ORIGINAL ARTICLE

Eating habits and energy and nutrient intake profile in children and adolescents with type 1 diabetes *mellitus*

Hábitos alimentares e perfil de ingestão de energia e nutrientes de crianças e adolescentes com diabetes mellitus *tipo 1*

Karla Cristina Queiroz[1], Rita de Cássia Gonçalves Alfenas[2], Ivani Novato Silva[3]

DOI: 10.5935/2238-3182.20150067

ABSTRACT

Introduction: adopting proper eating habits is crucial for the metabolic control of diabetes mellitus type 1 (DM1) in children and requires the involvement and effective participation of the family implying in changes in established eating patterns. **Objective:** to evaluate the dietary profile of children and adolescents with DM1 and their adaptation to current recommendations. **Patients and methods:** we studied 146 individuals aged between seven and 19 years old with at least one year of DM1 diagnosis and treated at the Division of Pediatric Endocrinology of the General Hospital, Federal University of Minas Gerais. The diet was assessed by a quantitative food frequency questionnaire, previously tested and validated in a pilot project. **Results:** the average percentage of ingested calories as protein and polyunsaturated fat was within the adopted recommendations; that of saturated fat and cholesterol exceeded the recommendation in the entire study population. The monounsaturated fat and carbohydrates intake in individuals under 14 years of age did not reach the adopted recommendation. Adolescents between 15 and 19 years old ingested a high percentage of calories from carbohydrates while children between seven and ten years old ingested more fat and protein. Adolescents between 15 and 19 years old presented the most inadequate eating habits. **Conclusion:** a diet with poor lipid profile, inappropriate eating habits, and nutritional inadequacies that contribute to poor control of DM1 are of concern.

Key words: Diabetes Mellitus, Type 1; Food Consumption; Diabetic Diet.

RESUMO

Introdução: *a adoção de hábitos alimentares adequados, fundamental para o controle metabólico da criança com diabetes mellitus tipo 1 (DM1), necessita do envolvimento e participação efetiva da família e pode implicar mudanças nos padrões alimentares já estabelecidos.* ***Objetivo:*** *avaliar o perfil alimentar de crianças e adolescentes com DM1 e sua adequação às recomendações atuais.* ***Casuística e métodos:*** *foram estudadas 146 pessoas com idade entre sete e 19 anos e no mínimo um ano de diagnóstico de DM1, atendidos na Divisão de Endocrinologia Pediátrica do Hospital das Clínicas da Universidade Federal de Minas Gerais. A dieta foi avaliada por meio de questionário quantitativo de frequência alimentar, testado e validado previamente em projeto-piloto.* ***Resultados:*** *o percentual médio de calorias ingeridas como proteínas e gordura poli-insaturada estava dentro das recomendações adotadas; o de gordura saturada e colesterol superou a recomendação em toda a população estudada. A ingestão de gordura monoinsaturada e a de carboidratos nos indivíduos com até 14 anos de idade não atingiu a recomendação adotada. Adolescentes entre 15 e 19 anos ingeriram alto percentual de calorias provenientes de carboidratos, enquanto as crianças entre sete e 10 anos de idade ingeriram mais gorduras e proteínas. Os adolescentes de 15 a 19 anos apresentaram hábitos alimentares mais inadequados.* ***Conclusão:*** *constituem motivo de preocupação a dieta com perfil lipídico insatisfatório e*

[1] Nutritionist. Master's degree. Nutritionist at the General Hospital of the Federal University of Minas Gerais – UFMG. Belo Horizonte, MG – Brazil.
[2] Nutritionist. PhD. Adjunct Professor at the Department of Nutrition and Health of the Federal University of Viçosa of Minas Gerais. Viçosa, MG – Brazil.
[3] MD Pediatrician. PhD. Professor at the Department of Pediatrics of the Medical School of UFMG and Coordinator of the Children and Adolescent Endocrinology Division of the General Hospital of UFMG.
Belo Horizonte, MG – Brazil.

Submitted: 2014/02/01
Approved: 2014/04/05

Institution:
Medical School of UFMG
Belo Horizonte, MG – Brazil

Corresponding Author:
Ivani Novato Silva
E-mail: ivanins@medicina.ufmg.br

hábitos alimentares inapropriados, inadequações nutricionais que contribuem para o mau controle de DM1.

