A Trend of Low Serum Vitamin B_{12} in Jordanian Adults from Two Ethnic Groups in Amman

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Abstract

Objective: To investigate the prevalence of vitamin B_{12} deficiency in Jordanian adults from two ethnic groups in Amman.

Methods: The plasma B_{12} level was measured in 290 subjects (124 men, 166 women, aged 16-72) from two ethnic groups; Circassians and Arabs. These participants were recruited by simple random sampling from both communities from June 2004 to March 2005.

Results: The prevalence of vitamin B_{12} deficiency (B_{12} level lower than 200 pg/ ml) was 50.8 and 46.9% in Arab and Circassians, respectively. No significant differences in the plasma B_{12} level were found between the different age groups in Arabs and Circassians and between the same age groups of the two populations. One notable exception was the subjects who are older than 60 years in Circassians. Their plasma B_{12} levels were significantly lower than those in the other age groups in Circassians and the same age group in Arab (P<0.05). There were differences in the plasma B_{12} level according to gender; the plasma B_{12} levels for men were lower than those obtained for women in both groups. This difference was significant (P<0.001) for Arab population. Compared to Circassian men, the plasma B_{12} levels of Arab men were also significantly lower (P< 0.001). The plasma B_{12} level was significantly lower in smokers compared to non-smokers in both groups (P<0.005).

Conclusion: The current study demonstrates the high prevalence of suboptimal cobalamin levels in Jordanian subjects living in Amman, and it shows that there are no differences in the prevalence as related to the two ethnic groups studied.

Keywords: Suboptimal Serum Vitamin B_{12} , Jordanian Adults, Arabs, Circassians.

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Introduction

Vitamin B_{12} (cobalamin) plays an important role in DNA synthesis and neurologic function. Deficiency can lead to a wide spectrum of hematologic and neuropsychiatric disorders that can often be reversed by early diagnosis and prompt treatment. [1]

Over the past 20 years, studies have shown high prevalence of vitamin B_{12} deficiency in Northern Europeans as well as of people of African descent. In the Middle East, pernicious anemia caused by vitamin B_{12} deficiency has been reported from Kuwait, Saudi Arabia and the United Arab Emirates. [2] In Israel, several studies have demonstrated the prevalence of vitamin B_{12} deficiency among the different ethnic groups and the elderly. [3]

Jordan is a developing Middle Eastern country of 5.3 million people that is undergoing rapid modernization. The population is highly urbanized; more than 80% of the population resides in urban areas. Jordanians are Arabs, except for a few small communities of Circassians, Armenians, and Kurds that have adapted to the Arab culture and represent less than 1% of the population. Genetically, the Jordanian population has been characterized as being heterogeneous, and this reflects ancient and recent admixture with neighboring populations, and important human migratory trends throughout history. [4]

The Circassians are a non-Arab Islamic people originally from the Caucasus region of western Asia. Circassians first arrived as a group in Jordan in 1878, where they settled in Amman (Wadi Seer, Na'ur and Sweileh). Today, Circassian populations can be found also in Jerash, Zarqa, Azraq and other parts of northern Jordan. Estimates of the Circassian population vary from 120,000 to 150,000. [5]

There are various methods for determining inadequate vitamin B_{12} status. The determination of the cobalamin concentration in serum or plasma is a specific measure but varies depending on the method and the particular laboratory. In adults, a concentration of 150 pmol/L (200 pg/ml) is considered the lowest level for an adequate supply. In a developing deficiency, serum concentrations are maintained by depleting stores of the vitamin. [6, 7]

It has been recently noticed by many medical practitioners that there is some prevalence of suboptimal concentrations of vitamin B_{12} in different age groups and especially within Circassians in the Jordanian population. Due to lack of information in Jordan on status of vitamin B_{12}, the aims of the current study are to prospectively assess the cobalamin states in an adult population of Jordanian subjects living in Amman, and to assess whether there are differences in the prevalence as related to the ethnic group (Circassians versus Arabs), gender, age and smoking status.

Material and Methods

Population: The subjects for this study consisted of participants of Arab and Circassian origins that lived in Amman. These participants were recruited by simple random sampling from both communities from June 2004 to March 2005. The objectives of this study were explained to the volunteers. One hundred and eighteen Arabs (men 68, women 50, aged 18-72 years) and one hundred and seventy two Circassians (men 56, women 116, aged 16-68 years), who participated voluntarily, were investigated. Information about subjects were obtained by general questionnaires. Exclusion criteria for both groups included strict vegetarians, people on continuous antacid or proton pump inhibitors and current users of B group vitamin supplements.

