

**DIETARY INTAKE OF COBALAMIN AND THIAMINE IN PREGNANT WOMEN  
FROM VALE DO JEQUITINHONHA, MINAS GERAIS**

**INGESTÃO DIETÉTICA DE COBALAMINA E TIAMINA EM GESTANTES DO  
VALE DO JEQUITINHONHA, MINAS GERAIS**

**INGESTA DIETÉTICA DE COBALAMINA Y TIAMINA EN MUJERES  
EMBARAZADAS DE VALE DO JEQUITINHONHA, MINAS GERAIS**

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**ABSTRACT:** The nutritional status of pregnant women, through the consumption of vitamins B12 and B6, directly influences the health and mortality of the fetus. In this sense, the objective was to study the prevalence of consumption of these micronutrients in the diet of pregnant women in Vale do Jequitinhonha, Minas Gerais. The research was carried out in a sample of 492 pregnant women assisted in maternity hospitals in 15 municipalities in Vale do Jequitinhonha. The prevalence of insufficient intake (AI) of vitamin B12 and vitamin B6 was found in 42 pregnant women (8.6%) and 66 pregnant women (13.5%), respectively. The maximum tolerated level of vitamin B6 (UL) was found above the reference value in 81 pregnant women (16.5%). A more intense nutritional education program during the prenatal and postpartum period is essential.

**KEYWORDS:** Cobalamin. Thiamine. Pregnant. Nutrition.

**RESUMO:** O estado nutricional da gestante, mediante consumo das vitaminas B12 e B6, influencia diretamente na saúde e na mortalidade do feto. Nesse sentido, objetivou-se estudar a prevalência do consumo desses micronutrientes na alimentação por gestantes do Vale do Jequitinhonha - MG. A pesquisa foi realizada em uma amostra de 492 gestantes atendidas em maternidades de 15 municípios do Vale do Jequitinhonha. A prevalência de ingestão insuficiente (AI) da vitamina B12 e da vitamina B6 foi verificada em 42 gestantes (8,6%) e em 66 gestantes (13,5%), respectivamente. O nível máximo tolerado de vitamina B6 (UL) foi encontrado acima do valor de referência em 81 gestantes (16,5%). Identifica-se fundamental um programa de educação nutricional mais intenso durante o pré-natal e o pós-parto.

**PALAVRAS-CHAVE:** Cobalamina. Tiamina. Gestante. Nutrição.

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**RESUMEN:** El estado nutricional de la mujer embarazada, a través del consumo de vitaminas B12 y B6, influye directamente en la salud y mortalidad del feto. En este sentido, el objetivo fue estudiar la prevalencia del consumo de estos micronutrientes en la dieta de las mujeres embarazadas en Vale do Jequitinhonha, Minas Gerais. La investigación se llevó a cabo en una muestra de 492 mujeres embarazadas atendidas en hospitales de maternidad en 15 municipios de Vale do Jequitinhonha. La prevalencia de ingesta insuficiente (AI) de vitamina B12 y vitamina B6 se encontró en 42 mujeres embarazadas (8,6%) y 66 mujeres embarazadas (13,5%), respectivamente. El nivel máximo tolerado de vitamina B6 (UL) se encontró por encima del valor de referencia en 81 mujeres embarazadas (16,5%). Es esencial un programa de educación nutricional más intenso durante el período prenatal y posparto.

**PALABRAS CLAVE:** Cobalamina. Tiamina. Embarazada. Nutrición.

## Introduction

To Gomes *et al.* (2019), the study of eating habits during pregnancy is of fundamental importance at this stage of the life cycle, since it is related to the health of the mother and fetus that is being generated. Thus, nutritional monitoring can be seen as a positive factor in health promotion, avoiding morbidity and mortality of pregnant women, with improvement of outcomes in maternal and child health and postpartum, promoting a good prognosis in the first years of life in the health of children and for women.

