Adolescent runway models: how is the food intake of this group?

Adolescentes modelos de passarela: como é o consumo alimentar deste grupo?

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ABSTRACT

Objective: To evaluate the adequacy of energy, macro and micronutrients intake in adolescent runway models.

Methods: This cross-sectional study enrolled 33 models and 33 non-models, with ages ranging from 15 to 18 years, paired by age and body mass index (BMI). Food intake was evaluated by a three-day food record. The average energy values were estimated in kcal, the proportional values of macronutrients as to the total caloric value of the consumed diet were also calculated, as well as the mean/medium values of the following micronutrients: calcium, iron, zinc, phosphorus, magnesium, folate, vitamin D, vitamin C, vitamin A and vitamin E.

Results: Among the studied adolescents, 24% presented BMI below the minimum values for the age. Mean energy intake was lower among the models compared to non-models (1,480.93±582.95 *versus* 1,973.00±557.63 kcal) ($p<0.05$). The fat intake, higher than the recommended, was similar in both groups (30.3% in models and 36.4% of the non-model adolescents – $p>0.05$). The inadequate consumption of micronutrients such as calcium, iron, zinc, magnesium, phosphorus, liposoluble vitamins, folate and ascorbic acid was observed in both groups.

Conclusions: The low energy intake (kcal) among models and the insufficient intake of minerals and vitamins are red flags for model agencies to be more committed to the health of these adolescents, ensuring that they get nutritional and medical follow-up.

Key-words: adolescent; eating; nutrients

RESUMO

Objetivo: Avaliar a adequação da ingestão de energia, macro e micronutrientes em adolescentes modelos de passarela.

Métodos: Estudo transversal de 33 adolescentes modelos e 33 não modelos, de 15 a 18 anos, pareadas por idade e índice de massa corpórea (IMC). A ingestão alimentar foi avaliada por meio de registro alimentar de três dias, sendo calculados os valores médios de energia, em kcal, os valores proporcionais dos macronutrientes em relação ao valor calórico total da dieta consumida, bem como os valores médios/medianos dos seguintes micronutrientes: cálcio, ferro, zinco, fósforo, magnésio, folato, vitamina D, vitamina C, vitamina A e vitamina E.

Resultados: Verificou-se que 24% das adolescentes do estudo apresentaram IMC abaixo dos valores mínimos para a idade. A média de ingestão de energia foi menor entre as modelos, em comparação às adolescentes não modelos (1.480,93±582,95 *versus* 1.973,00±557,63 kcal) ($p<0,05$). A ingestão de gorduras acima do recomendado foi semelhante entre os grupos – 30,3% das adolescentes modelos e 36,4% das adolescentes não modelos ($p>0,05$). O consumo

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inadequado de micronutrientes como o cálcio, ferro, zinco, magnésio, fósforo, vitaminas lipossolúveis, folato e ácido ascórbico ocorreu em ambos os grupos.

Conclusões: A baixa ingestão energética (kcal) entre as modelos e a ingestão insuficiente de minerais e vitaminas alertam para que as agências de modelos comprometam-se com a saúde dessas adolescentes, garantindo um acompanhamento médico e nutricional.

Palavras-chave: adolescente; ingestão de alimentos; nutrientes.

Introduction

Adolescence is a stage of life that is characterized by increased nutritional requirements and changes in body composition and during this period adequate energy intake is extremely important for growth and to maintain energy balance. During this phase, imbalances between dietary intake and energy expenditure have negative impacts on health, such as underweight, obesity or eating disorders[1]. Despite this, a number of studies have found the nutritional intake of adolescents to be inadequate[2,3]. Bertin *et al* assessed the nutritional intake of adolescents and found that the mean energy expenditure of female adolescents was 2,299.40 kcal±571.80 and that their intake of fats was above the levels recommended for their age group[4].

Adolescents' vitamin requirements are increased during anabolism and energy production. However, this age group tends not to consume sufficient quantities of these nutrients[1,3]. Studies have been conducted in Brazil to investigate micronutrient ingestion among adolescents and have shown that their intake of many different vitamins and minerals is insufficient[5-7].