Analysis: About 10 ml of venous blood was taken from each subject. Heparinised blood was used to determine plasma vitamin B_{12} and folate level. Plasma samples were stored at -20ºC. Vitamin B_{12} and folic acid were analyzed using Immulite 1000 analyzer, which is a competitive chemiluminescent enzyme immunoassay, catalogue number: LKVB1 and LKF01 for vitamin B_{12} and folic acid, respectively. All the experimental data were subjected to Student's t-test for independent samples for vitamin B_{12} level.

Results

Descriptive demographic characteristics are presented in Table (1). The plasma folate levels were determined for the individuals participating in the study and were found to be within reference interval for both groups (Table 1).

High prevalence of suboptimal serum B_{12} level was noted in both groups studied (Table 2). The percentage of the number of subjects with B_{12} level lower than 200 pg/ ml was 50.8 and 46.9% in Arabs and Circassians, respectively.

As it has been mentioned previously, the concentration of 150 pmol/L (200 pg/ ml) is considered the lowest level for an adequate supply. [6, 7] Most of the subjects who participated in the study (88.1% for Arabs and 87.5 % for Circassians) had a plasma B_{12} level lower than 400 pg/ml. No significant differences in the plasma B_{12} level were found ($P>0.05$) between the different age groups in Arabs and Circassians and between the same age groups of the two populations (Figure 1). One notable exception was the subjects that are older than 60 years in Circassians. Their plasma B_{12} levels were significantly lower than those in the other age groups in Circassians and the same age group in Arabs ($P<0.05$).

There were differences in the plasma B_{12} level according to gender. The plasma B_{12} levels for men were lower than those obtained for women in both groups. This difference was significant ($^{*}P<0.001$) for the Arab population. Compared to Circassian men, the plasma B_{12} levels of Arab men were also significantly lower ($^{*}P<0.001$). It can be seen from Table (3) that the plasma B_{12} level was lower in smokers compared to non-smokers in both groups. This difference was significant ($^{*}P< 0.005$).

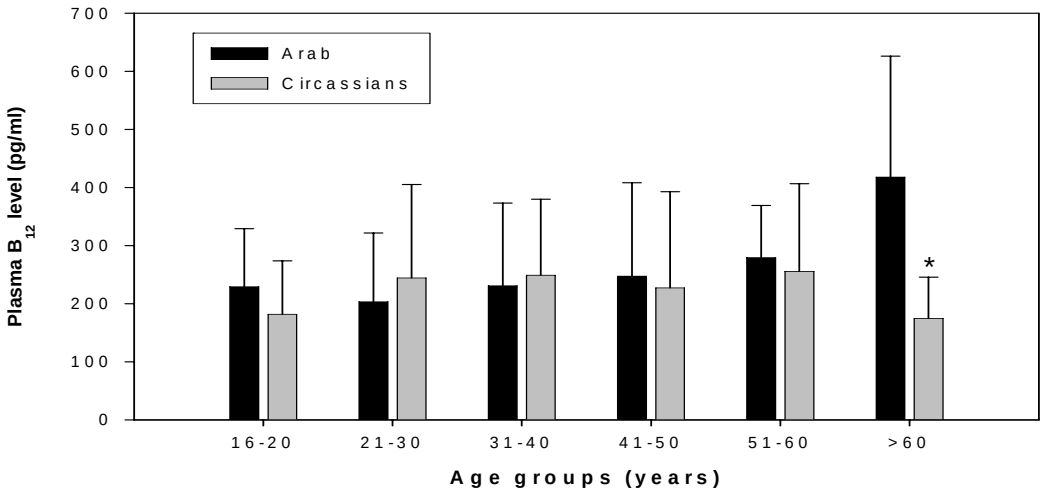

Figure 1: Plasma B_{12} level (pg/ml) versus Age groups (years) (* P< 0.05 vs. (51-60) Circassians).

Table 1: Demographic characteristics in Arabs and Circassians.

	Arabs (Men 68, women 50)		**Circassians** (Men 56, women 116)	
	Mean (SD)	Range	Mean (SD)	Range
Age (years)				
Men	30.6 (9.7)	18-64	39.4 (12.7)	20-68
Women	39.5 (14.0)	19-72	38.0 (12.0)	16-67
Weight (kg)				
Men	78.0 (10.2)	60-115	79.8 (11.3)	60-104
Women	66.9 (12.5)	48-96	65.9 (13.6)	42-110
Height (m)				
Men	1.75 (0.04)	1.66-1.86	1.76 (0.07)	1.60-1.95
Women	1.64 (0.05)	1.5-1.74	1.62 (0.06)	1.47-1.78
Body mass index (kg/m^2)				
Men	25.5 (3.1)	19.9-36.3	25.8 (3.4)	20.4-33.6
Women	24.9 (5.0)	18.1-38.5	25.1 (5.4)	16.1-45.8
Smokers				
Men	29%		41%	
Women	8%		24%	
Plasma Folate level (ng/ml)				
Men	10.9 (4.2)	4.7-24 (RI, 3.0-17.0)	10.2 (4.8)	4.3-24 (RI, 3.0-17.0)
Women	12.0 (4.4)	4.3-24 (RI, 3.0-17.0)	10.5 (4.6)	3.0-24 (RI, 3.0-17.0)

SD= standard deviation. RI= reference interval.

