Nutrition xxx (2012) 1–6

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

Nutritional status and food intake in patients with systemic lupus erythematosus

Mariane Curado Borges R.D., M.Sc. [a,*], Fabiana de Miranda Moura dos Santos M.D., M.Sc. [b], Rosa Weiss Telles M.D., Ph.D. [b], Cristina Costa Duarte Lanna M.D., Ph.D. [b,c], Maria Isabel T.D. Correia M.D., Ph.D. [d]

[a] School of Medicine, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[b] Rheumatology Service, Hospital das Clínicas, Department of Locomotor System, School of Medicine, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[c] Department of Locomotor System, School of Medicine, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[d] Department of Surgery, School of Medicine, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil

ARTICLE INFO

Article history:
Received 14 December 2011
Accepted 18 January 2012

Keywords:
Systemic lupus erythematosus
Nutritional status
Food intake
Nutrition
Excess weight

ABSTRACT

Objective: Systemic inflammation, therapy with corticosteroids, and reduced physical activity may increase the predisposition to accumulate body fat in patients with systemic lupus erythematosus (SLE). The aim of this study was to assess the nutritional status and food intake of patients with SLE.

Methods: One hundred seventy women with SLE were evaluated consecutively in a cross-sectional study. Nutritional status was assessed by subjective global assessment and body mass index. Food intake was assessed by a 24-h recall and a semiquantitative food frequency questionnaire. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), considering $P < 0.05$ as significant.

Results: The mean ± SD age of the patients was 39.14 ± 9.98 y, and the duration of the disease was 9.94 ± 6.18 y. Approximately 91.8% patients were classified as being well nourished; 6.5% were classified as suspected or moderately malnourished, and 1.8% were classified as severely malnourished. In terms of body mass index, malnutrition was found in 1.2% of the patients, normal weight in 35.9%, overweight in 35.3%, and obesity in 27.7%. Most patients reported food consumption below the estimated needs for energy. Calcium was the nutrient with the most inadequate intake. Low consumption of fruits, vegetables, and dairy products and a high consumption of oils and fats were reported.

Conclusion: The results showed that patients with SLE have inadequate nutritional status and food intake.

Introduction

Systemic lupus erythematosus (SLE) is a chronic systemic disease of unknown etiology, which is characterized by immunologically mediated injury in multiple body systems. The disease affects women during their reproductive years and its pathogenesis is a combination of genetic, environmental, and hormonal factors that lead to loss of balance control of cellular immunoregulation [1].

The objectives of treatment of SLE are to control the signs and symptoms, disease remission, and the prevention of damage caused by drugs and disease activity as well as relief of symptoms, suppression of certain presymptomatic changes, and long-term prevention. Among the drugs commonly used to treat SLE are non-steroidal antiinflammatory agents, steroids, and antimalarial drugs, in addition to the intravenous administration of cytotoxic drugs [1,2].

Systemic inflammation therapy with corticosteroids and reduced physical activity may increase the predisposition to body fat accumulation and development of coronary heart disease in patients with SLE [3–6]. Moreover, these patients are at a high risk of developing low bone mineral density, anemia, high plasma levels of homocysteine, and other risk factors for cardiovascular disease [7].

Maria Isabel T.D. Correia, M.D., Ph.D. is recipient of a research grant from the National Scientific and Technological Development Council (CNPq).

* Corresponding author. Tel.: +55 3188136267; fax: +55 3188136267.
E-mail address: maricurado@gmail.com (M. C. Borges).

0899-9007/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.nut.2012.01.015

Obesity also leads to inflammation, and there is little information about its effect on the symptoms, functional capacity, and markers of inflammation in patients with chronic inflammatory diseases, such as SLE. The accumulation of body fat leads to increased levels of proinflammatory cytokines, which may lead to the exacerbation of the inflammation present in SLE and increase the risk of developing diabetes mellitus, hypertension, and coronary heart disease [8]. On the other hand, these patients may be malnourished due to the continuous use of immunosuppressive drugs, which increases susceptibility to infections and gastrointestinal symptoms, providing for a greater risk of disorders of appetite and dietary changes [1].

These aspects suggest that the nutritional status and food intake of patients with SLE may interfere in the disease course [9]. Thus, assessing the nutritional status of these patients is of the utmost importance because reducing levels of body fat may lead to the reduction of inflammation and associated comorbidities as well as because treating the malnourishment may have an impact on their overall outcome.

