

Rev Biomed 2005; 16:71-77.

Low consumption of milk, fruit and vegetables, and reduced calcium, iron and zinc intake in female teenage athletes and Mexican karate competitors.

Original Article

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SUMMARY.

Objective.- The purpose of this study was to assess the food and nutrient intake of female Mexican teenage athletes and Mexican teenage karate competitors and to compare these levels during training and non-training periods.

Subjects and methods.- Members of the men's and women's karate team and teenage female athletes competing locally in the city of Tijuana, Mexico were studied. Dietary intake was assessed by a 3-day food record obtained during training and non-training days. Food intake was recorded using household measures.

Results.- Mean energy intake of the karate participants was 2,234 kcal (± 580), and 2097 kcal (± 722) for the athletes ($p = 0.20$). A higher intake of fat and saturated and polyunsaturated fatty acids was observed during non-training days ($p < 0.05$). Average intakes of iron and zinc were lower than the Recommended Dietary Allowance (RDA), 12% of

the sample reported intakes of iron and zinc lower than the 70% of the RDA, and 38% had calcium intakes $< 70\%$ of the RDA. Average daily intakes of grains and cereals were 11; fruit, 1.8; vegetables, 1; milk and milk products, 1; and meat and meat products, 4. More than 90% of all teenagers had vegetable intake amounting to less than three portions per day. More than 80% had milk and dairy products that were less than three portions per day. More than 60% had fruit intake of less than two portions per day, and more than 90% had meat and meat substitute intake greater than the recommended two portions per day.

Conclusion.- Higher intakes of low-fat meat, legumes, low-fat milk and dairy products, as well as fruits and vegetables, are highly recommended for this age group. (*Rev Biomed* 2005; 16:71-77)

Key words: Dietary intake, food consumption, nutrient intake, Mexican teenagers, sports nutrition.

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Received January 17, 2005; Accepted April 29, 2005.

This paper is also available at <http://www.uady.mx/sitios/biomedic/revbiomed/pdf/rb051621.pdf>

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RESUMEN.

Bajo consumo de leche, frutas, vegetales e ingesta reducida de calcio, hierro y zinc en atletas femeninas adolescentes y competidores adolescentes mexicanos de karate.

Objetivo.- Evaluar la ingestión de alimentos y nutrimentos de atletas adolescentes mexicanas y de competidores adolescentes mexicanos de karate y comparar estos niveles en periodos de entrenamiento y de no entrenamiento.

Sujetos y métodos.- Se estudiaron a miembros de uno y otro sexo del equipo de karate y a atletas adolescentes del sexo femenino, que compitieran localmente en la ciudad de Tijuana, México. La ingestión dietética fue evaluada por medio de registros de alimentos de 3 días, obtenidos tanto durante la temporada entrenamiento como en la de no entrenamiento.

Resultados.- El consumo fue estimado usando utensilios caseros como medidas. El consumo energético medio de los participantes de karate fue de $2,234 \pm 580$ kcal, y de $2,097 \pm 722$ kcal para los atletas ($p = 0.20$). Se observó una mayor ingesta de grasa y de ácidos grasos saturados y polinsaturados durante los días en que no había entrenamiento ($p < 0.05$). Los consumos promedio de hierro y zinc fueron inferiores a las ingestiones diarias recomendadas (IDR), el 12% de los participantes reportaron consumos de hierro y zinc menores que el 70% de las IDR, y el 38% tenía consumos de calcio menores que el 70% de las IDR. El consumo diario promedio de granos y cereales fue de 11 porciones; frutas, 1.8; verduras, 1; leche y productos lácteos, 1; y carnes y sustitutos cárnicos, 4. Más del 90% de todos los adolescentes tenían consumos de verduras de menos de tres porciones al día. Más del 80% consumía leche y productos lácteos que representaban menos de tres porciones al día. Más del 60% tenía consumos de fruta inferiores a 2 porciones por día, y más del 90% consumía más de las dos porciones recomendadas por día.

Conclusiones.- Para este grupo de edad se recomienda sobremanera una ingesta mayor de carne

baja en grasa, leguminosas, leche y productos lácteos bajos en grasa, así como fruta y verduras.

