

Full Length Research Paper

Deficiency of vitamin B12 among Jordanian people with psychological and biological activity

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This study was conducted to evaluate vitamin B12 level among Jordanians healthy people and its effects on psychological parameters. One hundred and eighty six subjects were recruited in the study. The subjects were chosen to be healthy, aged between 16 to 71 years. Participants were asked to fill a detailed questionnaire that covered medical data then they were divided into three age groups. Serum vitamin B12 levels were done for all volunteers. Results showed the mean values of B12 concentrations in males and females. There were lower mean B12 concentration in females (264.02 pmol/L) than males (281.56 pmol/L) and a total mean concentration was 265.79 pmol/L that is near the cutoff value which was 258 pmol/liter. The mean value of the B12 distributed in different age ranges for the mean concentration of the 16 to 25 years group was 249.03 pmol/L significantly lower than the other group. There were highly significant difference between the groups in terms of low sexual activity, Memory loss, Loss of appetite and depression and deficiency of vitamin B12.

Key words: Vitamin B12, B12 deficiency and psychological parameters.

INTRODUCTION

The study was conducted to assess if objective evidence for sexual activity, heart palpitation, loss of appetite, memory loss and depression was associated with low vitamin B12 concentrations. In Jordan vitamin B12 deficiency has increased in an alerting rate in the last decade. Several studies done in Jordan reported prevalence between 16 to 50% (Barghouti et al., 2009; Abu-Samak et al., 2008). Serum vitamin B12 test measures total amount of circulating cobalamin, either bound to transcobalamin, which represents the functionally important fraction of plasma vitamin B12 (Miller et al., 2006) or haptocorrin, which makes the vitamin unavailable for uptake by cells (Holleland et al., 1999). In a primary care setting, the indications for the measurement of serum vitamin B12 concentrations

typically include a history suggestive of pernicious anaemia, poor nutritional status, cognitive impairment, dementia, neuropathy or malabsorption. But although vitamin B12 supplementation is clearly indicated for the treatment of pernicious anemia or malabsorption associated with low vitamin B12, the relevance of supplementation with vitamin B12 (and other B vitamins) for the treatment of cognitive impairment is uncertain. Because poor nutritional status is common among older people with dementia, as is age-associated decline in the intestinal absorption of vitamin B12, it is not surprising that a substantial proportion of older people with dementia have low serum vitamin B12 concentrations. Nevertheless, it is widely believed that vitamin B12 deficiency accounts for only a small fraction of the reversible causes of dementia in older people (Malouf and Areosa, 2003; Magri et al., 2003).

More commonly, such individuals present with non-specific symptoms of fatigue and cognitive impairment that can be attributed to 'old age'. Some of the

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Table 1. The mean value of B12 levels of the study participants.

Sex of volunteers	No	Mean B12 concentration pmol/liter	S.D.
males	60	281.56	99.6
females	126	264.02	98.65
Totals	186	265.79	91.85

uncertainty about the importance of vitamin B12 deficiency relates to the limitations of the standard vitamin B12 assays. Low serum vitamin B12 concentrations do not accurately reflect intracellular vitamin B12 concentrations, and blood levels of homocysteine or methylmalonic acid are believed to be more reliable indicators of intracellular vitamin B12 status (Clarke et al., 2004). About 80% of vitamin B12 circulating in blood is biologically unavailable for most cells; the rest comprises holotranscobalamin (holoTC), which is the part of serum vitamin B12 bound to transcobalamin, the protein that delivers the vitamin to cells in the body and is easily measured (Morkbak et al., 2005).

Data collection

One hundred and ninety nine people were selected for the study, 13 were excluded; 6 had a history of systemic illness (e.g. diabetes mellitus, liver cirrhosis), 5 were on vitamin and/or supplement therapy and 2 had serum creatinine level ≥ 1.4 mg/dL. Finally, 186 (60 men and 126 women) adult Jordanian were randomly selected from all regions of Zarka city. All were in the age range 16 to 71 years. Those who were vegetarians and those who had any systemic illness, serious organ diseases, renal failure (creatinine ≥ 1.4 mg/dl), liver failure, alcoholism, taking food or multivitamin supplements or taking anticonvulsants, antimetabolites and antiviral drugs were excluded. Pregnant and lactating women were also excluded. The local ethics committee in Zarka University approved the study. Informed written consent was obtained from all respondents before being admitted into the study.

Data were collected using a questionnaire including items related to sexual activity, heart palpitation, loss of appetite, memory loss, and depression. Blood samples were taken in the morning. The serum was separated within 1 h of sampling by centrifugation (10 min, room temperature, at 2000 rpm) and was stored at -70°C until analysis.