Palavras-chave: Diabetes Mellitus *Tipo 1; Consumo de Alimentos; Dieta para Diabéticos*

INTRODUCTION

Diabetes mellitus type 1 (DM1) is the most common endocrine-metabolic disorder in childhood and adolescence with an increasing incidence.[1] Despite the numerous advances in treatment, it still has high morbidity and harm to the quality of life, especially related to necessary restricting therapies including dietary treatment.[2] The prescription of a balanced and individualized diet is essential and should be conducted considering the nutritional, socioeconomic, cultural, and psychological aspects in which individuals are inserted. Its main objective is to maintain plasma glucose and lipoproteins concentrations as close to normal as possible to foster growth and development within the expected, and reduce the risk of vascular disease and its complications.[3]

Although the adoption of proper eating habits is critical to patient management, adherence to dietary treatment is not always easy because it implies changes in eating patterns and involvement and effective participation of the family.

The nutritional diet composition is also important, and carbohydrates are the dietary component that have the most influence, especially on postprandial glucose. Considerable emphasis has also been given to the quality of ingested lipids: the preference for mono and polyunsaturated fats appears to be an important aspect of reducing the risk of cardiovascular disease presented in this population.[3-5]

There are few national publications related to the food intake profile of children and adolescents with DM1 in the large research databases. Studies of this nature are important because they allow estimating this consumption and possible factors related to nutritional inadequacies, which can be used as subsidies for planning more targeted nutritional interventions. The aim of this study was to evaluate the dietary pattern of children and adolescents with DM1 and compare it with the current nutritional recommendations.

MATERIAL AND METHODS

The study enrolled children and adolescents with DM1, between seven and 19 years old, with at least one year of diagnosis and treated at the Division of Pediatric Endocrinology of the General Hospital, Federal University of Minas Gerais (HC/UFMG). The calculation of the minimum sample size (n = 140) was executed considering the total number of children and adolescents with type 1 diabetes (n = 240) who met the criteria described above and considering a sample loss of 10%. The error margin of 5%, confidence level of 90%, and maximum variance for the proportion of responses were adopted. The sampling strategy was determined by the census, that is, individuals who attended the outpatient clinic of the HC/UFMG for nine consecutive months in every other random day were interviewed.

The study was approved by the Ethics Committee, under Opinion number 347/05. Parents or guardians, or the interviewees when over 18 years old, signed an informed consent form.

General information and eating routine was collected from the study participants through a semi-structured questionnaire previously tested in a pilot project that was answered by responsible parties or the patients themselves and supplemented the research in medical records.

Weight and height were measured according to the techniques recommended by Jelliffe[6] and body mass index (BMI) was calculated by dividing weight in kilograms by height in square meters.[7] Children and adolescents were classified according to BMIs and nutritional status as: underweight (<5th percentile), eutrophic (≥ 5th percentile and <85th percentile), at overweight risk (≥ 85th percentile and < 95th percentile), and overweight (≥ 95th percentile) according to percentiles generated by the DietPro software (version 4).[8]

The usual intake in the six months preceding the date of the evaluation was obtained using a quantitative food frequency questionnaire (QQFA), validated[9] and adapted to the studied population based on a pilot study. For each QQFA item, participants reported the average frequency of habitual consumption and usually consumed portion sizes with the help of a photographic example.[10] The nutritional composition of ingested diet was analyzed using the DietPro[a] software (version 4).[8] The diet nutritional adequacy was assessed by comparing the estimated daily intake of nutrients with reference values expressed in % of total energy intake (VET %) ingested: carbohydrates: 55-60%, protein 15-20%, and 0.8-1.0 g/kg of body weight, lipids: <30%, 10-15% monounsaturated fats, <10% poly, and <7% saturated, Cholesterol: 200 mg and fibers 14 g/1,000 kcal.[3, 11]

Foods were divided into seven groups following the recommendation of the American food pyramid adapted to the Brazilian population.[12] Sweets and fats were included in a single group due to the low participation of these items in the total consumption of food. We evaluated the relative participation of these groups in total food consumption by dividing the average consumption of each group by the average consumption summation of all groups (in grams and/or milliliters).

The relationship between caloric intake and basal metabolic rate (IC/TMB) was calculated to assess the quality of information obtained. TMB was estimated by the Schofield equations (1985) as recommended by FAO (2001).[13] The IC/TMB ratio was used as an indicator of super and underestimation of self-reported caloric intake based on the following cut-off points:[14] < 1.14 (severe underestimation); 1.14 to 1.34 (underestimation), and ≥2.4 (overestimation).