The aim of this study was to assess the nutritional status and food intake of patients with SLE.

Patients and methods

Patients

A cross-sectional study encompassing 170 women with SLE was conducted. Patients were selected from the Rheumatology Outpatient Clinic at Minas Gerais Federal University Medical School Hospital. The following inclusion criteria were used: female gender, age between 18 and 60 y, SLE according to the American College of Rheumatology revised classification [10,11], and having been diagnosed with the disease for over a year. Pregnant patients were excluded. The study was approved by the University's ethical committee and written informed consent was obtained from all patients.

Methods

Nutritional status was assessed by subjective global assessment (SGA) and body mass index (BMI). Subjective global assessment consists of questions about recent body-weight changes, gastrointestinal symptoms, food-intake habits and changes, alterations in functional capacity, and metabolic demands [12]. The patients were diagnosed as being well nourished, suspected or moderately malnourished, or severely malnourished [12]. According to BMI, patients were classified as malnourished (BMI $\leq$ 18.5 kg/m^2), normal weight (BMI = 18.6-24.9 kg/m^2), overweight (BMI = 25-29.9 kg/m^2), and obese (BMI $\geq$ 30 kg/m^2), based on the criteria of the World Health Organization [13]. Energy requirements were calculated according to the estimated energy requirement (EER) [14]:

$$\text{EER} = 387 - 7.31 \times \text{age [}y\text{]} + \text{Physical activity} \times (10.9 \times \text{weight [kg]} + 660.7 \times \text{height [m]})\text{[14]}$$

where

physical activity = 1.00—patient was classified as being inactive
physical activity = 1.27—patient was classified as being active

Food intake was assessed by a 24-h recall and a semiquantitative food frequency questionnaire. Patients reported food and beverages that were eaten on the day before the medical appointment and their respective quantities to quantify the 24-h recall [15]. The semiquantitative food frequency questionnaire included nutrients divided into groups such as the following [15]:

- grains
- vegetables
- fruits
- meat
- milk and dairy products
- beans
- oils
- sugars

Patients reported the frequency of each food intake (daily, three or four times a week, once or twice a week, biweekly, monthly, rarely, and never) and the amount consumed in household measures, which was subsequently converted to daily serving. The portions of food eaten from each group were calculated and compared with the recommendation according to the adapted food guide pyramid [16].

The nutrients assessed were as follows: energy, protein, fat, carbohydrate, fiber, calcium, iron, and vitamin B_{12}. These micronutrients were assessed because SLE patients present a high risk for the development of anemia and low bone mineral density. The software DietPro 5i version (Viçosa, Minas Gerais, Brasil) was used to quantify the intakes.

The relative distribution of macronutrients was assessed using the acceptable macronutrients distribution range: carbohydrate, 45% to 65%; protein, 10% to 35%; fat, 20% to 35% [14].

Calcium intake was assessed according to the adequate intake (AI) [17], iron and vitamin B_{12} according to the estimated average requirement (EAR) [18,19]. Fiber intake was calculated by g/1000 kcal and analyzed according to AI [14].

The Statistical Package for the Social Sciences (version 16.0; SPSS, Chicago, IL) software was used. Normal distribution of the study variables was tested using the Kolmogorov-Smirnov test. Categorical variables were presented as frequencies and percentages as well as continuous variables as the mean $\pm$ SD when the distribution was normal and as median $\pm$ interquartile range (IR) when the distribution was not normal.

Results

One hundred seventy women with SLE were assessed. Their mean $\pm$ SD age was 39.14 $\pm$ 9.98 y, and the duration of the disease was 9.94 $\pm$ 6.18 y. The nutritional status classification according to SGA is presented in Figure 1.

The mean $\pm$ SD BMI of the patients was 27.24 $\pm$ 5.42 kg/m^2. Sixty-two percent of the patients presented with excess weight. The distribution of nutritional status according to BMI is shown in Figure 2 (the two patients considered malnourished according to this parameter were excluded from the study).

Only 1.80% (3) of patients reported having one or two meals a day; 75.9% (126) reported three or four meals a day, and 22.3% (37) reported five or six meals a day.

The median $\pm$ IR of the EER was 2086.43 kcal (1941.84-2288.00 kcal). A significant difference was found between the EER of patients with normal weight and those with excess weight (Table 1).

