TRADITIONAL NUTRITION HABITS EFFECT ON CALCIUM AND VITAMIN B12 DURING PREGNANCY[1]

Çiğdem Sabbağ[1], Türkan Şahin[2]

[1]School of Tourism, Food and Beverage Management, Adıyaman University, Adıyaman,
[2] School of Health, Nursing Department, Adıyaman University, Adıyaman,
TURKEY.

[1] csabbag@adiyaman.edu.tr, [2]tsahin@adiyaman.edu.tr

ABSTRACT

The nutrition care has utmost importance during pregnancy for mothers' and fetus health. The study is carried out to determine the relation of nutrition habits and food type with serum Ca and B_{12} levels along with suggesting solutions for the expectant mothers who are tightly connected to traditions in Adıyaman (SE Turkey). The study is undertaken by questionnaires with the participation of 91 pregnants living in relatively less developed region of Turkey. The Ca and B12 levels of participants were obtained from Ministry of Health's Adiyaman 3rd Health Center archive. Data evaluated by SPSS 17 software. Participants Ca and B_{12} showed a significant decrease, $p<0.01$, with the development of pregnancy which revealed drawing of the said nutrients by fetus from mother. The cereals based food diversity can be classified as monotype nutrition due to the traditional eating habits. Moreover, subjects' folic acid, vitamin A, zinc, iron, B6 especially vitamin D levels are also critical. As changing traditional eating habits in the studied site would take time, Ca and B_{12} supplementation are needed to expectant mothers, and for the long run awareness within the society should be created via visual media which all will prevent mother and baby from serious health problems during and after pregnancy.

Keywords: Pregnancy, Calcium, Vitamin $B_{12,}$ Eating habits, Traditional nutrition

INTRODUCTION

The calcium (Ca) and vitamin B_{12} deficiencies are common global health issue among expectant women (Agrahar-Murugkar and Pal, 2004) and Turkey is not the expectation (Koç et al., 2006; Açılmış et al., 2011). During pregnancy, 25-30gr Ca is transferred from mother to fetus and 80% of the said amount is received in the 3rd trimester by fetus. Low calcium uptake causes hypertension and preeclampsia (Trumbo and Ellwood, 2007). Moreover, the newborns' bone density and growth are both adversely affected (Darwish et al., 2009). Along with Ca deficiency, at low B_{12} methylcobalamin will not develop and DNA synthesis cannot formed in fast developing tissues which causes megaloblastic anemia, birth anomalies and complications in nerve systems (Carmel, 2003). Although all minerals play a certain role in pregnancy, Ca is unique for growth and development of skeleton, muscles and abilities of blood clotting. Thus, pregnant should take sufficient Ca for fetus' and her health because of increased calcium consumption. Whether mother uptakes sufficient Ca or not, fetus drains mother's Ca sources for its growth and development which may cause osteoporosis, osteomalasia, and tooth loss of mother. Alike Ca, B_{12} is essential component for healthy pregnancy and baby development for adequate and balanced nutrition cycle. The low protein, folic acid and improper food preparation decreases B_{12} absorption (Rasmussen and Yaktine,

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2009). For giving a healthy birth and baby growth, mothers should be well informed for adequate and balanced nutrition since not only amount wise but also variety wise nutrient requirement for fetal development, and milk production increases during pregnancy and breastfeeding period (Halıcıoğlu et al., 2012). The study is carried out to determine the relation of nutrition habits and food type with serum Ca and B_{12} levels along with suggesting solutions for the expectant mothers who are tightly connected to traditions in Adıyaman (SE Turkey).

METHOD

The body Ca and B_{12} level, nutrition habits, and their relations along with suggestions for correcting deficiencies were studied with a total of 91 expectant women, most of them were housewives, above 18 years and more. Subjects data at various trimesters of pregnancy were obtained from Adıyaman 3rd Health Center (Governmental Institution) located in Adiyaman city of Turkey in SE Anatolia. A questionnaire was employed for directly addressing the aims of the research ie nutrition habits, and daily food consumption along with demographic properties. Thus, other than blood Ca and B_{12} values, the approximate nutritional status (sufficiency and deficiency) of participants were derived from daily food consumption (Ohno et al., 2005). The questionnaire was conducted face-to-face by experienced surveyors. The height and weight of samples were measured during questionnaire for determining body mass index. Data were statistically processed by SPSS 17. Median, percentage values and khi-square significance test were evaluated.