According to Werutsky *et al.* (2008), pregnancy is a period of greater nutritional need in the life cycle of women, since physiological adjustments occur in pregnant women and in nutrient demands for fetal growth, such as rapid cell division and development of new tissues and organs. Pregnant women who presented inadequate nutrient reserve, together with insufficient dietary intake of vitamins, may have an impairment of fetal growth and, consequently, reduction of the fetus's birth weight.

To Paniz *et al.* (2005), vitamin B12 or cyanocobalamin participate in a family of compounds generically called cobalamins, as it is a water-soluble vitamin, synthesized exclusively by microorganisms, in which it is found in most animal tissues and touched in the hepatic system in the form of adenosycobalamin. The natural source of vitamin B12 in the human diet is restricted to foods of animal origin, such as milk, meat and eggs.

To Painz *et al.* (2005), vitamin B12 is released by the digestion of proteins of animal origin, being absorbed by, in Portuguese, haptocorrina (transcobalamin), an R protein produced in saliva and stomach, being fundamental for it to be subsequently degraded by pancreatic proteases with consequent transfer of the molecule of vitamin B12 to an intrinsic gastric factor (FI), a glycoprotein of 44kDa produced by the parietal cells of the stomach. The

binding of vitamin B12 to FI forms in the mucosa a complex that must resist the proteolytic enzymes of intestinal light and which subsequently is attached to specific receptors of the epithelial cells of the terminal ileum, in which vitamin B12 is absorbed and bound to a plasma transporter and released into the bloodstream.

According to Silva (2018), biological markers for the diagnosis of vitamin B12 deficiency include reduced circulating concentrations of plasma B12, increased homocysteine, methylmalony-Coa levels. In this sense, to obtain effective doses in the pregnancy of vitamin B12 it is necessary that the pregnant woman has a diet rich in meat, eggs and milk. However, during pregnancy, vitamin B12 concentrations decrease significantly, since in the third trimester plasma vitamin concentrations may reach minimal concentrations causing vitamin B12 deficiency. This reduction occurs due to gestational physiological hemodilution, increased glomerular filtration, increased fetal and maternal demands, and changes in vitamin-binding proteins.

According to Refsum (2001), vitamin B12 deficiency leads to pernicious or megaloblastic anemia, which can cause neurological signs and symptoms related to signs of anemia, such as memory loss, paraesthesias, decreased sensitivity in the lower limbs and, in advanced cases, spinal cord demyelination.

To Maihara *et al.* (2006), pyridoxine, known as vitamin B6, is part of the B complex, being necessary for brain function and red cell formation, involved in immune function and hormonal activity of the human body. Sources of B6 vitamins are found in liver, poultry, fish, nuts and fruits, and lack of this can cause noticeable symptoms such as skin, tongue and mouth sores, nausea, nervousness and convulsions.

According to Futterleib and Cherubini (2005), pyridoxine and cobalamin deficiency can cause hyperhomocysteinemia, in which the baby is born with hereditary disease and may develop the classic homocysteinuria syndrome, including premature vascular disease and thrombosis, intellectual disability and skeletal abnormalities.

For the Ministry of Health (2002), in terms of neonatal development, in dietary planning, the pregnant woman should receive nutritional guidance according to age, nutritional status, pregnancy symptoms, physical activity and associated pathologies. In this sense, it is necessary to intake recommended daily vitamin B12 for pregnant women, which is 2.6 µg, and vitamin B6, which is 1.9 mg, through parameters of the Ministry of Health (2002)

Besides, Melo *et al.* (2007) state that early nutritional diagnosis, especially in the prenatal period, is necessary for the promotion of actions that contribute to better nutritional results, ensuring a good health status for the mother and baby.

Considering that the balanced diet is extremely relevant both in the restriction and the excess of certain nutrients in the gestational period can interfere in the growth and development of the fetus, the present work aims to estimate the intake of vitamin B6 and B12 by pregnant women from the Vale do Jequitinhonha - MG, one of the poorest regions of Brazil.