Table 2 presents the mean $\pm$ SD and the median $\pm$ IR of the nutrients assessed by the 24-h recall.

Patients reported eating only 72.8% of estimated energy needs; 73.5% of them had an intake of less than 90% of the requirements and only 9.6% reported eating more than 110%.

The majority (67.2%) of the normal-weight patients reported intakes less than 90.0% of needs and 9.8% more than 110%. In the excess-weight group, 74.7% of the patients reported intakes below 90% of needs, and 9.3% reported intakes of more than 110% (Table 3).

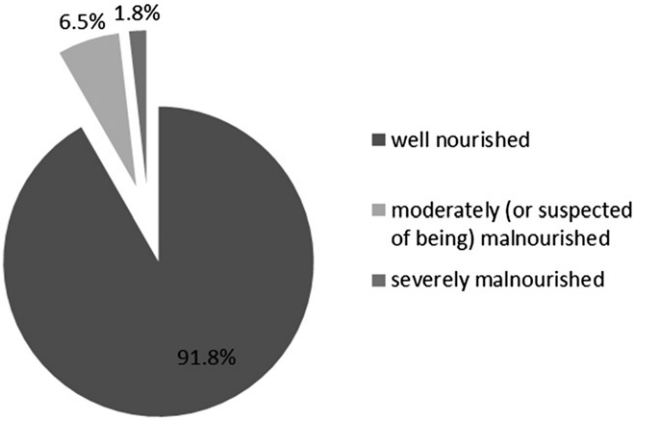

Fig. 1. Distribution of the nutritional status of SLE patients, according to SGA.

Please cite this article in press as: Borges MC, et al., Nutritional status and food intake in patients with systemic lupus erythematosus, Nutrition (2012), doi:10.1016/j.nut.2012.01.015

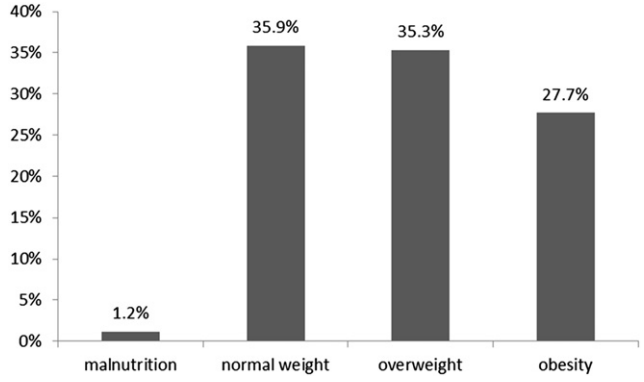

Fig. 2. Distribution of the nutritional status of SLE patients, according to BMI.

Calcium intakes of <1000 mg/d were reported by 92.9% of the patients in the group aged 19 to 50 y old, and calcium intakes of <1200 mg/d were observed in all patients aged between 50 and 59 y. Inadequate iron intake was present in 36.7% of patients between 19 and 50 y old and 12.5% of patients aged between 50 and 59 y. The intake of vitamin B_{12} was adequate in 52.3% of patients.

Both the normal-weight and the excess-weight group patients had intakes of calcium and fiber much lower than recommended and adequate intakes of iron and vitamin B_{12} (Table 3). There was no association between anemia and low intake of iron.

Table 4 shows the number of servings from each food group according to the food frequency questionnaire (FFQ).

The intake of vegetables was less than four servings per day in 98.8% (165) of patients, and intake of fruits and milk/dairy products was less than three servings per day in 85.6% (143) and 88.0% (146) of patients, respectively. Decreased intakes of grains, beans, and meat were observed in 32.3% (54), 21.6% (36), and 16.2% (27) of the patients, respectively. Considering oil intakes, 78.8% (126) of patients presented with higher intakes than recommended (Table 5).

The majority (82.8%) of normal-weight patients presented with consumptions of milk/dairy products below the recommendations and 100.0% and 86.4% reported intakes of vegetables and fruits, respectively, below the daily recommendation. In addition, in this group, 28.8% and 16.9% of patients had intakes of grains and meat lower than recommended, respectively. Sixty-nine percent of patients in this group showed consumption of oils and fats above the recommendation. Similarly, 90.7%, 98.1%, and 85.2% of excess-weight patients presented with intakes of milk/dairy products, vegetables, and fruit of less than three servings per day, respectively. In this group, the intakes of grains, beans, and meat were inadequate in 34.3%, 24.1%, and 15.7% of patients, respectively. The consumption of oils and fats above the recommendation was found in 83.8% of patients.