A total of 121 expectant women were visiting Adıyaman 3rd Health Center however 91were selected by the equation below which set the research population:

n=Nt2pq/d2(N-1)+t2 pq, where;

N: Number of population -120

n: Number of research population - 91

P: The occurrence frequency of research phenomena -60% (National studies in Turkey revealed 60-65% frequency for B_{12}) (www.perinatology.org.tr/page/58/Gebeler_Icin.Aspx, accessed 15.05.2013).

q: The nonoccurrence of the research topic (1-p) -40%

t: At certain degree of freedom and determined error level, the theoretical value obtained in t table – 1.96 (at α= 0.05, in ∞ degree of freedom, the theoretical t value was determined at statistical t table)

d: Based on occurrence frequency, it symbolizes the ± deviation (Karataş, 2002). At 95% probability (α= 0.05), the research population was calculated with d=0,05 deviation.

Thus, the research population was determined as follows:

n: $120.(1.96)^2.(0.60).(0.40)/(0.05)^2.120+(1.96)^2.(0.60).(0.40)$ = 91 expectant women.

Since no high level of calcium and vitamin B_{12} were determined among expectant mothers, low and normal ranges were evaluated. The BMI of samples were calculated based on their pregnancy period (Table 3) (1st trimester 0-14 weeks, 2nd trimester 15-27 weeks, 3rd trimester 28-40weeks).

RESULTS

The study focuses not only calcium and B_{12} levels but also weight gains and BMI and other personal information for evaluation of overall health of expectant mothers. The mothers ages

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varied from 17 years to 42 years and interviews were undertaken at weight gain of participants in 1st trimester is rather high whereas 2nd and 3rd trimester gain is within normal ranges. However, the BMI of mothers in final trimester is not above allowable limits (Table 1

Table 1. The suggested weight gain during pregnancy based on pre-pregnancy BMI values (Carmichael et al., 1997; Rasmussen and Yaktine, 2009).

Weight class based on height (kg/m$^{2)}$	Suggested weight gain (kg)	Suggested weight gain in 2nd and 3rd trimester (kg/week)
Underweight (BMI<19.8)	12.5-18.0	0.51
Normal (BMI 19.8-26.0)	11.5-16.0	0.42
Overweight (BMI 26.0-29.0)	7.0-11.5	0.28
Obese (BMI >29.0)	5-9	0.22

The proposed weight increase in first trimester varies from 0.5 to 2.0kg (Rasmussen & Yaktine, 2009). It is determined that the weight increases of participants are over than proposed figures in 1st trimester but for 2nd and 3rd trimester body weights were in normal range.

Based on blood analyses, obtained from Adıyaman 3rd Health Center, a negative relation between pregnancy week and amount of Ca and B_{12} were determined however there was a positive relation with increase of age and Ca and B_{12} levels. Especially the differences between pregnancy week and B_{12} level were statistically significant ($p<0.05$) (Table 2).

Table 2. Ca and B_{12} levels in relation to some properties of participants

	Ca*			B_{12}**		
	Low	Normal	p	Low	Normal	p
Age	27.1±5.3	28.0±6.2	0.46	27.2±5.9	28.3±5.7	0.36
Weight	67.6±12.2	70.1±11.9	0.32	71.5±12.9	66.4±10.4	0.04*
Pre-pregnancy BMI	24.0±4.1	24.4±4.8	0.65	25.0±4.7	23.4±4.2	0.08
Pregnancy week	20.6±10.4	17.8±11.1	0.23	21.3±10.4	16.2±10.8	0.02*

*Low 0-190, normal 191-663, high 664+ (pg/ml),

** Low 0-8.4, normal 8.4-10.5, high 10,6+ (mg/dl) (Mason, 2007).

The low Ca was common among secondary school graduates whereas low B_{12} was mostly determined at primary school graduates. Thus, the level education for this study is not negatively or positively effective on women's vitamin and mineral deficiencies.

The majority of the foods mostly cereal based are obtained from relatives living in rural areas due to the low income levels of the participants thus development of Ca and B_{12} symptoms are inevitable. Moreover, participants said in general they skip lunch due to their late breakfast habits which is the most important meal of the day in the region.

Tea, cheese, egg, olive and bread are widely consumed for breakfast while fruit, fruit juice, milk, honey, jam, grape molasses and butter consumption are quite low (Table 3). There is a linear relation between low milk consumption between low Ca and B_{12} levels at breakfast. Although cheese, generally rich in Ca and B_{12}, is said to be widely consumed, the low Ca and B_{12} deficiencies suggest insufficient amounts of consumption. Bread (wheat) consumption negatively affected participants Ca levels (Table 3).