In Brazil, the dietary habits of adolescent models are being studied by the "model health" project[8,9]. Madeira compared dieting among models and non-models with a mean age of 15 years and observed that the models dieted for weight loss more often than adolescents who were not models[8]. In another study undertaken in order to assess the dietary habits of models and also their dietary preferences, it was found that rice, bread and sugar were the foods they ate most (daily). Around 50% of the study population reported daily consumption of milk and dairy products. When these models were asked what the foods they most liked to eat, it was found that the most frequently mentioned food was chocolate and that they associated it with weight gain[9].

Previous research carried out as part of the project mentioned above focused on a qualitative assessment of the diet and did not publish data on the adequacy of the nutritional intake of this subset of adolescents who are considered at nutritional risk because of the thinness demanded by their profession. The objective of this study was to assess the adequacy of female adolescent runway models' energy intake, macronutrient intake and micronutrient intake and compare them with adolescents who are not models, identifying any differences between them in terms of the outcome "dietary intake".

Methods

This was a cross-sectional study of a population sample made up of female adolescents, half of whom were models and half of whom were not. The models were selected from agencies that took part in the Model Health project run by the Universidade Federal de São Paulo (Unifesp) Adolescent Care and Support Center (CAAA - *Centro de Atendimento e Apoio ao Adolescente*) from April of 2004 to April of 2005. Since 1997 this project has been developing a multidisciplinary integrated healthcare program for models and aspiring models. The criteria used to recruit models to the study were as follows: females aged from 15 to 18, with menarche more than two years previously, working as a runway model for at least six months in the city of São Paulo and living in an apartment run by a modeling agency or sharing with other models. Exclusion criteria were: chronic diseases, recent, self-reported weight loss or eating disorders[10].

The control group was recruited from public and private schools in the city of São Paulo and comprised adolescent girls paired with the models for age and body mass index (BMI) (within the same BMI percentile for age and sex). The decision to pair for BMI or, in other words, to choose thin adolescents for the control group, sprang from the question of what the repercussions of choosing this profession might be for dietary intake. The exclusion criteria for the control group were similar to those for the models.

The models were sampled by convenience and the sample size was estimated on the basis of the mean number of adolescents per apartment (n=10), the number of apartments per agency (n=1) and the number of agencies taking part (n=5). After visiting the agencies' apartments, 41 models who fit the inclusion criteria were identified. Two of them refused to take part in the project and six failed to attend one of their appointments. It should be pointed out that

the initial patient histories of the adolescents who did not attend indicated that their characteristics were similar to the remainder of the study group who did attend.

In order to recruit the controls, around 1,000 adolescent girls were measured and weighed. Initially, 33 adolescents who met the inclusion criteria were selected at random and then any girl who refused to participate or did not attend for tests was replaced by another adolescent, also selected at random.

This study was analyzed and approved by the Research Ethics Committee at the Unifesp under protocol number 0989/03.

The variables analyzed were socioeconomic status, weight, height, BMI, metabolic rate at rest and food diary results. Socioeconomic status was classified according to the criteria defined by the Brazilian Association of Market Research Companies (ABEP - *Associação Brasileira de Empresas de Pesquisa*)[11].

Weight (kg) was measured on an electronic balance. Height was measured in centimeters using a Sanny® extendable wall stadiometer. Body mass and height were then used to calculate BMI (kg/m^2) which was classified according to the 2000 CDC growth charts[12].

Metabolic rate at rest (MRR) was evaluated at the Unifesp Psychobiology and Exercise Research Center (CEPE – *Centro de Estudos em Psicobiologia e Exercício*) using indirect respiratory calorimetry and the result was calculated using Weir's equation[13].

Nutritional intake was assessed on the basis of a three-day food diary which participants were requested to complete when they attended for recruitment screening. The lead author instructed the adolescents on how to complete their diaries; including which days should be recorded (two weekdays and one day on the weekend), mealtimes, foods eaten, quantities and brands, where possible. The food diaries were used to calculate mean energy intakes, in kcal, and intakes of the macronutrients carbohydrates, protein and lipids, as a proportion of the total calorie content of the diet, in addition to mean/median intakes of the micronutrients calcium, iron, zinc, phosphorous, magnesium, folate, vitamin D, vitamin C, vitamin A, vitamin E and dietary fiber. The Nutrition Data System for Research software package was used to perform these calculations[14].