Table 1
Estimated energy requirement of patients with systemic lupus erythematosus according to BMI classification

	Normal weight	Excess weight
EER (kcal)*		
Median	2001.4	2133.4
IR	1851.5-2157.9	1995.4-2315.8

EER, estimated energy requirement; IR, interquartile range
Mann-Whitney test
* $P < 0.001$.

Table 2
Nutrient intake according to the 24-h recall of SLE patients

	24-h recall ($n = 124$)
Energy (kcal)	
Median	1,443.8
IR	1161.1-1853.1
Protein (%)	
Median	14.7
IR	11.9-17.6
Fat (%)	
Median	31.8
IR	26.9-37.1
Carbohydrate (%)	
Median	52.8
IR	48.0-58.1
Calcium (mg)	
Median	404.5
IR	252.9-596.2
Iron (mg)	
Median	9.2
IR	6.5-12.1
Vitamin B_{12} (μg)	
Median	2.2
IR	1.1-3.6
Fiber (g)	
Median	11.9
IR	7.4-17.4

IR, interquartile range

The weekly intake of sugar/sweets was considered low among obese patients and was, in fact, the only food group that differed between the groups.

Discussion

The assessment of nutritional status should be an integral part of patient care, as the imbalance between adequate metabolism and immunity leads to malnutrition. This will impact disease outcome and treatment [20–22]. In the current study, we have found a low prevalence of undernutrition, according to SGA. Although SGA is a nutritional assessment method especially recommended for hospitalized patients [23], it may also be an important tool for the early detection of malnutrition in outpatients, allowing rapid intervention and the prevention of complications. The low prevalence of undernutrition observed in

Table 3
Distribution of the nutrient intake of SLE patients, according to the 24-h recall

	Normal weight		Excess weight	
Energy[2] (kcal)	Median	1436.7	Median	1445.2
	IR	1206.6-1,791.4	IR	1117.9-1918.2
Protein[1] (%)*	Median	14.4	Median	15.53
	IR	12.0-16.4	IR	11.8-18.9
Fat[1] (%)	Median	32.2	Median	31.6
	IR	28.1-36.9	IR	26.1-37.3
Carbohydrate[1] (%)	Median	53.1	Median	52.6
	IR	48.5-58.0	IR	47.3-58.1
Calcium[2] (mg)	Median	364.3	Median	427.9
	IR	237.9-613.5	IR	257.4-591.6
Iron[1] (mg)	Median	9.4	Median	9.2
	IR	6.1-11.7	IR	7.3-12.7
Vitamin B_{12}[2] (μg)	Median	2.1	Median	2.2
	IR	1.2-2.8	IR	0.9-3.5
Fiber[2] (g)	Median	10.7	Median	12.1
	IR	7.0-15.8	IR	7.5-17.8

IR, interquartile range
1, Student's *t* test; 2, Mann-Whitney test
* $P < 0.05$.

Please cite this article in press as: Borges MC, et al., Nutritional status and food intake in patients with systemic lupus erythematosus, Nutrition (2012), doi:10.1016/j.nut.2012.01.015

Table 4
Daily intake of food servings per food group of SLE patients according to the food frequency questionnaire

	FFQ (servings/d)		Recommendations*
Grains	Mean	5.8	5 to 9 servings/d
	Median	5.8	
	IR	4.5-6.8	
Vegetables	Mean	1.4	4 to 5 servings/d
	Median	1.2	
	IR	0.6-2.0	
Fruits	Mean	1.4	3 to 5 servings/d
	Median	1.0	
	IR	0.5-2.0	
Meat	Mean	1.5	1 to 2 servings/d
	Median	1.5	
	IR	1.0-2.0	
Milk and dairy products	Mean	1.3	3 servings/d
	Median	1.0	
	IR	0.4-1.9	
Beans	Mean	1.3	1 servings/d
	Median	1.0	
	IR	1.0-2.0	
Oils	Mean	3.8	1 to 2 servings/d
	Median	3.4	
	IR	2.4-4.6	
Sugars†	Mean	3.4	1 to 2 servings/d
	Median	2.0	
	IR	0.8-5.0	

IR, interquartile range
* Reference: PHILIPPI, 1999.
† Servings calculated per week.

the current study is probably due to the fact that patients who are ambulatory mostly have the disease controlled. On the other hand, patients with active disease tend to have rapid and severe weight loss, leading to undernutrition. This was seen in the Brazilian National Survey (IBRANUTRI) study, which reported 70.1% of undernutrition among patients with autoimmune diseases [23]. On the other hand, excess weight (BMI $\geq$ 25 kg/m^2) was found in 63.0% of patients. The high frequency of overweight individuals with SLE has been reported in other studies [8,24].