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Table 3. Food types and distribution of participants' daily meals

	Calcium		B12	
	Low	Normal	Low	Normal
Breakfast				
Tea	15.22	16.55	20.87	15.95
Milk	6.52	12.95	5.83	8.62
Cheese	13.04	16.91	18.45	16.38
Egg	16.85	14.03	15.05	15.52
Turkish bagels, bread	17.39	6.47	14.08	14.22
Oil	7.07	7.55	4.85	5.17
Olive	15.22	17.27	12.14	15.09
Toast, sandwich	0.54	0.36	0.49	0.43
Fruit, juice	2.72	2.16	2.43	2.16
Honey, grape molasses	5.43	5.76	5.83	6.47
Lunch				
Soup, pilaf, pasta	19,67	18,99	18,71	15,29
vegetable dishes (no meat)	8,20	5,03	5,04	8,28
vegetable dishes (with meat)	6,56	7,82	7,91	7,01
Meat	4,92	5,03	5,76	4,46
Salad	12,30	17,88	18,71	13,38
Legume	7,38	5,03	4,32	7,64
Bread	18,03	16,76	17,99	17,83
pastry	4,10	3,35	4,32	3,82
Pudding	0,82	0,56	0,72	0,64
Milk, yogurt	9,84	9,50	9,35	11,46
Fruit	8,20	10,06	7,19	10,19
Dinner				
Soup, pilaf, pasta	11,43	13,22	16,50	13,37
Meatless vegetables dish	8,57	7,93	6,80	9,41
Meat and vegetable dishes	10,86	8,37	8,74	8,91
Meat	6,29	5,73	5,83	5,45
Salad	16,00	15,86	16,02	16,34
Legume	11,43	9,25	10,68	9,90
Bread	16,00	18,94	18,45	16,83
pastry	3,43	2,64	2,43	2,48
Pudding	1,71	0,88	1,46	0,99
Milk, yogurt	5,71	6,61	5,83	5,94
Fruit	8,57	10,57	7,28	10,40

*Low 0-190, normal 191-663, high 664+ (pg/ml),

** Low 0-8.4, normal 8.4-10.5, high 10,6+ (mg/dl) (Mason, 2007).

Table 4. The Energy and Food Intake of Pregnant and Daily Requirement Ranges

	Pregnant Woman								
	Calcium				Vitamin B12				
	Low	Meeting the Requirements (%)	Normal	Meeting the Requirements (%)	Low	Meeting the Requirements (%)	Normal	Meeting the Requirements (%)	Reference value of pregnant women
Energy (calories)	2207.0±374.6	91.9	2190.6±376.7	91.3	2108.2±369.6	87.8	2276.7±363.2	94.9	2400
Protein (g / day)	74.8±21.5	83.1-124,7	72.5±16.1	80.5-120.8	72.8±20.2	80.9-121.3	74.1±16.7	82.3-123.5	60-90
Carbohydrate (g/day)	343.7±126.9	95.4-104.1	378.6±142.6	105.2-114.7	334.1±125.7	92.8-101.2	392.3±142.1	108.9-118.9	330-360
Fat (g / day)	69.1±31.3	86.4-104.7	76.8±38.2	96.0-116.4	69.6±29.3	87.0-88.6	77.5±40.4	96.9-117.4	66-80
Calcium (mg)	997.4±249.3	76.7	1000.2±245.6	76.9	985.0±264.1	75.8	1011.6±230.2	77.8	1300
Magnesium (mg)	239.4±74.3	68.3	267.3±96.9	76.4	253.9±84.8	72.5	258.4±93.9	73.8	350
Phosphorus (mg)	1058.4±291.1	151.2	1065.3±262.2	152.2	1056.7±193.7	150.9	1067.9±254.9	152.5	700
Iron (mg)	14.5±4.1	53.7	15.0±4.4	55.6	14.4±4.2	53.3	15.1±4.4	55.9	27
Zinc (mg)	7.6±2.1	50.7	8.0±2.1	53.3	7.8±2.1	52.0	7.9±2.1	52.7	15
Vitamin A (IU)	5214.1±3398.2	67.7	6679.6±4372.0	86.7	5786.9±4065.1	75.2	6380.2±4076.9	82.9	7700
Vitamin D (IU)	184.7±2.9	46.2	142.7±2.51	35.7	168.6±2.7	42.2	151.0±2.6	37.8	400
Thiamine (mg)	2.7±1.0	192,8	2.5±0.7	178.6	2.4±0.9	171.4	2.6±0.7	185.7	1.4
Riboflavin (mg)	1.9±0.5	135.7	1.9±0.4	135.7	1.8±0.5	128.6	2.0+0.4	142.9	1.4
Vitamin B_6 (mcg)	1055.6±0.5	55.6	1150±0.5	60.5	1093.0±0.6	57.5	1131.2±0.5	59.5	1900
Vitamin B_{12} (mcg)	2.1±1.1	80.8	2.4±1.3	92.3	1.9±1.1	73.0	2.2±1.2	84.6	2.6
Folic acid (mcg)	460.4±144.5	76.7	466.3±109.1	77.7	437.8±133.3	73.0	487.4±110.4	81.2	600
Vitamin C (mg)	65.8±54.5	73.1	64.0±56.0	71.1	61.3±56.6	68.1	67.7±54.1	75.2	90
Pulp (g)	26.9±9.1	96.1	29.3±10.4	104.6	27.5±10.0	98.2	29.1±9.8	103.9	28

*Low 0-190, normal 191-663, high 664+ (pg/ml),
** Low 0-8.4, normal 8.4-10.5, high 10,6+ (mg/dl) (Mason, 2007).