Data were analyzed with the SPSS version 13.0 and R version 2.6.1 statistical softwares. Subjects were divided into three age groups: seven to 10, 11 to 14, and 15 to 19 years old. The chi-square test or Fisher's exact test, when indicated, were used to evaluate associations between categorical variables. Numerical variables between independent groups were compared by the Student t-test and ANOVA. Multiple comparisons between groups were performed using the Tukey's test. The significance level of 5% was adopted for all tests.

RESULTS

The study included 146 diabetic patients (62.3% females), schoolchildren (aged between seven and 19 years), with the mean age of 12.9 ± 3.6 years. The mean disease duration was 6.9 ± 3.6 years and the mean age at diagnosis was 6.0 ± 3.4 years. The average insulin dose was 0.84 ± 0.2 U/kg. Most (87.7%) patients were eutrophic, 8.9% were underweight, and 3.4% at risk of being overweight. Out of the studied subjects, 96.2% had monthly family incomes of up to five minimum wages and 62.3% up to 2 MW; 38.5% of mothers and 34.3% of fathers had up to four years of education.

When asked about the main difficulty faced in treatment, the majority of respondents mentioned the diet (55.5%), followed by having to apply insulin (20.5%), and undergoing frequent consultations (9.6%). Out of the patients who cited the diet (n = 81), 38.3% and 33.3% highlighted the fact of having to comply with quantities and restrict sucrose as the main difficulty as, respectively.

The dietary patterns of participants, divided by age group, are presented in Table 1.

Table 1 - Food pattern of 146 children and adolescents with type 1 diabetes

	Age Group (years)		
	7-10	11-14	15-19
Number of meals (n = 145)**[b]			
≤ 4 meals	03 (7.00%)	05 (9.6%)	19 (38%)
5-6 meals	31 (72.1%)	42 (80.8%)	30 (60%)
> 6 meals	09 (20.9%)	05 (9.60%)	01 (2.0%)
Scheduled meals (n = 146)**[b]			
Yes	40 (93%)	43 (82.7%)	35 (68.6%)
No	03 (7.0%)	09 (17.3%)	16 (31.4%)
Non-scheduled meals (n = 146)[a]			
Yes	17 (39.5%)	29 (55.8%)	24 (47.1%)
No	10 (23.3%)	12 (23.1%)	16 (31.4%)
Sometimes	16 (37.2%)	11 (21.2%)	11 (21.6%)
Use of the sweetener (n = 146)**[b]			
Sugar substituted only in drinks	00 (0.00%)	09 (17.3%)	09 (17.6%)
Uses only sweetener	41 (95.3%)	40 (76.9%)	34 (66.7%)
Uses sugar and sweetener	02 (4.70%)	03 (5.80%)	03 (5.90%)
Uses only sugar	0.0 (0.00%)	0.0 (0.00%)	03 (5.90%)
Others	0.0(0.00%)	0.0 (0.00%)	02 (3.90%)
School snack (n = 138)*[a]			
Free lunch 15 (34.9%)	15 (34.9%)	15 (28.8%)	10 (23.3%)
Home snack	28 (65.1%)	26 (50.0%)	12 (27.9%)
Purchases snack	0.0 (0.00%)	05 (9.60%)	10 (23.3%)
Does not snack	0.0 (0.00%)	06 (11.5%)	11 (25.6%)

* p< 0,01 ** p < 0,05. a- Chi-square test; b- Fisher's exact test (for proportions between groups).

The most common inadequacy was the habit of "snacking", and only 26% reported not having the habit of consuming food outside scheduled main meals. A higher proportion of adolescents in the 15-19 years old group was observed among those who did not have scheduled meals, consuming ≤ 4 meals/day, and among those who bought or did not snack at school. There was no association between income, education level of parents, and eating patterns in the studied participants.

The nutritional composition of the diet consumed by participants, divided by age group, is shown in Table 2.