Table 2: The percentage of the number of subjects with different plasma B_{12} level.

Plasma B_{12} level (pg/ml)	**% Arabs**	**% Circassians**	**% Total**
< 200	50.8	46.9	48.5
200-400	37.3	41.7	39.9
> 400	11.9	11.4	11.6

Table 3: Summary of the results of the study: mean (SD) of plasma B_{12} level and the number of subjects in both groups (Arabs and Circassians).

	Arab		Circassians		
	Mean (SD) (pg/ml)	**n**	**Mean (SD) (pg/ml)**	**n**	***P*-value**
Age groups (years)					
16-20	229 (100)	10	182 (92)	10	0.142
21-30	203 (119)	39	244 (161)	46	0.089
31-40	231 (142)	41	249 (131)	42	0.274
41-50	247 (161)	12	227 (165)	45	0.355
51-60	279 (90)	9	256 (151)	19	0.306
> 60	418 (208)	7	175 (71)	10	0.010
Body mass index (kg/m^2)					
<18.5	447 (191)	3	240 (76)	8	0.105
18.5-24.9	245 (131)	58	238 (144)	79	0.299
25-29.9	214 (149)	44	235 (148)	60	0.237
30-34.9	239 (139)	41	245 (198)	18	0.467
35-39.9	247 (66)	3	179 (81)	4	0.140
> 40	N.A.*	0	141 (38)	3	N.A.*
Sex					
Men	168 (89)	68	226 (107)	56	0.0008
Women	333 (145)	50	239 (163)	116	0.0002
Smoking status					
Non smokers	254 (150)	94	253 (158)	122	0.493
Smokers	177 (76)	24	189 (104)	50	0.283

* ***N.A. not available.***

Discussion

In the present study, we aimed to assess the status of vitamin B_{12} in a sample of seemingly healthy individuals in Amman, and we have demonstrated a high frequency of suboptimal serum vitamin B_{12} level in the Jordanian population in both groups studied, Arabs and Circassians (Table 2). The plasma B_{12} level for around 50% of the subjects that have participated in this study was lower than 200 pg/ml. Similar findings have been reported in a study conducted by Fora and Mohammad (2005) in North Jordan. [8] They found suboptimal (<222 pg/ml) serum levels of vitamin B_{12} in 48.1% of all participants (the study included 216 healthy adult volunteers). Despite the low levels of serum vitamin B_{12}, they have observed normal hematological values and absence of obvious clinical manifestation of vitamin B_{12} deficiency in this sample. [8]

The mean level of serum vitamin B_{12} is similar to those reported by Fora and Mohammad (2005) in north Jordan [8] and Ardawi et al. (2002) in Saudi adults. [9] It should be remembered that preclinical deficiency is the state in which metabolic evidence of insufficiency exists in a person who is without symptoms or anemia. Thus, many patients with low-normal levels of vitamin B_{12} may have silent vitamin B_{12} deficiency. Subtle megaloblastic changes might be discernible in a small minority of such cases, but usually even neutrophil hypersegmentation is lacking. The serum folic acid level was within the normal limits which may mask the manifestations of the vitamin B_{12} level. Similar to our findings, Fora and Mohammad (2005) observed normal levels of serum folate in the suboptimal group. [8]

A significant association between low cobalamin levels and poor spatial copying skills was reported in nondemented elderly subjects, although the cognitive defect was even more strongly associated with abnormal folate and homocysteine levels. [6] Homocysteine and methylmalonic acid levels are more sensitive and specific indicators of functional vitamin B_{12} deficiency. [10] Stabler and Allen (2004) reported similar observations on vitamin B_{12} deficiency as being a worldwide problem. [2]

In the current study, there were no differences in the prevalence of vitamin B_{12} deficiency as related to the ethnic group (Circassians and Arabs). A different observation on the effects of ethnic origin was observed in studies of other populations. A significantly higher prevalence of vitamin B_{12} deficiency was observed in whites compared with African-Americans and Asians. [11]