Table 5
Daily intake of servings, according to the food frequency questionnaire

	Normal weight		Excess weight	
Grains[1]	Mean	5.9	Mean	5.8
	Median	5.8	Median	5.5
	IR	4.7-6.9	IR	4.4-6.8
Vegetables[2]	Mean	1.2	Mean	1.5
	Median	1.2	Median	1.3
	IR	0.5-1.7	IR	0.7-2.0
Fruits[2]	Mean	1.4	Mean	1.4
	Median	1.2	Median	1.0
	IR	0.5-2.0	IR	0.5-2.0
Meat group[2]	Mean	1.5	Mean	1.5
	Median	1.5	Median	1.5
	IR	1.0-2.0	IR	1.1-2.0
Milk/dairy products[2]	Mean	1.3	Mean	1.2
	Median	0.9	Median	1.0
	IR	0.4-2.1	IR	0.4-1.7
Beans[2]	Mean	1.2	Mean	1.3
	Median	1.0	Median	1.0
	IR	1.0-2.0	IR	1.0-2.0
Oils[2]	Mean	3.6	Mean	4.0
	Median	3.2	Median	3.7
	IR	2.1-4.1	IR	2.7-4.9
Sugars[2*,†]	Mean	4.5	Mean	2.8
	Median	3.0	Median	1.5
	IR	1.5-6.5	IR	0.5-3.8

IR, interquartile range
1, Student's *t* test; 2, Mann-Whitney test
* $P < 0.001$.
† Servings calculated per week.

The identification of excess weight as a risk factor for the perpetuation of inflammation in patients with SLE and the consequent decline in quality of life is extremely important because this can potentially be modified [8]. Weight loss through dietary intervention and physical activity results in decreased circulating levels of inflammatory cytokines, which could promote improvement in the symptoms of SLE patients [25,26].

The relationship between nutrition and SLE is not well established, especially because SLE is a disease of multifactorial origin with genetic, environmental, and hormonal factors. However, the quality of the diet is extremely important in patients with SLE because they have a higher risk of developing cardiovascular diseases, low bone mineral density, and anemia [7]. Brown related the influence of nutrition in SLE and reported that some nutrients, such as vitamin E, vitamin A, selenium, ω-3 fatty acids, calcium, and vitamin D, may have beneficial impacts on the symptoms of SLE. In contrast, excess calories, proteins, fats, zinc, and iron can aggravate the symptoms [27].

The majority of the patients presented with inadequate intakes of calcium, iron, vitamin B_{12}, and fiber. Shah et al. and Caetano et al. also found insufficient intakes of these nutrients in SLE patients with or without dietary intervention [7,28]. Furthermore, the data in the current study are similar to those presented in a series encompassing healthy individuals [29,30]. Inadequate calcium intake was observed in the majority of patients in the current study, according to the 24-h recall. The FFQ also confirmed the low consumption of dairy products. In NHANES III, calcium intake below the recommendation was also observed in the general population [29]. Adequate intake of calcium is especially important in patients with SLE because many of them have low bone mineral density associated with prolonged use of corticosteroids [31]. Therefore, supplementation of this mineral should be commonly recommended for these patients.

Inadequate intakes of iron were observed in this study and are observed frequently in the general population [29]. Similar to our study, Shah et al. also found low iron intakes in patients with SLE, although they found no association between anemia and low intakes of iron [7]. SLE is associated with an increased prevalence of anemia but this is due to multifactorial issues, including iron deficiency, hemolytic anemia, and other causes [32]. Therefore, the consumption of food sources rich in iron, such as meat, beans, and green vegetables, should be encouraged in this population.