Table 2 - Content of macronutrients, fatty acids, cholesterol, and fibers (mean ± SD) in diets consumed by 146 children and adolescents with type 1 diabetes

Nutrients	Age Group (years)		
	7-10 (n=43)	11-14 (n=52)	15-19 (n=51)
Calories (kcal) *	1.813.8±280.4[b]	2.143.9±459.8[c]	2.091.1±516.3[c]
% Carbohydrate *	52.5±3.6[d]	53.7±5.0[d]	56.7±5.0[e]
% Carbohydrate + mono*	60.9±3[d]	62.1±4.1[d]	64.9±4[e]
% Fat**	30.9±3.4[f]	30.3±3.3	29±3.8[g]
% Saturated *	10.4±1.6[d]	9.9±2.0[d]	8.8±1.7[e]
% Monounsaturated	8.4±1.3	8.4±1.4	8.3±1.7
% Polyunsaturated	6.5±1.1	6.5±1.1	7.0±1.6
% Protein*	16.6±2.3[d]	15.9±2.7[d]	14.6±2.7[e]
g protein/Kg weight*	2.9±0.7[h]	2.2±0.6[i]	1.4±0.5[j]
Cholesterol (mg)	224.9±63.7	235.3±77.3	201±90.2
Fiber (g/1000Kcal)	16.6±3.1	15.2±3.2	15.6±3.4

* p<0.01 ** p<0.05 (ANOVA). b, c- different between each other; d, e- different between each other; f, g- different between each other; h, i, j- different between each other.

Calories

The caloric intake of the seven to 10 years old group was significantly lower than that of participants aged 11 to 19 years; no difference was found between the 11-14 years and 15-19 years old groups.

In this study, the IC/TMB average ratio was 1.61 ± 0.35. According to the adopted criteria, the prevalence of under- and overestimation in the self-reporting of energy intake was 20.5 and 4%, respectively. The prevalence of severe underestimation was 5.5%. Among those who showed underestimation, there were a predominance of females (73.3%) and adolescents in the 15-19 years old group (63.3%).

Protein

The percentage of calories ingested from protein was significantly lower in the group of adolescents between 15 and 19 years old group compared to the other two groups. The mean percentage intake was in line with the recommendation in patients aged up to 14, and slightly below the minimum threshold recommended in the 15-19 years old group. Based on the criterion of grams of protein per kilogram of weight, the average intake was over the recommendation in all groups. Out of all respondents, 4.8% surpassed the ingestion of 20% VET and 93.8% of the 1.0 g protein/kg of body weight. The average per capita income of those who ate less than 15% of VET protein was significantly lower (p = 0.037) than those consuming protein within or above the recommended range.

Fats

The percentage of calories ingested from lipids and saturated fat was significantly lower in the 15-19 years old group compared to other age groups. The average percentage consumption of fats was near the upper limit adopted as a reference in the three groups. Out of all respondents, 54.1% reported lipid intake higher than 30% of VET.

A statistically significant association (p = 0.026) between the percentage of fat intake and BMI was observed. All overweight individuals showed lipid intake ≥ 30% of VET; 69.2% of underweight respondents showed lipids intake < 30% of VET.

The average percentage intake of saturated fat was higher than the recommendation in all age groups. Ingestion of more than 10% of VET was observed in 42.5% of the study population, however, considering the recommended intake of less than 7% of VET, the proportion of inadequacy increased to 91.1%.

The average intake of monounsaturated fat was lower than recommended, and that of poly-unsaturated fat was within the limit.

The mean cholesterol intake exceeded the recommendation. Out of all respondents, 12.3% exceeded the ingestion of 300 mg/day and 58.9% of 200 mg/day. A higher proportion of females (p = 0.046) reported intake lower than 200 mg cholesterol/day compared to males (48.4 vs. 29.1%).

Carbohydrates

The percentage of calories ingested from carbohydrates was significantly higher in the 15-19 years old group compared to other age groups, although it was within the recommended. Among the participants aged less than 14 years, the average percentage intake was lower than recommended. Out of all participants, 11.6% had intake higher than 60% of VET and 62.3% lower than 55%.

No difference in fiber intake by age group was observed, and the average intake exceeded the recommendation of 14 g/1,000 kcal in all groups.

No significant differences were observed in the percentage distribution of nutrients between genders.

The relative share of food groups in the total consumption of food is presented in Table 3.

Table 3 - Relative share of food groups (mean ± SD) in the food consumption of 146 children and adolescents with type 1 diabetes

Groups of foods	Age Group (years)		
	7-10 (n=43)	11-14 (n=52)	15-19 (n=51)
Cereals and tubers (%) *	24.2±6.1[b]	26.5±7.8[b]	31.1±10.4[c]
Fruits	16.9±9.6	15.7±11.1	17.1±9.6
Vegetables (%)	8.1±4.9	8.1±4.3	8.9±6.1
Meat and eggs (%)	11.0±4.4	10.0±3.7	9.4±4.5
Legumes (%)	13.3±3.7	12.9±5.2	13.6±6.4
Dairy products (%) **	24.0±11.3[b]	23.9±16.0[b]	16.5±17.7[c]
Gorduras e guloseimas (%)	2.6±1.7	3.0±1.9	3.3±3.1

*p<0.01 **p<0.05 (ANOVA). b, c- different between each other.