In a population-based study by Ganji and Kafai (2003) in the third National Health and Nutrition Examination Survey (1988–1994), the association between serum total homocysteine level, race-ethnicity and blood vitamin concentration was investigated. [12] Among all the race-ethnicity groups examined, non-Hispanic whites had the highest serum total homocysteine concentrations higher than those of non-Hispanic blacks and Mexican-Americans. [12] It was also reported that cobalamin deficiency with elevated serum methylmalonic acid concentration is more prevalent in elderly white than in African American women and elevated serum total homocysteine and folate deficiency are more prevalent in elderly African American than in white women. [13] Similar findings on the effect of ethnic origin have been reported in Israel. Gielchinsky et al. (2001) have studied the level of plasma B_{12} in Ashkenazi Jews and reported a high prevalence of low serum vitamin B_{12}; further screening of multiethnic healthy blood donors was undertaken which reported that low serum B_{12} among Ashkenazi Jews reflects a genetic predisposition rather than an environmental factor in Israel. [3]

Figlin et al. (2003) assessed the prevalence of vitamin B_{12} and folic acid deficiency in the general Israeli population of elders. The study reported a significantly higher prevalence of vitamin B_{12} deficiency in subjects of Asian or African origin compared to subjects of European origin, but prevalence of folic acid deficiency was similar in these ethnic groups. [14]

In the present study no significant differences in the plasma B_{12} level were found (P<0.05) between the different age groups in Arabs and Circassians and between the same age groups of the two populations with exception of the subjects that are older than 60 years in Circassians (Figure 1). This finding is consistent with other published data about the prevalence of vitamin B_{12} in the elderly. [7, 12, 15-18] There is a variety of reasons why elderly, especially geriatric subjects, are at high risk for nutrient deficiencies including age-associated physiological changes, chronic diseases, and a high prevalence of drug intake. Vitamin B_{12} deficiency is one of the most important problems in the nutrition of the elderly since the absorption of cobalamin is often reduced in this group.

The present study reported differences in the plasma B_{12} level according to gender. The plasma B_{12} levels for men were lower than those obtained for women in both groups. Similar observations on the effects of male gender were observed in studies of other populations. [9, 14, 19] While others have reported no differences of plasma B_{12} level according to sex. [8, 12, 15]

Cigarette smoking is known to be associated with a raised plasma homocysteine level. [12] Smokers also tend to have lower levels of the B-vitamins, folate, vitamin B_6 and vitamin B_{12}, all of which affect homocysteine levels by acting as co-factors (vitamins B_6 and B_{12}) or co-substrate (folate) for the enzymes controlling homocysteine metabolism. [20]

It has been proposed that several of the hundreds of chemical components of cigarette smoke, primarily organic nitrites, nitrous oxide, cyanates and isocyanates, interact with folic acid and vitamin B_{12} coenzymes, transforming them into biologically inactive compounds. [7]

In the present study, plasma vitamin B_{12} was significantly higher in non-smokers than in smokers in both groups studied (Table 3). For Arabs, the average plasma vitamin B_{12} level was 177 pg/ml in the smokers and 254 pg/ml in the non-smokers. And this comes in accordance with what was reported in earlier studies. [20, 21]

The change in dietary habits by the Jordanian population from being dependent on homemade to manufactured food was one of the causes for low serum vitamin B_{12} levels suggested by Fora and Mohammad (2005), they could not also exclude inadequate dietary intake, decreased vitamin B_{12} bioavailability, low socioeconomic status and other factors leading to low serum vitamin B_{12} levels. [8] The authors also emphasized on the importance of the early diagnosis of functional vitamin B_{12} deficient subjects to prevent the possible occurrence of the complications associated low vitamin B_{12} status, like poor growth, anemia and neuropsychiatric manifestations including mood changes, and disturbances in sensory, motor, and cognitive functions. [8]

In summary, a trend of low serum vitamin B_{12} in Jordanians living in Amman have been demonstrated. The findings of this study imply that medical practitioners should be aware of the extent of the prevalence of vitamin B_{12} deficiency and actions should be undertaken to improve the status of vitamin B_{12} in the Jordanian population. In view of the high prevalence of mild, preclinical deficiency, routine cobalamin supplementation in the general population, or in segments of it such as the elderly or pregnant vegetarians, may be advisable. [6] Vitamin B_{12} should be added to iron and folate supplements given to pregnant and lactating women. [2]

Because of the high prevalence of vitamin B_{12} deficiency in the elderly and its association with neurocognitive diseases, [22] the daily use of cobalamin supplements of >50 μg/day can be recommended for elderly people aged 60 years and over. [7] The early diagnosis of vitamin B_{12} deficiency is important to prevent further tissue damage and improve the condition. [23] These findings need to be confirmed by using a larger number of subjects in different areas of Jordan to ascertain the extent of vitamin B_{12} deficiency in the Jordanian population.

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