## Methodology

The scenario studied was the Vale do Jequitinhonha, a region that occupies 14.5% of the area of the State of Minas Gerais, totaling approximately 85.000 km<sup>2</sup> of territorial extension located geographically in the Northeast of Minas Gerais, bordering the Mucuri and the North of Minas Gerais. According to research by the Hospital Information System of the Unified Health System (SIH/SUS) of the Ministry of Health conducted in 2010, the Vale do Jequitinhonha has 80 municipalities and of these, twenty-nine have a record of delivery.

The sampling for primary data collection was obtained contemplating as universe of the research the total number of deliveries in the Vale do Jequitinhonha - MG. In 2010, approximately 12,500 deliveries occurred, which consequently represented the number of pregnant women in this macro-region, according to surveys available in DATASUS - Tabnet.

The field investigation was carried out in the maternity hospitals of 15 selected municipalities with a rate of deliveries higher than one per day or 30 deliveries per month and which perform 78% of deliveries in the region. In addition, two to three health units were selected for each municipality in which the research was conducted.

A standardized semi-quantitative food frequency questionnaire was applied to quantify vitamins B12 and B6 among pregnant women. This questionnaire was established as a standard, tested in advance by pilot study mediation, completed during interviews and after obtaining the consent of women for data collection.

To analyze vitamin B12 and B6 intake, the *Recommended Dietary Allowances* (RDA) was consulted, which indicates that the recommended daily vitamin B12 intake is approximately 2.6 micrograms (µg). Regarding vitamin B6, the RDA states that adequate daily intake for pregnant women is approximately 1.9 mg per day.

According to Padovani *et al.* (2006), it is not possible to establish the UL value (upper limit of higher intake of a nutrient) for vitamin B12. However, in this study, the UL value for vitamin B6 was 80 mg for pregnant women under 18 years of age and 100 mg for pregnant women between 19 and 50 years of age.

The interviewers were instructed to apply the questionnaires, accompanied by a researcher more experienced in field research, through quantitative methodological analysis. Thus, a sociodemographic questionnaire was also applied with the following variables: skin color (self-reported); the marital status of the woman (with a partner and without a partner); family income (in Reais); participation in the Bolsa Família Program; schooling (in years); and age (in full years) of the mother.

In addition, there was research of a variable of conduct: whether the pregnancy was planned (yes or no), teenage pregnancy (yes to children under 18 years old), number of pregnancies. In addition to the prenatal variables, they consist of the same (yes or no), number of consultations and place of occurrence and whether the pregnant woman received nutritional guidance during this period, if positive, by whom such orientations, reason and period of the same were performed. The inclusion criterion for the research among the pregnant women was that they should be in the third trimester of pregnancy at the time of the questionnaire application, and must consent to participate in the research and live in one of the eighty municipalities of Vale do Jequitinhonha and the signing of the Free and Informed Consent Term was requested.

The data of the questionnaire were entered in Excel and later transferred to Epiinfo (2007) for statistical analysis. In the case of discrete variables, such as age and dietary intake, means, medians and standard deviation were calculated. When necessary, the comparison of means was performed by the ANOVA test using Origin 6.0 program (Microcal Software Inc.). For categorical variables, frequencies, standard deviation, Confidence Intervals (95%) and, for the association tests when appropriate, the Prevalence Ratio (PR) were calculated, considering the 95% Confidence Limit.

Among the foods present in the Semi-quantitative Food Frequency questionnaire, 57 of them have vitamin B12 in their composition and 130 have vitamin B6. Thus, in the analysis of vitamin B12 concentration in the diet, 87 foods were excluded because they did not contain cobalamin and 14 were excluded because they did not contain pyridoxine.

The research project was evaluated and approved by the Research Ethics Committee of the State University of Montes Claros via Plataforma Brasil, under a substantiated opinion no. 2,890,870/2018.

## Results

A total of 492 interviews were conducted with pregnant women who were in the last trimester of pregnancy and who were prenatal in the Basic Health Units studied, belonging to the Unified Health System (SUS) of 15 municipalities in the Vale do Jequitinhonha - MG. In this sense, it is observed that the family income of pregnant women was up to one minimum wage (66.7%), with an overall average of 1.44 minimum wages. There was a proportion of 45.7% of pregnant women who participated in the income transfer program "Bolsa Família" of the Brazilian Federal Government for, on average, 3.7 years.