The most significant share of food consumption was of the group of cereals in adolescents from 15-19 years old compared to other age groups due to the high consumption of some foods like rice, bread, and cookies. Among the groups considered sources of protein, the highest proportion was related to dairy products, followed by legumes, and finally, meat and eggs. The intake of milk products by adolescents aged 15 to 19 years was significantly lower when compared to the other groups. In this study, these foods together with meats also constitute the main source of fats because the participation proportion of fats and treats was small. In assessing the share of food groups according to gender, a more significant participation of the group of cereals (29.6 vs. 26.1%) and dairy products (24.7 vs. 19.3%) was detected in males ($p < 0.05$).

DISCUSSION

The evaluation of food consumption has been one of the biggest challenges in epidemiological studies, and despite the significant progress in this area, one of the main difficulties is the lack of instruments to allow accurate measurements of food intake.

The relationship between IC and TMB has been used to evaluate the accuracy of estimated caloric intakes in food intake studies. The self-reporting underestimation is a fact observed in individuals with chronic diseases such as DM1.[15,16] This aspect should be considered in routine nutritional care, and anthropometric and biochemical data should be used in the planning of nutrition guidelines in addition to the information related to food intake.

In this study, the prevalence of underreporting of energy intake was lower than in other studies.[15,16] It is possible that the method and technique adopted to estimate the caloric intake were adequate. The highest proportion of adolescents aged 15 to 19, among those possibly with underestimated calorie intake, could explain the fact that a difference in calorie intake between this group and the 11-14 years old group was not observed.

Adolescence is a period characterized by a series of physical, social, and psychological changes that affect the feeding behavior of individuals.[17] The complexity of these transformations provides increased difficulty in accepting the disease and favors the worsening of metabolic control, making diabetic adolescents particularly susceptible to eating disorders.[18]

In the studied group, the highest nutritional inadequacy was observed among adolescents, especially in the 15-19 years old group. A high proportion of individuals in this age group purchase or do not snack at school. Despite that the analysis of meal composition was not carried out in this study, it is possible that the nutritional quality of snacks purchased at many school cafeterias is inadequate. In addition, the non-consumption of these snacks can increase the chances of hypoglycemia due to long periods without food, jeopardizing the proper disease control.

Besides the non-consumption of snacks, another improper feeding practice was the habit of "snacking", reported by many of the evaluated participants. This habit can harm the glycemic control of these individuals because meal times should be synchronized with the profile of insulin used; it has been observed that the habit of consuming sucrose and some types of school snacks negatively influence the glycemic control.[19]

Conversely, when the distribution of dietary macronutrients was analyzed, the average percentage of carbohydrate consumption has not exceeded the recommended upper limit as also reported by other authors.[20-23] This is possibly due to the increased consumption of carbohydrates occurs simultaneously to other macronutrients. Because the main dietary source of pure carbohydrate is sucrose, and most participants have a restricted intake of it, the consumption of carbohydrates is at the expense of breads, crackers, rice, and pasta. The increased consumption of these preparations is usually associated with the increased intake of margarine, meats, sauces and, consequently, fats and proteins. Thus, the in-

creased percentage of carbohydrate intake may have occurred parallel to other macronutrients, keeping the percentage intake of carbohydrates within the recommended range or even below.

The average fiber intake was satisfactory for the entire studied population, being higher than that observed for several authors.[15,20-22,24] This result reveals a positive aspect of the diet of these individuals because adequate fiber intake may contribute to disease control. The adequacy of fiber intake was mainly due to the regular bean consumption by the diabetics in this study. The average bean consumption was 194.6 ± 78.2 g/day (data not shown), which provides 16.5 g fiber/day.[8] This represents more than 50% of the fibers average intake in the studied population. Thus, this typical habit of the Brazilian population can explain the higher fiber intake recorded in this survey compared to those in international studies. In a cross-sectional study involving 722 non-diabetic Brazilian adolescents, the excessive intake of fat and non-habitual consumption of beans was associated with insufficient consumption of fibers.[25] These results show the importance of encouraging the maintenance of this habit in our population.