The consumption of vitamin B_{12} was lower than recommended in 46.8% of the patients. Low intakes of vitamin B_{12} are generally associated with low intakes of foods of animal origin, the only dietary sources of this vitamin [33]. As meats are also major sources of iron, patients with low consumption of this food group may also have a deficiency of this mineral and vitamin B_{12}. However, no association was found between inadequate intakes of vitamin B_{12} and anemia. Low serum vitamin B_{12} is associated with increased plasma homocysteine [34], which, in turn, increases the risk of cardiovascular disease [35]. Although no determination was made of plasma concentrations of vitamin B_{12}, the low intake reported in this study may reflect low levels of this vitamin. The data on the intake of meat and beans in the FFQ confirm the low intake of these foods, which may reflect the intake of iron and vitamin B_{12}.

Fiber intakes were below the recommended daily intake, as confirmed by the low consumption of fruits and vegetables observed in the FFQ. Shah et al. also observed a low fiber intake in patients with SLE [7]. Similarly, inadequate intakes of fiber were found in the general population [29,36].

Please cite this article in press as: Borges MC, et al., Nutritional status and food intake in patients with systemic lupus erythematosus, Nutrition (2012), doi:10.1016/j.nut.2012.01.015

A high consumption of fats and oils was seen. This can be very detrimental in patients with SLE because they are more prone to the development of dyslipidemia and cardiovascular disease [37,38].

The low frequency of sugar and sweet intake reported by patients points to the potential lack of data reliability because the frequency of overweight as well as high serum concentrations of glucose and diabetes were higher in this population group than are found in the general population [39,40].

Two different methods of assessing diet intake were used in this study, as there is no gold standard instrument. Our results showed no correlation between the two methods used, as well as its relationship with the patients' nutritional status. The average energy intake obtained by the 24-h recall was below the estimated energy need. However, excess weight was found in 62.0% of this sample. This result may be explained by errors inherent to the individual and the methods per se [41]. The 24-h recall is subject to errors of memory and one single day of recall does not represent the routine intake of the individual [15,42]. On the other hand, the validity of the FFQ may have been compromised by an incomplete list of foods and/or errors in information of the frequencies and portions eaten [43]. Furthermore, there was no difference between the intake of any nutrient in the normal-weight patients compared with those with excess weight, which confirms the potential unreliability of the data. Nevertheless, our results were similar to the sparse data encompassing SLE patients [7].

In summary, this study has shown similarities between the dietary intake of patients with SLE and the eating habits of the Brazilian population reported by Levy-Costa et al., who found high intakes of sugars, sweets, oils, and fats, and a low consumption of fruits and vegetables [30]. Similarly, Caetano et al. assessed the dietary intake of patients with SLE and arthritis and identified excessive intakes of lipids and proteins and low intakes of micronutrients [28].

Conclusion

Patients with SLE have inadequate nutritional status and food intake. Thus, interventions aimed at promoting adequate nutritional status may contribute to reduction of comorbidities and improved quality of life in these patients. It would also be important to know the influence of overweight and dietary interventions on the inflammation already present in SLE.

Acknowledgments

Acknowledgments are made to the FAPEMIG (The State of Minas Gerais Research Foundation) for financial support and to the CNPQ (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for the research grant to Correia, MITD.