It can be observed that the mean age of the pregnant women included in the study was 25.3 years (SD= 6.2 years), since the minimum age was 13 years and the maximum was 43 years. Thus, the prevalence of ethnicity was brown or black (78.5%) and the majority lived with a partner (72.3%). Among the interviewees, 39.8% were in the first pregnancy and 66.1% had had up to six prenatal consultations.

Approximately 40.0% of the pregnant women (n=195) received food guidance from health professionals, in order to provide a better quality of life for the pregnant woman and the baby, and 150 of them (76.3%) were during pregnancy. The objective of most pregnant women (80.0%) was to have a healthy pregnancy. However, the others pointed out that this orientation occurred due to reduction (6.7%) or weight gain (7.7%) or other reasons (4.6%) and two pregnant women did not know how to answer the question (1.0%).

In addition, it was observed that most pregnant women (92.7%) did not smoke before pregnancy and 473 pregnant women (96.1%) did not smoke as pregnant women. For alcohol consumption (alcohol consumption), it was observed that 74.3% did not drink alcoholic beverages before pregnancy, and this proportion increased to 96.5% during pregnancy.

According to the data obtained in the Food Frequency questionnaire, the prevalence of vitamin B12 intake is insufficient (AI<2.6 mcg) and was verified in 42 pregnant women (8.6%). Vitamin B6 insufficiency was present in 66 pregnant women (13.5%). Therefore, the maximum tolerated level of vitamin B6 (UL), up to 80 mg of daily vitamin B6 intake for pregnant women under 18 years of age and 100 mg for pregnant women aged 19 to 50 years, was found above the reference value in 81 pregnant women (16.5%) (Table 1).

**Table 1** - Characteristics of pregnant women assisted by the Unified Health System, included in the sample. Vale do Jequitinhonha, Brazil, 2013.

Characteristic	Category	Number of pregnant women	Percentage %
Age <sup>a</sup> (years)	10 – 19	100	20,3
	20 – 34	346	70,3
	35 – 45	43	8,8
	Did not answer	3	0,6
Ethnicity <sup>a</sup> (self-declared)	Yellow	19	3,9
	White	86	17,5
	Black or brown	387	78,6
Civil State <sup>a</sup>	With mate	356	72,3
	No mate	136	27,6
	Did not respond	1	0,3
Schooling <sup>a</sup>	Fundamental	161	32,7
	High School	294	59,7
	Superior	33	6,7
	Did not respond	4	0,8
Family income <sup>a</sup>	Up to one minimum wage	328	66,7
	More than the minimum wage	164	33,3
Bolsa Família <sup>a</sup>	Yes	225	45,7
	No	267	54,3
Number of pregnancies <sup>a</sup>	One	196	39,8
	Two	147	29,9
	Three	89	18,1
	Over three	60	12,2
Number of Prenatal queries <sup>a</sup>	Less than six	325	66,1
	Six or more	167	33,9
Pregnancy planning <sup>a</sup>	Yes it was planned	210	42,7
	It wasn't planned	279	56,7
	Did not respond	3	0,6
Received food guidance during pregnancy <sup>a</sup>	Yes	195	39,6
	No	297	60,4
Smoking before pregnancy <sup>a</sup>	Yes	36	7,3
	No	456	92,7

Smoking during pregnancy <sup>a</sup>	Yes	19	3,9
	No	473	96,1
Vit consumption. B12 (total) (total			
(total (total( total (	enough	450	91,4
((total)	insufficient	42	8,6
Vit consumption. B6 (total)			
	enough	426	86,5
	insufficient	66	13,5
Vit consumption. B6 >UL			
	above UL	81	16,5

Source: Search data. Prepared by the authors

<sup>a</sup> Sample size N= 492 <sup>b</sup> Sample size N= 440

There are multiple origins of vitamin B12 and B6 insufficiency, since the socioeconomic and pregnancy factors found in the study that correlate to insufficient vitamin B12 intake were: only three meals per day (PR=1.9) and six or more prenatal consultations (PR=1.9). The consumption of up to three meals per day is also related to insufficient vitamin B6 intake (Table 2 and 3).