Methods

Serum vitamin B12 level was measured by competitive protein binding assays in the Jerusalem consulting laboratory (Zarka-Jordan) by using Chemiluminescence immunoassay; Immulite 2000 (Siemens Medical Solutions Diagnostics, Deerfield, IL). As in an earlier report (Stabler et al., 1999), vitamin B12 deficiency was defined according to two classifications, using a high and a low cutoff, in order to explore the existence of a dose-response relationship. High-cutoff vitamin B12 deficiency is present when the serum vitamin B12 level is less than 258 pmol/liter. A low-cutoff vitamin B12 deficiency is present when the serum vitamin B12 level

is less than 148 pmol/liter.

Statistical analysis

Data were presented as mean \pm SD (standard deviation), of the indicated number of experiments, students t-test and one-way ANOVA. All analysis was calculated utilizing the computer data processing (SPSS, version 14) a probability value ($P < 0.05$) was considered to be statistically significant.

RESULTS

One hundred and ninety nine people were selected for the study, 13 were excluded; 6 had a history of systemic illness (e.g. diabetes mellitus, liver cirrhosis), 5 were on vitamin and/or supplement therapy and 2 had serum creatinine level ≥ 1.4 mg/dL. Finally, 186 respondents (60 men and 126 women) were assessed. Table 1 shows the mean values of B12 concentrations in males and females in the selected group of population. There was lower mean B12 concentration in females (264.02 pmol/L) than males (281.56 pmol/L) and a total mean concentration (265.79 pmol/L) that is near the selected cutoff value which was 258 pmol/liter.

Table 2 demonstrates the mean as well as the range of concentration of B12, distributed in different ranges of age groups. The participants were divided into three age groups: 16 to 25 years; in this group the participants were 60 and the mean concentration was low in this group sample according to the serum vitamin B12 low high cutoff (249.03 \pm 78.7). Forty six of the participants in this group (76.6%) showed vitamin B12 deficiency according to high cutoff, while eight of them (13.3%) showed deficiency at low cutoff.

The total mean values of the other groups selected, showed no vitamin B12 deficiency, while 38 (46.3%) and 24 (54.5%) showed deficiency at high cutoff in the age groups 25 to 45 and 45 to 71, respectively. Furthermore, only 8 (9.7%) and 2 (4.5%) showed deficiency at the selected low cutoff.

Table 3 shows relationship between B12 levels and psychological parameters and biological activity, 90 volunteers with a mean vitamin B12 level of 260.7 \pm 95.1, 52 of them (58%) are low in their vitamin B12 level are suffering from low sexual activity according to high cutoff, while only 3 (7%) are affected according to low cutoff. 42 (52%) out of 82, 44 (50%) out of 88, 54 (52%) out of 104

Table 2. The mean value of B12 levels according to age groups.

Age (years)	No.	Vitamin B12 (pmol/liter) Mean \pm (SD)	Low vitamin B12 level			
			High cutoff (258 pmol/liter)		Low cutoff (148 pmol/liter)	
			No.	%	No.	%
16 to 25	60	249.03 \pm 78.7	46	76.6	8	13.3
25 to 45	82	284.3 \pm 112.6	38	46.3	8	9.7
45 to 71	44	289.19 \pm 113.85	24	54.5	2	4.5

Table 3. The relationship between the mean value of B12 levels with psychological and biological activity.

Say yes for	No.	Vitamin B12 (pmol/liter) Mean \pm (SD)	Low at high cutoff		Low at low cutoff	
			No.	%	No.	%
Low sexual activity	90	260.7 \pm 95.1	52 *	58	3	7
Depression	82	271.1 \pm 92.2	42 *	52	8	10
Heart palpitation	88	290.4 \pm 105.3	44 *	50	12	14
Memory loss	104	268.2 \pm 90.7	54 *	52	8	8
Loss of appetite	88	262.5 \pm 90.4	46*	53	10	12

* P < 0.01.

and 46 (53%) out of 88, are answered yes for suffering of depression, heart palpitations, memory loss and loss of appetite, respectively.