References

[1] Lanna CCD, Ferreira GA, Telles RW. Lúpus Eritematoso Sistêmico. In: Carvalho MAP, Lanna CCD, Bértolo MB, editors. Reumatologia: diagnóstico e tratamento. 2nd ed. Rio de Janeiro: Guanabara Koogan; 2008. p. 364–85.
[2] Bosch X, Guilabert A, Pallarés L, Cerveral R, Ramos-Casals M, Bové A, et al. Infections in systemic lupus erythematosus: a prospective and controlled study of 110 patients. Lupus 2006;15:584–9.
[3] Tam LS, Li EK, Leung VY, Griffith JF, Benzie IF, Lim PL, et al. Effects of vitamins C and E on oxidative stress markers and endothelial function in patients with systemic lupus erythematosus: a double blind, placebo controlled pilot study. J Rheumat 2005;32:275–82.
[4] Turner E, Dishy V, Chung CP, Harris P, Pierces R, Asanuma Y, et al. Endothelial function in systemic lupus erythematosus: relationship to disease activity, cardiovascular risk factors, corticosteroid therapy, and coronary calcification. Vasc Health Risk Mang 2005;1. 261c–2.
[5] Asanuma Y, Chung CP, Oeser A, Shintani A, Stanley E, Raggi P, et al. Increased concentration of proatherogenic inflammatory cytokines in systemic lupus erythematosus: relationship to cardiovascular risk factors. J Rheumat 2006;33:539–45.
[6] Lillaby V, Haugen M, Morkrid L, Froy FK, Holven KB, Forre O. Body composition, lipid and lipoprotein levels in childhood-onset systemic lupus erythematosus. Scand J Rheumatol 2007;36:40–7.
[7] Shah M, Adams-Huet B, Kavanaugh A, Coyle Y, Lipsky P. Nutrient intake and diet quality in patients with systemic lupus erythematosus on a culturally sensitive cholesterol lowering dietary program. J Rheumat 2004;31:71–5.
[8] Oeser A, Chung CP, Asanuma Y, Avalos I, Stein M. Obesity is an independent contributor to functional capacity and inflammation in systemic lupus erythematosus. Arthritis Rheum 2005;52:3651–9.
[9] Minami Y, Sasaki T, Arai Y, Kurisu Y, Hisamichi S. Diet and systemic lupus erythematosus: a 4 year prospective study of Japanese patients. J Rheumat 2003;30:747–54.
[10] Tan EM CA, Fries JF. The 1982 revised criteria for the classification of systemic lupus erythematosus. Arthritis Rheum 1982;25:1271–7.
[11] Hochberg MC. Updating the American college of rheumatology revised criteria for the classification of systemic lupus erythematosus. Arthritis Rheum 1997;40:1725.
[12] Detsky AS, Mclaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN 1987;11:8–13.
[13] World Health Organization. Obesity: preventing and managing the global epidemic. Report of WHO consultation. Geneva: WHO; 1997.
[14] Institute of Medicine. 2002. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: The National Academies Press. Available at: http://www.nap.edu/books/0309085373/html. Accessed August 20, 2009.
[15] Thompson FE, Byers T. Dietary assessment resource manual. J Nutr 1994;124:2245–317.
[16] Philippi ST, Latterza AR, Cruz ATR, Ribeiro LC. Pirâmide alimentar adaptada: guia para escolha dos alimentos. Rev Nutr 1999;12:65–80.
[17] Institute of Medicine. 1997. Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. Washington, DC: The National Academies Press. Available at: http://www.nap.edu/books/0309065542/html. Accessed August 20, 2009.
[18] Institute of Medicine. 2001. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenun, Nickel, Silicon, Vanadium, and Zinc. Washington, DC: The National Academies Press. Available at: http://www.nap.edu/books/0309085373/html. Accessed August 20, 2009.
[19] Institute of Medicine. 2000. Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Washington, DC: The National Academies Press. Available at: http://www.nap.edu/books/0309085373/html. Accessed August 20, 2009.
[20] Waitzberg DL, Correia MITD. Nutritional assessment in the hospitalized patient. Curr Opin Clin Nutr Metabol Care 2003;6:531–8.
[21] Goiburu ME, Goiburu MM, Bianco H, Díaz JR, Alderete F, Palacios MC, et al. The impact of malnutrition on morbidity, mortality and length of hospital stay in trauma patients. Nutr Hosp 2006;21:604–10.
[22] Hajer GR, Haeften TW, Visseren FLJ. Adipose tissue dysfunction in obesity, diabetes, and vascular diseases. E Heart J 2008;29:2959–71.
[23] Waitzberg DL, Caiaffa WT, Correia MITD. Hospital malnutrition: the Brazilian national survey (IBRANUTRI): a study of 4000 patients. Nutrition 2001;17:573–80.
[24] Chaiamnuay S, Bertoli AM, Fernández M, Apte M, Vilá LM, et al, LUMINA Study Group. The impact of increased body mass index on systemic lupus erythematosus. J Clin Rheumatol 2007;13:128–33.
[25] Esposito K, Pontillo A, Di Palo C, Giugliano G, Masella M, Marfella R, et al. Effect of weight loss and lifestyle changes on vascular inflammatory markers in obese women: a randomized trial. JAMA 2003;289:1799–804.
[26] Nicoletti G, Giugliano G, Pontillo A, Cioffi M, D'andrea F, Giugliano D, et al. Effect of multidisciplinary program of weight reduction on endothelial functions in obese women. J Endocrinol Invest 2003;26:RC5–8.
[27] Brown AC. Lupus erythematosus and nutrition: a review of the literature. J Renal Nutr 2000;10:170–83.
[28] Caetano MC, Ortiz TT, Terreri MT, Sarni RO, Silva SG, Souza FI, et al. Inadequate dietary intake of children and adolescents with juvenile idiopathic arthritis and systemic lupus erythematosus. J Pediatr 2009;85:509–15.
[29] Alaimo K, Mcdowell MA, Briefel RR, Bischof AM, Caughman CR, Loria CM, et al. Dietary intake of vitamins, minerals, and fiber of persons ages 2 months and over in the United States: third national health and nutrition examination survey, phase I. Adv Data 1994;258:1–28.
[30] Levy-Costa RB, Sichiere R, Pontes Ndos S, Monteiro CA. Disponibilidade domiciliar de alimentos no Brasil: distribuição e evolução (1974-2003). Rev Saude Pública 2005;39:530–40.
[31] Mendoza-Pinto C, García-Carrasco M, Sandoval-Cruz H, Muñoz-Guarneros M, Escárcega RO, Jiménez-Hernández M, et al. Risk factors of

