 levels on quality of life (QOL) among healthy university students.**

Materials and Methods: **This cross-sectional study involved 359 healthy university students (age 18-30 years) of both genders. Their QOL was as vitamin B12 level was measured using the IMx system (Abbott laboratories IMX, USA).**

Results: **No correlation was detected between B12 levels and the two major QOL subscales: the Physical Component Summary (PCS) and Mental Component Summary (MCS). Additionally, none of the other eight subscale of the SF-36 was significantly correlated with b12 levels.**

Conclusion: **We conclude that no correlation exists between B12 levels and QOL scores among young adult healthy populations. Further investigations are required to confirm the impact of B12 status on QOL among healthy populations.**

Key Words:

B12, Quality of life, University, Students, Jordan.

Introduction

Vitamin B12 (B12) is a water soluble essential vitamin that is found mainly in animal products. B12 plays a critical role in neurologic function, and, along with folic acid, DNA synthesis and hematopoiesis[1]. B12 deficiency is a common problem that affects the general population, particularly elderly people. It may take years to develop and begins with depletion of serum B12, followed by cellular deficiency and biochemical changes including elevated homocysteine (Hcy) and methylmalonic acid (MMA)[2].

Vitamin B12 deficiency is associated with hematologic and neuropsychiatric manifestations, including macrocytic (megaloblastic) anemia, paresthesias, peripheral neuropathy, impaired memory, irritability, depression and dementia[3]. Recent studies found an association between B12 deficiency and increasing risk of cardiovascular disease (CVD)[4,5] cancer[6,7], mental health problem[8], osteoporosis[9], and defect-birth outcomes[10]. It has also been suggested that adequate levels of B12 have a protective effect against chronic disease and neural tube defect[11].

The diagnosis of vitamin B12 deficiency has traditionally been based on low serum vitamin B12 level, which is usually less than 200 pg/mL (150 pmol/L), along with clinical evidence of disease[12]. Furthermore, recent evidence showed that methylmalonic acid and homocysteine are additional status indicators that should be evaluated to enhance the diagnostic value of serum B12 concentrations[13-16].

B12 deficiency remains one of the most common nutrition deficiencies in the world. In Jordan, the exact prevalence of B12 deficiency in general population has not been assessed, but B12 deficiency appears to be a significant problem in different age ranges[17,18]. A number of recent researches showed a high frequency of suboptimal serum vitamin B12 level among adult in Jordan[18]. Other studies found a high prevalence of B12 deficiency in Jordanian youth increasing at an alarming rate[17]. The main objective of this

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study was to investigate the correlation between B12 levels and quality of life among healthy university students in Jordan using a validated Arabic version[19,20] of the Current Health Assessment (SF-36), which is one of the most widely used health surveys.

Materials and Methods

After an announcement of our study at various colleges in the University, three hundred and fifty nine (n= 359) healthy university students from Jordan University of Science and Technology were willing to participate in the research. This study was carried out in the Medical Laboratory at King Abdullah University Hospital and lasted for approximately 4 months. The following inclusion criteria were adopted: volunteer University students of both genders; volunteer's age should be between 18 and 30 years; volunteer should not have acute or chronic illness. Volunteer should not be on chronic medications; volunteer should not be on any medications that might affect the B12 absorption parameters (e.g. metformin, anticonvulsants, vitamin supplements, proton pump inhibitors, H_2-receptor antagonists, oral contraceptives and acetylsalicylic acid). Finally, female volunteers should not be pregnant or on contraceptives.

The Human Research Committee at the Jordan University of Science and Technology approved this research. Every volunteer signed a written informed consent after explaining the purpose of the study, how much blood to be withdrawn and confidentiality of information.

A cross-sectional design was used to investigate the correlation between serum B12 levels and health-related quality of life (HRQOL) for healthy University students in Jordan. At the beginning of the study, all participants were requested were asked to sign a written informed consent. Then, they were asked to fill out a questionnaire that provided information about students including age, gender, weight, height, smoking status, medical and medication history students. To assess the quality of life (QOL), participants were asked to fill out the Arabic version of the 36-item Short-Form (SF-36) Healthy Survey SF-36 questionnaire[21]. The survey consists of eight subscales: physical functioning, bodily pain, vitality or energy level, social functioning, mental health, general health perceptions, role limitations because of physical problems, and role limitation due to personal or emotional problems[24]. In addition to the eight scales, the SF-36 authors have developed two summary scales that provide a more concise measure of overall physical and mental health, the Physical Component Summary (PCS) and Mental Component Summary (MCS). These are linear combinations of all eight of the original scales, with the PCS heavily weighting physical measures and the MCS heavily weighting mental health measures[22].