(Rev Biomed 2005; 16:71-77)

Palabras clave: Ingestión dietética, consumo de alimentos, ingestión nutrimental, adolescentes mexicanos, nutrición para el deporte.

INTRODUCTION.

Several authors have expressed concern over the lack of formal studies of dietary intake and nutritional practices of athletes (1, 2). The effect of intensive exercise on dietary fat intake depends on the gender and physical activity of the population. Female athletes usually get less of their energy from fat than their sedentary counterparts (3). Football players seem to have even higher fat intake than sedentary individuals (4). Benardort (5) suggested that young athletes, especially those actively involved in training and talented enough to be considered "elite", without careful monitoring by an appropriate multidisciplinary team may be placed at high risk of disease (5). During early puberty, children may gain up to 20% of their final adult height, and this stage is affected by nutritional factors such as intake of energy, protein, and trace elements. Deficient intake may delay pubertal development, impede growth and muscle development, and affect cognitive performance (6, 7). Therefore, teenage athletes should be monitored nutritionally during training and non-training periods. In a study conducted among ninth-grade students in the state of Baja California, an overall low intake of milk, fruit and vegetables was shown (8, 9).

To our knowledge nutrient and food intake has not been studied in athletically competitive Mexican teenagers. The present study surveyed the dietary intake of athletes and karate participants during training and non-training periods.

SUBJECTS AND METHODS.

This study was carried out during March and

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April 2000 in Tijuana, Baja California, the northwestern-most Mexican City that borders the U.S. state of California.

Subjects. Men and women from the karate team and women from the athletic team from Tijuana participated in the study. Informed consent was obtained from the parents of nine boys (12–17 years) and four girls (13–18 years) from the karate team and eight female athletes (12–17 years). The average weight of the participants was 58 kg for males (44–82 kg) and 51 kg for females (37–59 kg).

Dietary assessment. Dietary intake was assessed by means of a 3-day food record (consecutive days including one weekend day) obtained during training and by 3-day food record during non-training days. The same three days of the week were used for both training and non-training days. Teens were trained by a nutritional expert to record a 3-day food record. Portion sizes were estimated using household measures. Food records were analyzed for energy and nutrient intake using Nutritionist Five Version 2.2 for Windows. In addition to energy intake, dietary intake of the following nutrients was evaluated: carbohydrate, fats (saturated, monounsaturated, polyunsaturated), protein, calcium, iron, and zinc. For macronutrients, total grams and percentage of total energy were

calculated. Food group intakes were compared to the recommendations of the La Manzana de la Salud (The Apple of Health) (10, 11). The Manzana de la Salud is an illustrated dietary guideline designed by the Instituto de Nutrición de Baja California to encourage Mexicans in the northwestern part of Mexico to meet the nutrient recommendations. Quantitative and qualitative evaluation of La Manzana de la Salud has been conducted in healthy women from different socioeconomic backgrounds (10). The Apple of Health guideline shows three main meals a day that include at least one group of foods (cereals and grains, fruit, vegetables, milk and dairy products, and meat and meat products) in each meal (10, 11).

Statistical analysis. Data are presented as means \pm standard deviation. Statistical analysis was carried out using SPSS statistical software package (SPSS for Windows, Version. 10). The mean differences of intake between training and non-training days were analyzed using the Mann-Whitney test.

RESULTS.

Twenty-one athletes and teenage karate competitors completed 121 food records. Mean energy intake during training was 2,094 (± 632) kcal,

Table 1
Mean dietary intake of energy, macronutrient, and micronutrient intake in karate participants.

Nutrient	Training Mean \pm SD	Non-Training Mean \pm SD	<i>p</i>*	Total Mean \pm SD
Energy, kcal	2133 \pm 315	2329 \pm 414	0.79 ¹	2237 \pm 317
Protein, g	90 \pm 16	94 \pm 23	0.50 ²	92 \pm 16
Fats, g	78 \pm 16	93 \pm 17	0.05 ¹	87 \pm 30
Carbohydrates, g	276 \pm 64	289 \pm 56	0.10 ¹	281 \pm 82
Saturated fat, g	28 \pm 12	33 \pm 10	0.04 ²	30 \pm 11
Monounsaturated fat, g	23 \pm 11	26 \pm 9	0.18 ¹	25 \pm 11
Polyunsaturated fat, g	13 \pm 9	17 \pm 10	0.05 ²	15 \pm 10
Calcium, mg	1052 \pm 409	1112 \pm 481	0.58 ¹	1066 \pm 566
Iron, mg	13 \pm 4	14 \pm 5	0.48 ²	13 \pm 5
Zinc, mg	13 \pm 14	12 \pm 5	0.80 ²	12 \pm 10
Fiber, g	17 \pm 12	16 \pm 8	0.56 ¹	16 \pm 10