Energy requirements were calculated on the basis of metabolic rate at rest measured using indirect calorimetry and the physical activity level proposed by the *Food and Agriculture Organization of the United Nations* (FAO)[15]. Energy intake (EI) was classified as adequate or inadequate on the basis of the mean total energy requirement (TER)±20%[16]. The appropriate Dietary Reference Intakes for the sample's age range were used to classify the adequacy of the percentages of macronutrients as a proportion of EI[17].

In line with DRI methods, mean intakes of calcium, vitamin K, vitamin D and fiber were classified according to their Adequate Intake (AI) values. All other micronutrients (vitamin C, vitamin A, vitamin E, iron, magnesium, phosphorous, folate and zinc) were classified according to their Estimated Average Requirements (EAR)[18,19].

The data obtained were initially analyzed using the Kolmogorov-Smirnov test in order to identify the distribution of variables. Continuous variables with normal distribution are shown as means plus standard deviations and Student's t test for independent samples was used to compare the adolescents who were models with those who were not. Variables with asymmetrical distributions were compared using the Mann-Whitney nonparametric test. These variables are presented as medians and confidence intervals (CI95%). The chi-square test or Fisher's exact test were used to test for associations between qualitative variables. Data were analyzed with the aid of the Statistical Package for the Social Science (SPSS), version 12.0. The level of significance was set at $p<0.05$.

Results

A total of 66 female adolescents were assessed. All were aged 15 to 18 years and 33 of them were runway models while 33 of them were not. The two groups did not differ statistically in terms of their socioeconomic status according to the Brazilian Economic Classification Criteria. Socioeconomic classes A and B accounted for 54.6% of the models and 57.7% of the control group ($p=0.80$) while classes C and D accounted for 45.4% of the models and 42.3% of the non-models ($p=0.98$).

Classifying the adolescents according to their BMI demonstrated that 24% of them had a BMI below the ideal range for their age, while 60.6% of the models and 63.6% of the control group reported engaging in physical activity ($p=0.80$). Table 1 lists the adolescents' anthropometric characteristics and their metabolic rate at rest.

Mean energy intake was 1,480.93Kcal±582.95 and 1973.00kcal±557.63, for models and non-models respectively ($p=0.001$), and 54.5% of the models and 33.0% of the non-models had low energy intake ($p>0.05$). There was no association between energy intake and socioeconomic

level nor between energy intake and nutritional status, in either group.

Analyzing the adequacy of the sample's macronutrient intake, it was observed that 97% of the models and 91% of the non-models had adequate protein intake (p=0.799). Carbohydrate intake was low in 12.1% of the models and 9.1% of the non-models (p=0.414). With regard to lipids, it was found that 30.3% of the models and 36.4% of the non-models ate more fat than is recommended (p=0.631). Table 2 lists mean dietary fiber and micronutrient intakes. Median vitamin C intake was 58.86mg (95%CI: 66.45 to 495.32) for the models and 62.97mg (95%CI: 45.99 to 228.38) for non-models (p=0.964). Similar proportions of models and non-models had mean intakes of dietary fiber, calcium, vitamin K and vitamin D that were below the recommended AI (p>0.05, Figure 1).

Analysing the percentages of inadequate micronutrient intakes, we observed that more models had inadequate zinc intake than non-models (p=0.017). There were no statistically significant differences between the groups in terms of the percentage with inadequate phosphorous, magnesium, vitamin A, vitamin E or folate intakes (Figure 2). Figure 3 illustrates the analysis of iron and vitamin C intakes.

Discussion

One constant and interesting feature of the Model Health project has been the insight gained into the repercussions of the profession of model for the nutritional status of adolescent models[8-10]. The metabolic data collected in this study demonstrate that even having a biotype typical of models these adolescent girls have a comparable metabolic rate at rest to non-models. Despite this, the models' mean energy intake was significantly lower than that of the adolescent girls who were not models (1480.9 versus 1973.0 kcal). These results demonstrate that the groups have similar requirements but different intakes and it is probable that living with the family is a protective factor against insufficient nutritional intake. Notwithstanding, even the group of adolescent girls who are not models and live with their families had energy intake levels that were below the requirements of this stage of life, or borderline (~1900kcal).