vertebral fractures in women with systemic lupus erythematosus. Clin Rheumatol 2009;28:579–85.
[32] Voulgarelis M, Kokori SI, Ioannidis JP, Tzioufas AG, Kyriaki D, Moutsopoulos HM. Anemia in systemic lupus erythematosus: aetiological profile and the role of erythropoietin. Ann Rheum Dis 2000;59:217–22.
[33] Mafra D, Cozzolono SMF. Vitamina B_{12} (cobalamina). In: Cozzolino SMF, editor. Biodisponibilidade de Nutrientes. 2nd ed. Barueri: Manole; 2005. p. 395–403.
[34] Selhub J, Morris MS, Jacques PF. In vitamin B12 deficiency, higher serum folate is associated with increased total homocysteine and methylmalonic acid concentrations. Proc Natl Acad Sci USA 2007;104:19995–20000.
[35] Fowler B. Homocystein—an independent risk factor for cardiovascular and thrombotic diseases. Ther Umsch 2005;62:641–6.
[36] Bonomo E, Caiaffa WT, César CC, Lopes AC, Lima-Costa MF. Consumo alimentar da população adulta segundo perfil sócio-econômico e demográfico: Projeto Bambuí. Cad Saúde Pública 2003;19:1461–71.
[37] Svenungsson E, Gunnarsson I, Fei GZ, Lundberg IE, Klareskog L, Frostegard J. Elevated triglycerides and low levels of high-density lipoprotein as markers of disease activity in association with up-regulation of the tumor necrosis factor α/tumor necrosis factor receptor system in systemic lupus erythematosus. Arthritis Rheum 2003;48:2533–40.
[38] Escárcega RO, García-Carrasco M, Fuentes-Alexandro S, Jara LJ, Rojas-Rodriguez J, Escobar-Linares LE, et al. Insulin resistance, chronic inflammatory state and link with systemic lupus erythematosus-related coronary disease. Autoimmun Rev 2006;6:48–53.
[39] Sada KE, Yamasaki Y, Maruyama M, Sugiyama H, Yamamura M, Maeshima Y, et al. Altered levels of adicytokines in association with insulin resistance in patients with systemic lupus erythematosus. J Rheumat 2006;33:1545–52.
[40] Nguyen NT, Magno CP, Lane KT, Hinojosa MW, Lane JS. Association of hypertension, diabetes, dyslipidemia and metabolic syndrome with obesity: finding from the National Health and Nutrition Examination Survey, 1999 to 2004. J Am Coll Surg 2008;207:928–34.
[41] Costa AGV, Priore SE, Sabarense CM, Franceschini SCC. Questionário de Freqüência de Consumo Alimentar. Rev Nutr 2006;19:631–41.
[42] Fisberg RM, Slater B, Marchioni DML, Martini LA. Inquéritos alimentares: métodos e bases científicos. Barueri: Manole; 2005.
[43] Lopes ACS, Caiaffa WT, Mingoti AS, Lima-Costa MFF. Ingestão alimentar em estudos epidemiológicos. Rev Bras Epidemiol 2003;6:209–18.

Please cite this article in press as: Borges MC, et al., Nutritional status and food intake in patients with systemic lupus erythematosus, Nutrition (2012), doi:10.1016/j.nut.2012.01.015