Statistical Analysis

The statistical analysis was performed using the Statistical Package for Social Sciences software (SPSS 15, Chicago, IL, USA). Since most variables were not normally distributed, data analysis was conducted using Spearman's rho correlation coefficient to investigate the correlation of vitamin B12 and each dimension of SF-36. Group differences (such as gender difference in quality of life) were investigated using ANOVA or independent sample *t*-test and. *p* value of less than 0.05 was considered significant.

Results

Three hundred and fifty nine healthy University students of both genders (18 to 30 years old) participated in this study. Table I shows demographic characteristics of the participants. Females represented 60.4% of the sample. As for age, 14.5% of the sample was 18-20 years old, 80% of the sample was 21-25 years old and the rest was 26-30 years old. The table also shows that 63.2% of the sample had normal body mass index (BMI) and 15% of the participants used to smoke. In addition, no correlation was found between the demographic characteristics of the volunteers such as age, gender, smoking, and BMI, and the quality of life (Table I). Therefore, it can be concluded that none of these variables have affected the relationship between B12 and quality of life.

Participants' laboratory data showed that the means of variables such as complete blood cell count, serum B12 levels and folate levels were within normal ranges (Table II).

Among the studied sample, 96.4% (346) got normal B12 plasma level, whereas only 3.6% (n=13) showed B12 plasma level lower than nor-

Table I. Demographic characteristics of volunteers (N = 359). No correlation was observed between age, gender, BMI, and physical activity, and the quality of life subscales.

Factor	Volunteers n (%)	Physical health mean ± SD	*P*-value	Mental health mean ± SD	*p*-value
Age			0.780		0.912
18-20 yrs	52 (14.5)	53.08 ± 6.2		53.34 ± 10.4	
21-25 yrs	290 (80.0)	52.20 ± 8.1		52.73 ± 10.1	
26-30 yrs	17 (4.7)	52.18 ± 8.4		53.17 ± 8.2	
Gender			0.153		0.734
Female	142 (60.4)	51.59 ± 8.0		52.62 ± 10.4	
Male	217 (39.6)	52.81 ± 7.8		52.98 ± 9.8	
BMI			0.169		0.869
Underweight	22 (6.1)	50.12 ± 7.2		54.51 ± 10.3	
Normal	226 (63.2)	52.61 ± 7.8		52.89 ± 10.0	
Overweight	88 (24.9)	52.68 ± 8.0		52.65 ± 10.2	
Obesity	21(5.8)	49.42 ± 8.5		52.21 ± 9.4	
Smoking status			0.408		0.200
Non-smoker	302 (85.0)	52.50 ± 7.8		53.13 ± 10.0	
Smoker	54 (15.0)	51.54 ± 8.1		51.22 ± 10.2	

mal range (<200 pg/ml). Table III shows the distribution of volunteers between the different levels of B12 plasma concentration, where the vitamin levels were divided into eight categories and the number of volunteers within each category was counted. Accordingly, it was found that 33.4% of volunteers had B12 levels between 300-399 pg/ml and 31.4% of participants had suboptimal levels of B12 (200-299 pg/ml).

Table IV shows the correlation between vitamin B12 level and quality of life, when compared with each of the two major subscales of the SF-36 questionnaire (the PCS and MCS). It can be noticed that none of the SF-36 other subscales had a significant correlation with vitamin B12 level.

Discussion

Changes in the levels of micronutrient such as vitamins and minerals can be associated with reduced QOL. However, in this study, we report

Table II. Descriptive statistics of volunteer's lab data (N = 359).