Since we are dealing with models, it is assumed that the low calorie intake will be related to a range of different factors. One of these factors would be weight watching or weight loss demanded by modeling agencies and fashion designers. It should also be understood,

Table 1 – Anthropometric characteristics and metabolic rate at rest

	Non-models (n=33)				Models (n=33)			
Variables	**Minimum**	**Maximum**	**Mean**	**SD**	**Minimum**	**Maximum**	**Mean**	**SD**
Age (years)	15.00	18.60	16.76	1.02	15.00	18.90	16.77	1.05
Body mass (kg)	37.70	57.30	47.72	5.05	45.80	66.20	55.72**	4.53
Height (cm)	150.00	174.00	163.52	6.24	170.00	183.00	175.33**	3.47
BMI (kg/E²)	16.27	20.54	17.80	1.05	15.64	21.03	18.10	1.19
MRR (Kcal/d)	654.00	2293.80	1309.43	409.44	643.00	1912.20	1367.22	285.84

**p<0.01 according to the t test; BMI: body mass index; MRR: metabolic rate at rest (daytime); SD: standard deviation.

Table 2 – Mean dietary fiber and micronutrient intakes, by study group

Variable	Non-models (n=33)				Models (n=33)			
	Minimum	**Maximum**	**Mean**	**SD**	**Minimum**	**Maximum**	**Mean**	**SD**
Fiber (g)	7.55	35.01	15.83	6.28	2.57	35.88	16.25	7.73
Ca (mg)	14.12	1449.46	723.27	319.90	195.11	1605.61	744.20	325.78
Mg (mg)	94.61	444.84	243.91	84.20	62.75	423.38	211.74	84.37
P (mg)	522.78	1834.77	1068.41	328.42	370.43	1934.32	969.93	361.73
Fe(mg)	5.12	22.99	13.72	4.58	2.61	22.34	9.62**	4.23
Zn (mg)	3.74	18.77	10.52	3.92	2.27	13.33	7.47**	2.84
Folate (µg)	159.18	760.95	387.62	135.61	56.02	861.16	313.11	188.02
Vit. A (µg)	149.02	1528.81	509.35	287.30	165.12	3053.60	859.20**	640.41
Vit. E (mg)	1.60	10.89	4.83	1.80	1.08	8.34	3.85*	1.74
Vit. K (mg)	26.72	610.35	100.71	102.74	16.38	152.90	66.02	36.67
Vit. D (µg)	0.42	5.66	2.68	1.51	0.70	10.44	3.54	2.57

* p<0.05 according to the t test; **p<0.01 according to the t test; SD: standard deviation.

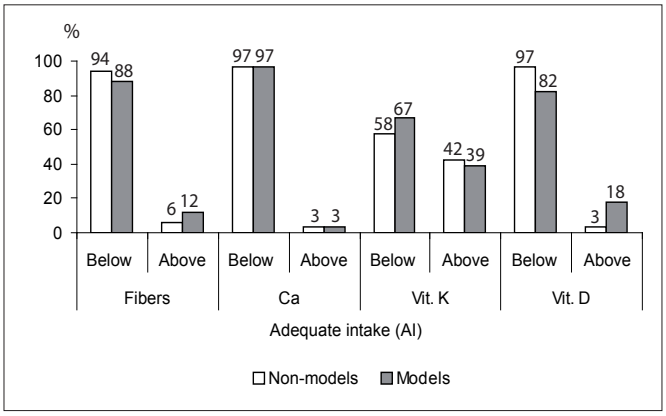

Figure 1 – Distribution of adolescents (%) by fiber, calcium, vitamin K and vitamin D intakes. According to the chi-square test or Fisher's exact test: $p>0.05$