**Table 2** - Prevalence of insufficient vitamin B12 intake according to economic and gestational characteristics. Vale do Jequitinhonha, 2013.

Characteristic	Vitamin B12 intake (µg/day)					
	UL	Characteristic	UL	Characteristic	UL	Characteristic
Household income						
Up to one minimum wage	ND	26	302	7,92%	1	
More than one minimum wage	ND	15	149	9,14%	1,2	0,6-2,1
Participation in Bolsa Família						
Yes	ND	15	210	6,66%	1	
No	ND	28	239	10,48%	1,6	0,9-2,9
Maternal age						
10-19 years old	ND	8	92	8%	1	



20-34 years old	ND	37	309	10,69%	1,3	0,6-2,8
35-45 years old	ND	6	37	13,95%	1,7	0,6-4,7
<b>Ethnicity</b>						
White	ND	4	82	4,65%	1	
Black/ Brown	ND	35	352	9,04%	1,9	0,7-5,3
Yellow	ND	2	17	10,52%	2,3	0,4-11,5
<b>Marital status</b>						
With mate	ND	35	321	9,83%	1,2	0,6-2,3
No mate	ND	11	125	8,08%	1	
<b>Schooling</b>						
Fundamental	ND	15	146	9,31%	1,2	0,6-2,3
High School	ND	22	272	7,5%	1	
Superior	ND	4	29	12,12%	1,6	0,6-4,4
<b>Pregnancy planning</b>						
Unplanned	ND	22	257	7,88%	1	
Planned	ND	20	190	9,52%	1,2	0,7-2,2
<b>Number of pregnancies</b>						
One	ND	20	176	10,20%	1,4	0,8-2,5
More than one	ND	22	274	7,43%	1	
<b>Number of prenatal consultations</b>						
Less than six	ND	21	304	6,46%	1	
Equal to or greater than six	ND	21	146	12,57%	1,9	1,1-3,4
<b>Number of meals per day</b>						
Up to three	ND	18	120	13,03%	1,9	1,1-3,4
More than three	ND	24	329	6,79%	1	

Source: Research data - Prepared by the authors

**Table 3** - Prevalence of insufficient vitamin B6 intake according to economic and gestational characteristics. Vale do Jequitinhonha, 2013.

Characteristic	Vitamin B6 intake (mg/day)		Insufficient consumption	RP	IC 95%
	AI<1.9mg	AI>1.9mg			
Household income					
Up to one minimum wage	43	285	13,10%	1	
More than one minimum wage	22	142	13,41%	1	0,6-1,7
Participation in Bolsa Família					
Yes	31	194	13,77%	1,1	0,7-1,7
No	34	233	12,73%	1	
Maternal age					
10-19 years old	12	88	12%	1	
20-34 years old	42	304	12,13%	1	0,6-1,8
35-45 years old	8	35	18,6%	1,6	0,7-3,5
Ethnicity					
White	7	79	8,13%	1	
Black/ Brown	53	334	13,69%	1,7	0,8-3,6
Yellow	4	15	21,05%	2,6	0,8-7,9
Marital status					
With mate	45	311	12,64%	1	
No mate	21	115	15,44%	1,2	0,8-1,9
Schooling					
Fundamental	28	133	17,39%	1,9	0,6-5,9
High School	32	262	10,88%	1,2	0,4-3,7
Superior	3	30	9,09%	1	
Pregnancy planning					

Unplanned	39	240	13,97%	1,3	0,8-2,2
Planned	22	188	10,47%	1	
Number of pregnancies					
One	30	166	15,30%	1,3	0,8-2,1
More than one	34	262	11,48%	1	
Number of prenatal consultations					
Less than six	41	284	12,61%	1	
Equal to or greater than six	28	139	16,76%	1,3	0,9-2,1
Number of meals per day					
Up to three	25	113	18,11%	1,6	1,1-2,6
More than three	39	314	11,04%	1	