	Normal range	Minimum	Maximum	Mean	Standard deviation
Complete blood cell count					
Red Cell Distribution Width (RDW)	10-15%	8.1	20.4	12.0	1.8
Platelets	150-39010^3/mm^3	129.0	507.0	266.6	60.8
Mean Cell Hemoglobin (MCH)	26.5-33.5 pg	17.6	33.8	26.7	2.3
Mean Cell Hemoglobin Concentration (MCHC)	31.5-35 g/dl	30.7	43.9	32.8	0.7
Mean Cell Volume (MCV)	80-97 µm^3	56.0	98.0	81.2	6.3
Hematocrit (HCT)	35-50%	28.2	54.2	41.3	4.5
White Blood Cell (WBC)	3.5-10 10^3/mm^3	0.2	14.4	7.2	1.8
Red Blood Cell (RBC)	3.8-5.8 10^3/mm^3	3.8	7.4	5.1	0.6
Hemoglobin (HGB)	11-16.5 g/dl	9.1	17.6	13.6	1.5
Serum B12 levels	200-950 pg/ml	144.9	998.4	374.9	139.8
Serum Folate levels	2.5-17 ng/ml	1.2	20.0	8.9	3.0

Table III. Percentage of volunteers according to different level of vitamin B12 (N = 359).

Level of vitamin B12	n (%)
< 200	13 (3.60%)
200-299	112 (31.2%)
300-399	120 (33.4%)
400-499	61 (17.0%)
500-599	28 (7.80%)
600-699	15 (4.20%)
700-799	4 (1.10%)
> 800	6 (1.70%)

that changes in the levels of B12 are not correlated with the QOL among young adult population using the SF-36 survey of QOL. In that regard, none of the Sf-36 eight subscales were correlated with B12 levels.

It has been estimated that the B12 deficiency is one of the most common nutritional deficiencies in the world[23]. However, the prevalence of B12 deficiency in the general population has not been exactly determined, but there are several studies that investigated the prevalence of B12 deficiency and different percentages that ranged from 26.7% to 49% were reported[18,24-27]. Results of this investigation indicate a prevalence of 3.6% among young adult University students, which is much lower than what has been previously reported[18,24-27]. Since the prevalence of B12 deficiency is increased with advanced aged, the low prevalence of B12 deficiency that is reported by this study, can be explained based on the younger age of our population.

Table IV. Correlations between vitamin B12 level and SF-36 subscales.

	Correlation coefficient	Vit. B12 Sig. (2-tailed)	N
PF	–.060	.259	357
RP	–.056	.286	359
BP	–.094	.076	359
GH	.035	.509	359
VT	.083	.117	359
SF	.018	.738	359
RE	–.045	.394	359
MH	.033	.532	359
Physical health	–.087	.099	357
Mental health	.000	.992	359

In this research, none of the eight subscales of SF-36 used had significant correlation with B12 levels, and consequently no correlation between levels of B12 and quality of life was found. This finding is at contrast with results reported in some previous studies. For example, Bernard et al.[28] found that older individuals with vitamin B12 deficiency experience more pain than those who have normal vitamin B12 levels. Additionally, Mauro et al.[29] and Sun et al.[30] demonstrated that B12 injection has been used successfully to treat lower back pain or degenerative neuropathy pain. These findings suggest a negative correlation of B12 levels with the bodily pain subscale of the SF-36. However, such potential correlation was not noticed in our study.

Previous studies have suggested that low B12 levels may be involved in chronic fatigue syndrome, which is symptomatically relieved by B12 injection regardless of the cause[31-34]. This could be explained by the fact that B12 is generally essential for energy production and cell division. However, no significant correlation was detected in by this study between B12 level and the vitality subscale of the SF-36.

Folate and vitamins B12 play an important role in immunity. In fact, folate or B12 deficiency modulate immune competency and resistance to infections[35]. Studies indicate that folate or B12 deficiency reduce CD8+T lymphocytes in proportion to CD4+ cells[36,37]. In addition, elderly who were supplemented with folate and B12, had superior natural killer cell cytotoxicity, indicating enhanced immune response[38]. Therefore, the immune system is a major effecter to B12 deficiency[39, 40].

Certain limitations of this study must be underlined. First, our results were based only on B12 levels, without measuring the relative concentration of methylmalonic acid and/or homocysteine, which might be considered as supportive measure of B12 deficiency. Secondly, the study took place only in student population that usually have specific characteristics affected by social and psychological factors, dietary habits, stress of study and emotional and environmental stressors.

Conclusions

In the present study, no correlation between B12 levels and QOL scores was detected when these scores involve two major summary

scales: the PCS and MCS scales. The same results were recorded when studying the correlation of vitamin B12 level with each subscale of SF-36. Finally, it must be noticed that further investigations are essential to confirm the impact of B12 level on QOL among healthy population.

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