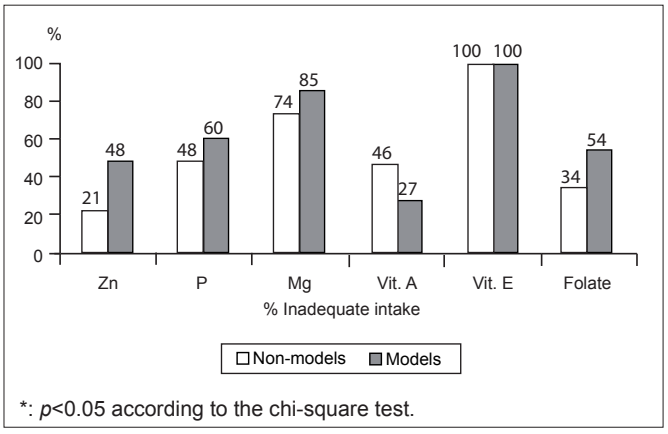

Figure 2 – Distribution of adolescents (%) by inadequacy of zinc, phosphorous, magnesium, vitamin A, vitamin E and folate intakes.

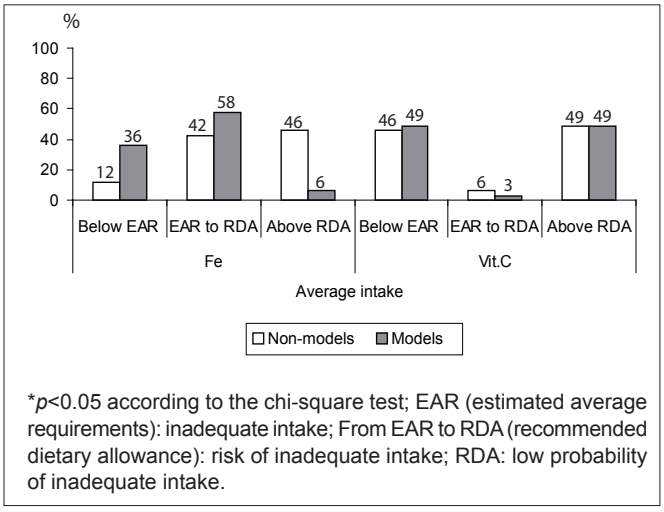

Figure 3 – Distribution of adolescents (%) by iron and vitamin C intakes.

however, that the fact that this profession does not have a regular routine and so models often lack the time to prepare food and also the inexperience of these adolescents in preparing meals may also contribute to insufficient nutritional intake[10]. This being so, the agencies should be providing models who live in their apartments with their main meals.

Research into the energy intake of adolescents has shown that energy intake is variable during this phase of life. A study conducted in the city of Florianópolis, Santa Catarina, Brazil, found that more than 50% of a sample of 403 adolescent girls enrolled at public and private schools had energy intakes below their requirements[20] . Another study conducted in the state of Paraná with adolescents aged 15 to 17 years found that 13% had energy intakes that were greater than the recommended level, while 60% had below-recommended calorie consumption[2].

Inadequate (too low) nutritional intake for intermediate lengths of time does not necessarily lead to malnutrition, because of the body' adaptation mechanisms. However, if maintained for prolonged periods, it can lead to the physical signs of malnutrition[21]. Seen from this perspective, it is believed that adolescent models go through periods of privation, of normal eating and of excessive energy intake, depending on how their workload fluctuates (fashion shows, catalogue launches, etc.) which may be preventing them from exhibiting malnutrition.

Although inadequate energy intake was observed in this study, it should be remembered that these dietary data should be viewed with caution, since the food diaries may have been subject to missing meals or other food intake, despite the fact that this is one of a most widely used methods in nutritional studies[22]. Furthermore, the reduced sample size contributed to these results. Despite this limitation, it is still worth pointing out that these data may be of use for future studies, in addition to being a first step in elucidating the influence of the modeling profession on adolescents' nutritional intake.

With regard to macronutrient intakes, we observed that the two groups were similar in this respect. More than 90% of both groups had adequate protein intake. Other studies of adolescents have found varying results for protein intake[20,23].

Under consumption of carbohydrates was detected in 12.1% of the models and 9.1% of the girls in the control group. International studies have shown low carbohydrate

intake among adolescents[3,24]. One study conducted in Brazil with adolescents from both public and private schools observed that around 30% of the population had inadequate (too low) carbohydrate intake. The authors made it clear that this nutrient is essential for adolescents[20]. In contrast, another recent study of adolescents in public schools in South of Brazil observed that less than 15% of them (n=422) had inadequate carbohydrate intake[4]. For adolescent models who are working at shows, doing tests and going to fittings almost every day, an adequate intake of this nutrient is essential to replace the energy spent during their daily routines.