The low protein intake observed in the 15-19 age group was related to the reduced relative share of dairy products in the total food consumption by adolescents. Nevertheless, the average intake in the three age groups is close to the recommendation and that reported in other studies.[15,20-23] Two parameters are classically used to estimate protein diet recommendation:% of VET, which can range from 10 to 30% and the recommendation of grams of protein per kilogram of weight.[26] In this study, difference in the proportion of adequacy of protein intake according to the comparative method, VET %, and g/kg was observed, suggesting that these two recommendations are not equivalent. These differences would be especially evident in a prescription diet with restricted amounts of protein, necessary for some patients, and corroborating this divergence.

Concerning fats, although more than 50% of respondents present intake ≥ 30% of VET, the average percentage was less than that obtained in other studies.[21-23] Such a comparison is, however, difficult because in addition to differences in eating habits, the percentage of dietary lipids recommended in the literature ranges from 25 to 35%[20], < 30%[22.23], 30 to 35%, and < 35%[2] of VET[21]. Therefore, one can assume that diets with more liberal amounts of fats may have been prescribed, which may have contributed to the high average percent intake in some studies.

The significant low proportion of the dairy group in total food consumption of adolescents aged 15 to 19 years was also related to the low consumption of saturated fats and low cholesterol intake found in girls of that age. The mean percentage intake of saturated fat was lower than that found by other authors,[21-23] that may also be due to differences in eating habits between our population and others in international studies. The evaluation of the percentage of saturated fat intake against the current trend of consumption reduction (<7% VET) resulted in a significant increase in the proportion of individuals who exceeded the maximum recommended. In addition, cholesterol intake exceeded the recommendation on a significant percentage of the population, although lower than that reported in other studies.[21,24]

The average intake of monounsaturated fat was lower than the current recommendation and highlighted in other studies.[22,23] The high prevalence of individuals with total and saturated fat intake was higher than the recommendations and suggests that the studied population is at increased risk for dyslipidemia and cardiovascular diseases considering that saturated fat is a major dietary determinant of LDL cholesterol plasma levels.[3]

Another important factor related to the occurrence of dyslipidemia is overweight. Although the prevalence of overweight in this population was low, an association between overweight and increased fat intake was observed. Considering that child overweight is an independent predictor of the development of dyslipidemia in adulthood,[27] the need for the periodic monitoring of nutritional status in this population is even more evident.

Considering the current recommendations suggesting that the consumption of monounsaturated fat as the main source of dietary fat and reduced consumption of saturated and trans fats, we observed that the feeding lipid profile of the studied population was not adequate.

CONCLUSION

The occurrence of bad eating habits among the studied participants and diet consumption with poor lipid profiles were observed. Given the importance of maintaining proper metabolic control and increased risk of cardiovascular disease, the investment in guiding this population about the dietary pattern and improved fat intake quality is necessary.

Simultaneous educational work with families is necessary to help patients complying with these guidelines in order to involve them in treatment and supporting and encouraging regular diet adherence and maintenance of dietary plans.