Source: Research data - Prepared by the authors

It can be observed that vitamin B6 intake above the tolerable limit was recorded in pregnant women who have more than one minimum wage (PR=2.1), pregnant women who are aged 20-34 years (PR=1.8), pregnant black/brown (PR=4) and yellow ethnic groups (PR=4.5), pregnant women who did not have planned pregnancy (PR=1.5) and pregnant women who consume more than three meals per day (PR=2.5) (Table 4).

**Table 4** - Prevalence of consumption in relation to what is tolerable (UL) of vitamin B6 according to economic and gestational characteristics. Vale do Jequitinhonha, 2013.

Characteristic	Vitamin B6 intake (mg/day)				
	UL<80mg up to 18 years <100mg from 19 to 44 years	UL>80mg up to 18 years <100mg from 19 to 44 years	Insufficient consumption	RP	IC 95%

**Household income**

Up to one minimum wage	289	39	17,72%	1	
More than one minimum wage	123	41	15,70%	2,1	1,4-3,1

**Participation in Bolsa Família**

Yes	186	39	17,88%	1,3	0,8-1,9
No	231	36	13,48%	1	

**Maternal age**

10-19 years old	90	10	10%	1	
20-34 years old	283	63	16,53%	1,8	1,0-3,4
35-45 years old	35	8	19,51%	1,9	0,8-4,4

**Ethnicity**

White	82	4	4,70%	1	
Black/ Brown	314	73	18,91%	4	1,5-10,8
Yellow	15	4	21,05%	4,5	1,2-16,5

**Marital status**

With mate	305	51	13,74%	1	
No mate	112	24	21,62%	1,2	0,8-1,9

**Schooling**

Fundamental	129	32	53,33%	1,3	0,9-2,0
High School	250	44	15,01%	1	
Superior	28	5	15,15%	1	0,4-2,4

**Pregnancy planning**

Unplanned	225	54	19,42%	1,5	1,0-2,3
Planned	183	27	12,85%	1	

**Number of pregnancies**

One	167	29	14,79%	1	
More than one	244	52	17,62%	1,2	0,8-1,8

**Number of prenatal**

<b>consultations</b>					
Less than six	267	58	17,90%	1,3	0,8-2,0
Equal to or greater than six	144	23	13,77%	1	
<b>Number of meals per day</b>					
Up to three	127	11	7,97%	1	
More than three	283	70	19,83%	2,5	1,4-4,6

Source: Research data - Prepared by the authors

## Discussion

According to Cardoso Filho *et al.* (2019), water-soluble vitamins such as B6 and B12 play a major role, since it is fundamental for human development. In this sense, the prevalence of vitamin B12 intake found in this study was 8.6% among pregnant women and vitamin B6 was among 13.5% of pregnant women. In pregnancy, the deficiency of the vitamins cited may associate deterioration of the intellectual capacity of the newborn in low doses, and in high doses can cause severe neural damage and serious side effects.

According to Cardoso Filho *et al.* (2019), the deficient intake of vitamins B12 and B6 could be attributed to the dietary characteristics of the population studied, since the association between few meals per day with nutritional deficiency was recorded in the study. Therefore, it is important to emphasize that these vitamins are found in several foods, for example: fish, meat, eggs, cheese and milk, and are dissolved in water. Therefore, storage in the body is one of the main characteristics of these vitamins.

To Santos *et al.* (2006), during pregnancy, the presence of nutritional alterations such as parasitosis infections, hemopathies (anemias), hypertensive syndromes, placental insufficiency and obesity should be evaluated. These changes may cause greater chances of hemorrhage during childbirth and puerperal infection, as well as may give birth to premature newborns with restricted intrauterine growth (IU), which present greater possibilities of neonatal infections, respiratory infections and increase the statistic of perinatal deaths.