DISCUSSION

The results of our study showed that the mean serum B12 level in the younger age group (16 to 25years) was significantly lower than the older group (25 to 45years and 45 to 70years) (Table 2). These results are consistent with those of Barghouti et al. (2009) who found that high frequency of vitamin B12 deficiency (serum level <180 pg/ml) was observed in the age group between 18 to 24 years (51.8%) as compared with other age groups. This prevalence of B12 deficiency in younger adults can be explained by their eating habits that are usually highly dependent on consumption of junk foods by the younger group. High frequencies of vitamin B12 deficiency among young adults were also reported in studies conducted in several countries. In India, Yajnik et al. (2006) found that 67% of the participating healthy men (aged 30 to 50 years) had low vitamin B12 levels (<150 pmole/L). In Iran, Shams et al. (2009) studied vitamin B12 deficiency in 984 healthy subjects aged 20 to 80 years. Their study was conducted on 408 subjects who were between 20 to 40 years. Shams and his colleagues found that among this young age group, 28.3% (156 of 408) had serum B12 level less than 200 pg/ml and this percentage increased to reach 53.9% in those who had

serum B12 <250 pg/ml (220 of 408). All these results agree with our results. However, in a study conducted in Spain, serum vitamin B12 was reported to be significantly higher in younger age (25 to 39 years) than in age groups (40 to 49 years) (Planells et al., 2003).

Gender was shown to have no effect on the occurrence of low vitamin B12 level. There was no significant difference in the mean serum vitamin B12 level between males and females ($p = 0.05$). Similar results were found in the studies done by other authors (Fora and Mohammad, 2005; Planells et al., 2003). These authors reported no significant differences in the mean serum B12 between both sexes. However, Barghouti et al. (2009) and Hakooz et al. (2006) found that males had significantly lower vitamin B12 level than females ($p < 0.05$). In contrast, Habib (2008) found that males had marginally higher serum B12 concentration than females. The difference on results could be related to eating habits of the study samples.

We found that low vitamin B12 level was more common in our sample than has been previously reported in patients with major depression. Mischoulon et al. (2000) found correlation between the severity of depression and the level of vitamin B12 at baseline, displayed a weak positive correlation. Engström and Träskman-Bendz, (1999) found no correlation between the levels of folate or B12 and the severity of depression, but an inverse relationship between the level of folate and severity of depression has been reported in some other studies (Carney et al., 1990; Wesson et al., 1994). A low B12

level was relatively common among our samples with depressive disorder, which is in accordance with previous studies (Alpert and Fava, 1997). Moreover, our study included only young and middle-aged respondents with depression, which may have influenced the results. The association between B12 and depression may be more prominent in elderly subjects, among whom folate deficiency has been relatively common in some studies (Quinn and Basu, 1996). Poor appetite and inappropriate food intake as symptoms of depression could result in low levels of vitamin B12. These results agree with our study. It might reflect to lower intake of vitamins from food or assimilation from the gastrointestinal track, or a higher rate of metabolism of these vitamins. Depression may also affect the quality of food in the diet. Morris et al. (2003) found that levels of blood folate had decreased after an episode of depression. However, loss of appetite, weight loss and being underweight were not related to folate levels. There are several theories concerning potential associations between depression and levels of vitamin B12 and folate. Vitamin B12 and folate are connected with the synthesis of monoamines and are involved in single carbon transfer methylation reactions connected with the production of monoamine neurotransmitters (Bottiglieri, 1996). However, Vitamin B12 deficiency may also result in the accumulation of homocysteine, which has been suggested to lead to exito-toxic reactions and may enhance depression (Parnetti et al., 1997). Bottiglieri et al. (2000) found raised levels of homocysteine in 52% of depressed inpatients. Vitamin B12 is also required in the synthesis of S-adenosylmethionine (SAM), which is needed as a methyl donor in many methylation reactions in the brain.

This study showed that low serum vitamin B12 concentrations were associated with symptoms of memory impairment. These associations provide support for the suggestion that biologically active fraction of vitamin B12, are a more reliable indicator of intracellular vitamin B12 status than the standard vitamin B12 assay and agree with study of Lewerin et al. (2005).

Our sample included more women than men; all these variables may influence the results. Men and women may have different dietary habits; a low vitamin B12 level and B12 deficiency have been found to be common among younger women (Penninx et al., 2000). Vitamin B12 is an important vital coenzymes that could interfere with the production of many enzymes and hormones in humans. One of these hormones could be testosterone that affect the sexual habits and performance, that's why nearly two third of the volunteers who have deficiency are suffering from low sexual activates.

Finally, patients with psychotic depression may have lower B12 levels than non-psychotic depressives (Bell et al., 1991). Psychotic depression is a common indication for inpatient treatment. For these entire reasons one should be careful about generalizing these findings to all

groups of depressive patients. Another explanation is that depression may also affect the quality of food in the diet which lowers levels of blood vitamins during an episode of depression (Morris et al., 2003).

Conclusions

The results of this study revealed that there are relation between deficiency of vitamin B12 and Low sexual activity, depression, Heart palpitation, memory loss and loss of appetite. Further intensive research, that studies the concentration of sex hormones and using international criteria for proper assessment of depression and other psychological parameters are proposed.

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