Participants' food types for lunch and dinner is somewhat some and quite limited which also induces low intake of Ca and B_{12}. They mainly consume cereal based bread, pasta, soup, cracked wheat pilaf (bulgur) whereas yogurt, fruit, milk products, meat and vegetable rich in nutrients not sufficiently consumed (Table 4) which may be attributed to low income and traditional food types. This type of food consumption, quite common within Turkey (Çakmak et al., 1999), can also create deficiencies in pregnant women zinc, iron and vitamin D levels.

The nutrition habits of pregnant women in the study area provided sufficient energy, protein, carbohydrate fat and fiber. The high cereal based food consumption led to excess levels of thiamine, riboflavin and phosphorous (Table 4). The high P level in the study area is not related to meat and milk products but to cereals which was also suggested by Ravidran et al., (1994) in their study in Sri Lanka. The excess thiamine or riboflavin may cause high fluid retention or edema and hypersensitivity in body (Fukuwatari et al., 2009). The low amounts of B6, Vitamin A, C, D and Mg, which is not surveyed in this study, also suggest improper diet of pregnant women in the region. For example low meat, legumes and vegetables consumption, which is also, determined in the study (Table 4) causes B_6 deficiencies (Mason, 2007). The lowest nutrient determined among women is vitamin D which is insufficient consumption of marine and milk food products as well as low outdoor activities of expectant mothers' women along with traditional covered outfit for protecting from harsh sun light.

DISCUSSION

Sufficient vitamin and mineral uptake during pregnancy is indispensable for mothers' health and healthy development of fetus. At insufficient nutrition fetus meet required vitamin and minerals by drawing from mothers bones (Avendaño-Badillo et al., 2009) which causes decrease of mothers' bone and tooth strength which was a common phenomenon among expectant mothers in our study (Ergür et al., 2009). And for meeting body vitamin and mineral loss women tend to consume more energy bearing carbohydrates and fats that both have negative effect on BMI. Thus, the weight increases of participants are over than proposed figures which were suggested from 0.5 to 2.0kg in 1st trimester by Rasmussen and Yaktine, 2009). However, the weight increases for 2nd and 3rd trimester were in normal ranges.

The weight increase along with low Ca and B_{12} are most probably due to cereal based and low diversity food nutrition of participants. The low diversity of food consumption in general led to deficiencies in vitamin and mineral levels of humans (Mason, 2007). Particularly low Ca levels yielded softening of bones and tooth decays (Avendaño-Badillo et al., 2009). The high carbohydrate containing food consumption in the study sites are attributed to two factors: traditional eating attitudes and the low socioeconomic status of rural women, both causing increasing prevalence of overweight/obesity (Sabbag, 2012).

Aside low B_{12} and Ca, the thiamine, riboflavin and phosphorous levels of participants are above daily required levels. The said nutrition elements are crucial for body health but excess levels cause serious health disorders alike high fluid retention or edema and hypersensitivity (Fukuwatari et al, 2009). The low level of B6, vitamin A, D, C, magnesium, zinc and iron of participants, obtained from Adıyaman 3rd Health Center database, are all indicating improper nutrition which are generally related to low animal food consumption (USDA, 2011). Although B6 deficiency is not common in the world, the low diversity food consumption may yield B6 insufficiency which is also determined in the study site. The deficient amounts of said nutrients also lowered absorption of B_{12} vitamin (FAO/WHO, 2002).

The low level of education generally accused for improper nutrition at several studies (Bukke and Lavik, 2012) ie the balanced nutrition is achieved mainly among educated people is not

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the case in Adıyaman region since low Ca level is more common among secondary school graduates than primary school graduates. So, this may suggest insufficient nutrition information programs in high schools in the region.

CONCLUSION

Nutrition is an indispensable building stone for establishing a healthy society. Since human life starts with pregnancy a sufficient and balanced nutrition program or nutrition management is needed from the first day of pregnancy. By employing nutrient management, health problems which need time and high expenses for recovery of mother and baby rooted in improper nutrition would be prevented. The negative effect of current cereal based nutrition habits due to traditional customs and socio-economics for relatively less developed part of Turkey are outlined in the study. For meeting expectant mothers' nutrition demands for providing low Ca and B_{12} alternative foods widely grown can be solution alike using olive oil and purslane instead of fish for omega source. Unfortunately, changing traditional nutrition habits in general takes time, thus for increasing mother's low Ca and B_{12} level medical support can be better solution for the time being. But for the long run, family's awareness and knowledge should be enhanced via several tools such as visual media and on site trainings.

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