On the other hand, in this study, 17.62% of pregnant women who eat more than three meals per day exceeded the upper limit of higher vitamin B6 intake. For Boog (1999), it is a fact that women when pregnant increase and include foods in their usual diet and/or modify their eating habits, both because of the increased appetite inherent in the biological changes of their body and because of concern about the fact that they are pregnant and the birth of a healthy baby. In this study, insufficient intake of vitamin B12 was found in pregnant women who had six or more prenatal visits during pregnancy. These data suggest that changes in

nutritional status point to deficiencies in the content and quality of prenatal care, despite the amount of these consultations.

Thus, Aquino and Philippi (2002) affirm that prenatal care is of fundamental importance from the qualitative point of view that presupposes the performance of health professionals prepared to assess the nutritional status of pregnant women early. In this sense, when performing individualized nutritional guidance, the optimization of maternal nutritional status is aimed at. However, it should not be forgotten that the guidelines on healthy eating should be offered according to the economic, social and cultural possibilities of each patient.

When comparing with the data of the study conducted by Santos *et al.* (2006), with pregnant women from the municipality of Ribeirão Preto, the results reveal that pregnant women, at various times, were not given dietary guidelines that say little about a healthy, complete and varied diet and, in others, do not receive any type of nutritional guidance in prenatal care. However, studies show that when pregnant women receive guidance on nutrition, consequently there is an improvement in nutritional status, both pregnant women with weight below or above the recommended. That is, the dietary alteration is related to knowledge about nutrition.

In this study, it was observed that pregnant women with a family income higher than one minimum wage exceeded the upper limit of higher vitamin B6 intake. In general, Lacerda (2007) comments that, as per capita income increases, the degree of sophistication in food consumption increases, opting for the most elaborate ones.

To Kac *et al.* (2004), the study conducted in the city of São Paulo infers that the registration of monthly food purchases made it possible to evaluate the influence that family income and food prices had on the diet of families, and that the total calories acquired by the family increased with the increase in family income. Thus, it is observed that the higher family income is related to the possibility of higher food intake and, consequently, greater food supply of micronutrients found in food.

This study showed that pregnant women between 20 and 34 years of age exceeded the upper limit of higher vitamin B6 intake. The data suggest that pregnant women in adulthood have a greater concern with nutritional quality, while eating habits in the vast majority of adolescents tend to be irregular, since they choose more attractive foods, available, practical and cheap, with little concern to perform a healthy diet.

According to Gipson, Koenig and Hindin (2008), pregnant women with black/brown and yellow ethnicities exceeded the upper limit of higher vitamin B6 intake, compared to the research conducted in the city of Rio de Janeiro. The study revealed a series of nutritional

inadequacies during pregnancy and postpartum, with differences according to skin color. In addition, it demonstrated interaction between schooling and skin color for the following variables: consumption of fats and sugar during pregnancy and consumption of cereals, meats, fruits and alcoholic beverages during the postpartum period.

According to Kac *et al.* (2004), it is plausible to assume that black and brown women have higher energy consumption than white women during pregnancy and postpartum, and may also lead to greater weight gain in pregnancy and, consequently, higher rates of postpartum weight retention. Thus, the relationship between ethnicity and high vitamin B6 intake in pregnant women with black/brown ethnicity is demonstrated, possibly due to the lifestyle habits of these management so far, linked to food, especially hypercaloric. This study showed that pregnant women who had their pregnancy in an unplanned manner exceeded the upper limit of higher vitamin B12 and B6 intake.

## Conclusion

The present study allowed the knowledge of the prevalence of inadequate intake of serum levels of vitamin B12 and vitamin B6 and the upper limit of higher vitamin B6 intake among pregnant women in the Vale do Jequitinhonha - MG. The prevalence showed that socioeconomic and pregnancy factors are directly related to gestational nutrition, and these alterations can have repercussions for the health of the fetus. Therefore, a more intense nutritional education program during prenatal and postpartum, which takes into account the economic and social factors of life of patients are fundamental to change the dietary pattern of pregnant women and provide a good quality of health for the mother and baby.

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