REFERENCES

1. Patterson CC, Dahlquist GG, Gyürüs E, Green A, Soltész G, the EURODIAB Study Group. Incidence trends for childhood type 1 diabetes in Europe during 1989—2003 and predicted new cases 2005-20: a multicentre prospective registration study. Lancet. 2009; 373(9680):2027-33.
2. Smart C, Aslander-van VE, Waldron S, Swift P. Nutritional management. Global IDF/ISPAD Guideline for Diabetes in Childhood and Adolescence. 2011; 31:S67-9.
3. American Diabetes Association. Standards of Medical Care in Diabetes 2013: position statement. Diabetes Care. 2013; 36 (Suppl 1):S21-3.
4. Nutrition Subcommittee of the Diabetes Care Advisory Committee of Diabetes UK. The implementation of nutritional advice for people with diabetes. Diabet Med. 2003; 20:786-807.
5. Wheeler ML, Dunbar SA, Jaacks LM, Karmally W, Mayer-Davis EJ, Wylie-Rosett J, et al. Macronutrients, Food Groups, and Eating Patterns in the Management of Diabetes: A Systematic Review of the Literature, 2010. Diabetes Care. 2012; 35:434-45.
6. Jellife DB. Evaluacion del estado de nutrición de la comunidad. Ginebra: Organizacion Mundial de la Salud; 1968.
7. Bray GA, Grey DS. Obesity. Part I – Pathogenesis. West J Med. 1988; 149:429-41.
8. Monteiro, JBR, Esteves E. Diet Pro, versão 4.0: Sistema de suporte à avaliação nutricional e prescrição de dietas. A Agromídia Software; 2001.
9. Ribeiro AB, Cardoso MA. Construção de um questionário de freqüência alimentar como subsídio para programas de prevenção de doenças crônicas não transmissíveis. Rev Nutr. 2002; 15:239-45.
10. Monteiro JP, Pfrimer K, Tremeschin MH, Molina MC, Chiarello P. Consumo Alimentar. Visualizando porções. Rio de Janeiro: Guanabara Koogan; 2007.
11. National Research Council. Recommended Dietary Allowances. 10th ed. Washington: National Academy Press; 1989. 284p.
12. Philippi ST, Latterza AR, Cruz ATR, Ribeiro LC. Pirâmide alimentar adaptada: guia para escolha dos alimentos. Rev Nutr. 1999; 12:65-80.
13. World Health Organization. Report of a Joint FAO/WHO/UNU Expert Consultation. Human energy requirements. Food and nutrition technical reports series. Rome: WHO; 2001. 96p.
14. Johansson L, Solvoll K, Bjorneboe G-EAa, Drevon CA. Under- Under and overreporting of energy intake related to weight status and lifestyle in a nationwide sample. Am J Clin Nutr. 1998; 68:266-74.
15. Orbey NC, Margeirsdottir HD, Brunborg C, Andersen LF, Dahl-Jorgensen K. The influence of dietary intake and meal pattern on blood glucose control in children and adolescents using intensive insulin treatment. Diabetologia. 2007 Oct; 50(10):2044-51.
16. Buyken AE, Toeller M, Heitkamp G, Karamanos B, Rottiers R, Michele Muggeo, et al. Glycemic index in the diet of European outpatients with type 1 diabetes: relations to glycated hemoglobin and serum lipids. Am J Clin Nutr. 2001; 73:574-81.
17. Gambardella AMD, Frutuoso MFP, Franch C. Prática Alimentar de Adolescentes. Rev Nutr. 1999; 12:5-19.
18. Jack Jr L. Biopsychosocial factor affecting metabolic control among female adolescents with type 1 diabetes. Diabetes Spectrum. 2003; 16:154-6.
19. Queiroz KC, Silva IN, Alfenas RCG. Associação entre fatores nutricionais e o controle glicêmico de crianças e adolescentes com diabetes melito tipo 1. Arq Bras Endocrinol Metab. 2010; 54: 319-25.
20. Hegelson VS, Viccaro L, Becker D, Escobar O, Siminerio L. Diet of adolescents with and without diabetes. Trading candy for potato chips? Diabetes Care. 2006; 29:982-87.
21. Forsander G, Malmodin B, Eklund C, Persson B. Relationship between dietary intake in children with diabetes mellitus type 1 their management at diagnosis, social factors, anthropometry and glycaemic control. Scand J Nutr. 2003; 47:75-84.
22. Mayer-Davis EJ, Nichols M, Liese A, Bell R, Dabelea D, Johansen J, et al. Dietary intake youth with diabetes: the SEARCH for diabetes in youth study. J Am Diet Assoc. 2006; 106:689-97.
23. Lodefalk M, Aman J. Food habits, energy and nutrient intake in adolescents with type 1 diabetes mellitus. Diabet Med. 2006; 23:1225-32.
24. Saito M, Kuratsune H, Nitta H, Kawahara K, Hamano M, Matsuda M, et al. Plasma lipid levels and nutritional intake in childhood and adolescence-onset young type 1 diabetic patients in Japan. Diabetes Res Clin Pract. 2006; 73(1):29-34.
25. Vitolo MR, Campagnolo PDB, Gama CM. Fatores associados ao risco de consumo insuficiente de fibra alimentar entre adolescentes. J Pediatr (Rio J). 2007; 83:47-52.
26. Institute of Medicine, Food and Nutrition Board. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (macronutrients). Washington: National Academy of Sciences; 2005.
27. Haney EM, Huffman LH, Bougatsos C, Freeman M, Steiner RD, Nelson HD. Screening and treatment for lipid disorders in children and adolescents: systematic evidence review for the US Preventive Service Task Force. Pediatrics. 2007; 120:189-207.