* Mann-Whitney test

Table 2
Mean dietary intake of energy, macronutrient, and micronutrient intake in teenage athletes.

Nutrient	Training Mean ± SD	Non-Training Mean ± SD	P*	Total Mean ± SD
Energy, kcal	2036 ± 700	2159 ± 752	0.09	2097 ± 722
Protein, g	72 ± 31	77 ± 34	0.60	74 ± 32 (14)
Fats, g	101 ± 103	83 ± 40	0.09	92 ± 78 (34)
Carbohydrates, g	265 ± 107	286 ± 115	0.17	275 ± 111 (52)
Saturated fat, g	29 ± 15	28 ± 14	0.15	28 ± 15
Monounsaturated fat, g	26 ± 17	25 ± 12	0.14	25 ± 14
Polyunsaturated fat, g	13 ± 9	17 ± 14	0.05	15 ± 12
Calcium, mg	1057 ± 669	1070 ± 535	0.68	1063 ± 599
Iron, mg	11 ± 5	14 ± 6	0.14	12 ± 6
Zinc, mg	9 ± 5	11 ± 6	0.30	10 ± 5
Fiber, g	16 ± 9	18 ± 10	0.48	17 ± 10

* Mann-Whitney test

and 2,265 (±632) kcal during non-training days ($p=0.79$). Tables 1 and 2 show mean energy, macronutrient, and micronutrient intakes during training and non-training days in athletes and karate competitors, respectively. During non-training days, the teenagers competing in karate consumed more total fat (36%), saturated ($p < 0.04$) and polyunsaturated fat ($p < 0.05$) (Table 1). Female athletes also had a higher intake of polyunsaturated fat during non-training days ($p < 0.05$) (Table 2). Table

3 shows that protein and zinc intake were higher in teenagers engaged in karate ($p < 0.01$). Average intakes of iron and zinc were lower than the Recommended Dietary Allowance (RDA) (12), 12% of the sample reported intakes of iron and zinc $< 70\%$ of the RDA, and 38% had calcium intakes $< 70\%$ of the RDA.

Karate competitors (male and female) had higher intake of grains and cereals ($p < 0.0001$) while athletes had a higher intake of vegetables ($p < 0.07$).

Table 3
Mean dietary intake of energy, macronutrient and micronutrient intake in karate and teenage athletes

Nutrient	Karate Mean ± SD (%)	Athletes Mean ± SD (%)	P*	Total Mean ± SD
Energy, kcal	2234 ± 580	2097 ± 722	0.20	2180 ± 641
Protein, g	92 ± 30 (16)	74 ± 32 (14)	0.01	85 ± 32 (15)
Fats, g	87 ± 30 (35)	92 ± 78 (34)	0.51	89 ± 54 (34)
Carbohydrates, g	281 ± 82 (50)	275 ± 111 (52)	0.28	279 ± 94 (51)
Saturated fat, g	30 ± 11	28 ± 15	0.26	30 ± 13
Monounsaturated fat, g	25 ± 11	25 ± 14	0.78	25 ± 12
Polyunsaturated fat, g	15 ± 10	15 ± 12	0.77	15 ± 10
Calcium, mg	1066 ± 566	1063 ± 599	0.85	1065 ± 576
Iron, mg	13 ± 5	12 ± 6	0.39	13 ± 6
Zinc, mg	12 ± 10	10 ± 5	0.03	11 ± 9
Fiber, g	16 ± 10	17 ± 10	0.64	16 ± 10

* Mann-Whitney test

Table 4
Mean food consumption between teenage karate competitors and teenage Mexican female swimmers