With regard to lipids, around 30% of the adolescent girls in both groups ate an excessive quantity of fats in relation to the total calorie content of their diets. Similar results have been observed in other studies[20,23]. In the case of these models, easily prepared foods such as instant noodles or biscuits with fillings, which contain excessive quantities of fat, are a routine part of the diet[9].

Both groups had dietary fiber intakes below the recommendation for their age group (~16g/day - Table 2). A study conducted with adolescents in a provincial city in the state of Rio Grande do Sul observed that 69% of the 426 girls assessed had fiber intake below the recommendation; the low quantities of beans eaten contributed to this result[25]. Clinical contacts made by the Model Health team lead to the consideration that the low consumption of fiber among the models may be related with the substitution of meals (that include beans and greens) for unhealthy snacks and to the small quantity of fruit eaten during the day, especially on days when they are working, when the typical packed lunch will contain biscuits or cereal bars.

With regard to micronutrients, a great proportion of the adolescent girls in both groups had intakes below their DRIs, without significant differences between the groups. Mean calcium intake was low in both groups (approximately 700mg/day). These results are in line with other studies undertaken in Brazil, which have revealed low consumption of dairy products, and consequently low calcium intake among adolescents[26,27]. Mean magnesium and phosphorous intakes were also below the levels recommended for this age group, as were vitamins D and K. In common with calcium, three nutrients are important for the process of bone mineralization which takes place at this age[28]. Nevertheless, few studies of adolescents have analyzed their intake of these minerals[3].

Mean iron intake was lower among the models (~9mg/day) than among the non-models (~13mg/day). The qualitative analysis of iron intake showed that a significant number of models had mean intakes below the EAR. Studies conducted both here in Brazil and internationally have shown inadequate iron intake among adolescents[3,29]. An earlier study of 110 models showed a 15.5% prevalence of anemia, which is a worrying figure when one is dealing with models whose daily routine is one of tests and shows that often take the entire day and may contribute to inadequate nutrition because of missing meals that are important for iron intake (such as a midday meal).

In common with iron, zinc intake was significantly lower among the models (~7mg/day) in comparison with the non-models (10mg/day). Approximately 50% of the models and 20% of the non-models had an inadequate intake of this mineral. Urbano *et al* studied adolescents of both sexes and found that 79% of the 28 girls studied had inadequate zinc intake[7]. Zinc is also found in foods that tend to be a part of main meals (meat, eggs) and intake levels may be reduced by models missing or substituting these meals because of shows and tests.

Approximately 50% of both groups had vitamin C intake below the estimated average requirement. Folate intake was similar for both groups. Inadequate intakes of these vitamins have also been demonstrated in other studies with adolescents[6,30] and may be associated with missing meals, and, as a result, eating little fruit and dark-green vegetables. It should also be pointed out that, in the experience of the Model Health project members, even when adolescents eat at home, they do not always eat vegetables because they are considered troublesome to prepare. These types of food tend to be eaten when the models eat at restaurants that give them agency-linked discounts, which is not always an option because of the locations of these establishments or even because of financial considerations.

With regard to vitamins A and E, the qualitative assessment of these nutrients showed that 46% of the non-models and 27% of the models had inadequate Vitamin A intake and that 100% of the adolescents in both groups had inadequate vitamin E consumption. Studies show that intakes of these vitamins are generally deficient in adolescents[1,3].

The results of this study show that both adolescent girls who are models and adolescent girls who are not models had inadequate dietary habits and that both groups are

in need of nutritional guidance. Although lean adolescents do not always seek professional healthcare with the objective of modifying their dietary habits, adolescent models are now under more "pressure" to seek medical and nutritional help, with the objective of avoiding eating disorders, and this may facilitate access to appropriate nutritional information.

In the case of the models, these results should be a warning to their agencies about the importance of committing to the health of these adolescent girls. It is recommended that the agencies provide, as the very least, the models' main daily meals and medical care and nutritional monitoring. It is also important that nutritional intake be assessed using other methods, due to the variability of models' dietary intake caused by their profession's lack of a fixed routine.

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