Nutrient	Karate		Athletes		<i>p</i> *	Total	
	Mean	Median	Mean	Median		Mean	Median
Grains and cereals	14.5	13.5	6.5	6.5	0.001	11	11
Fruit	1.5	1.4	2.4	1.8	0.07	1.8	1.0
Vegetables	1.1	1.0	1.0	0.0	0.34	1.0	0.5
Milk and Dairy products	1.6	1.5	1.7	1.5	0.58	1.6	1.5
Meat and meat products	3.7	3.5	4.6	3.5	0.53	4.0	3.5

* Mann-Whitney test

However, all competitive karate and teenage athletes had lower intakes of fruit, vegetables and milk and dairy products (Table 4). Of the teenagers competing in karate, more than 90% had vegetable intakes of less than three portions a day. More than 80% had milk and dairy products of less than three portions daily, more than 60% had fruit intake lower than two portions a day, and more than 90% had meat and meat products intake larger than the recommended two portions a day. In addition, 98% of the teenage karate competitors consumed more than nine portions of grain products daily.

DISCUSSION.

The karate participants in this study show no statistical difference in energy, carbohydrate and protein intake between training and non-training periods. However, during non-training days higher intakes of fat and saturated fats were observed (Table 1). Among female athletes, there was no statistical difference in energy, macronutrient, and micronutrient intake; however, iron intake was lower than recommended during both training and non-training days (Table 2). This result suggests that during non-training days these Mexican teenagers increase their overall consumption of foods, mainly high-fat-containing food, which might result from increased spare time, time at home and time spent watching TV. Although energy intake in teenage karate competitors was 2237 kcal, and in athletes 2097 kcal, those figures are lower than those reported

among 15- to 18-year-old swimmers (13). In addition, the energy and protein intake was lower than the sprinters, middle-distance runners, long-distance runners, jumpers, and throwers reported by male and female elite Japanese track-and-field athletes (14), and from elite Nordic skiers (15). However, energy intake in this study was similar to female elite surfers during competition, but higher than elite surfers during training (16). These results might be due to the fact that the Mexican teenage athletes, even though they were team participants, were not considered "elite." Variations of energy intake between training and non-training periods, although not statistically significant, are consistent with the pattern of energy intake shown in other studies. In highly competitive Nordic skiers the pattern of energy intake followed the same pattern of energy expenditure (15); however, in the group of teenage Mexican athletes increased energy intake followed lower energy expenditure, possibly leading to overweight and obesity, an escalating burden to the Mexican population (17).

The average intake of iron was lower than the Recommended Dietary Allowances (RDAs), and 38% of these teenage boys and girls consumed <900 mg of calcium and 10% had zinc intake <7.7 mg. Overall average consumption of calcium, iron, and zinc was lower than in most studies of young Nordic skiers and controls (15). Iron and zinc were also lower than in male and female Japanese athletes, nationally ranked bodybuilders, and male cyclists during a 2,050 mile ride (14, 18, 19). On the other

hand, the low consumption of calcium is consistent with the low consumption of milk products in this group and in the food consumption survey conducted in the public high school in Baja California (8). Low iron and zinc intake are also consistent with the National Nutrition Survey conducted in 1999 in school children and in 12- to 49-year-old women (20).

This study also shows low consumption of milk, fruit, and vegetables along with a high consumption of grains and cereals in karate competitors of both genders and a high consumption of meat and meat products in the female athletes. These results are also consistent with a low consumption of fruit, vegetables, milk, and dairy products described in Mexican children and teenagers (8, 9). Other studies among elite Australian triathletes have shown that, during training, sandwiches, fruit, Muesli bars, and dried fruit are included in their diets (2). In the study conducted by Burke, the high carbohydrate intake of the triathletes was explained by a significantly higher intake of breads and cereal (5). Those results are consistent with the high intake of cereal and grain products reported by the teenage karate competitors. On the other hand, the greater proportion of energy from fat is explained by the increased consumption of meat and meat products, which is also consistent with the high consumption of those products in football players (21). These results, however, are not consistent with the low zinc and iron intake shown in Mexican teenagers. Thus, higher intake of legumes, low-fat meat, low-fat milk, and dairy products, as well as fruits and vegetables, are highly recommended for this group.

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