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ORIGINAL ARTICLES

# Associations between eating speed, diet quality, adiposity, and cardiometabolic risk factors

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**Objective** To assess the associations between eating speed, adiposity, cardiometabolic risk factors, and diet quality in a cohort of Spanish preschool-children.

**Study design** A cross-sectional study in 1371 preschool age children (49% girls; mean age, 4.8 ± 1.0 years) from the Childhood Obesity Risk Assessment Longitudinal Study (CORALS) cohort was conducted. After exclusions, 956 participants were included in the analyses. The eating speed was estimated by summing the total minutes used in each of the 3 main meals and then categorized into slow, moderate, or fast. Multiple linear and logistic regression models were fitted to assess the β-coefficient, or OR and 95% CI, between eating speed and body mass index, waist circumference, fat mass index (FMI), blood pressure, fasting plasma glucose, and lipid profile.

**Results** Compared with participants in the slow-eating category, those in the fast-eating category had a higher prevalence risk of overweight/obesity (OR, 2.9; 95% CI, 1.8-4.4; *P* < .01); larger waist circumference (β, 2.6 cm; 95% CI, 1.5-3.8 cm); and greater FMI (β, 0.3 kg/m$^2$; 95% CI, 0.1-0.5 kg/m$^2$), systolic blood pressure (β, 2.8 mmHg; 95% CI, 0.6-4.9 mmHg), and fasting plasma glucose levels (β, 2.7 mg/dL, 95% CI, 1.2-4.2 mg/dL) but lower adherence to the Mediterranean diet (β, −0.5 points; 95% CI, −0.9 to −0.1 points).

**Conclusions** Eating fast is associated with higher adiposity, certain cardiometabolic risk factors, and lower adherence to a Mediterranean diet. Further long-term and interventional studies are warranted to confirm these associations. *(J Pediatr 2022;■:1-9)*.

The vast majority of strategies to prevent or treat overweight and obesity in children are based on increasing physical activity, decreasing sedentary behaviors, and promoting adherence to a healthy diet.[1] However, some

| | |
|---|---|
| BMI | Body mass index |
| CEBQ | Child Eating Behaviour Questionnaire |
| CESNID | Centre d'Enseyament Superior de Nutrició i Dietètica |
| CORALS | Childhood Obesity Risk Assessment Longitudinal Study |
| FMI | Fat mass index |
| HDL-c | High-density lipoprotein cholesterol |
| LDL-c | Low-density lipoprotein cholesterol |

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A list of additional members of the CORALS study investigators is available at www.jpeds.com (**Appendix**).

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recent studies have reported that greater adiposity and other cardiometabolic risk factors also can be influenced by certain behaviors, such as eating speed and eating frequency, among others, in adults, adolescents, and children.[2] Eating quickly has been related to higher dietary energy intake, body mass index (BMI),[2] obesity prevalence,[3,4] and certain metabolic disorders.[2,5] In contrast, chewing slowly and increasing the number of chewing cycles during a meal have been negatively associated with adiposity.[6] It has been proposed that a slower eating speed might enhance the development of a satiety signal, which could limit the total food intake.[7]

Even though a universal definition for "speed of eating" has not been settled, a few authors define it as the time that a person takes to eat one meal.[8] Other authors refer to "eating rate" (as the estimation in grams per minute of food consumed)[9] or "energy intake rate" (energy intake by unit of time; kcalories per minute),[10] which may be considered more objective measures. Eating rate has been associated with food textures,[11] tastes,[10] and an increased overall energy.[12] Some authors have suggested that a fast eating rate is associated with high-fat content meals,[10] which usually have a softer texture and intense taste.[13] In addition, the consumption of soft-textured foods may be associated with a lower number of chewing cycles.[14] Meanwhile, a low energy intake rate has been associated with solid textures and low water content,[10] whereas a greater energy intake rate has been related to fat, sweet, and sour taste intensity,[10] as well as to increased consumption of ultra-processed foods that may contribute to poor dietary quality.[15] A high energy intake rate also has been associated with a faster eating rate.[16]

To our knowledge, associations between eating speed and diet quality have not been explored in children, and their associations with cardiometabolic risk factors have been rarely assessed. The present cross-sectional study aimed to assess the associations between eating speed, diet quality, adiposity, and cardiometabolic risk factors in a Spanish cohort of children aged 3-6 years.

## Methods

This cross-sectional study is based on the baseline data of the Childhood Obesity Risk Assessment Longitudinal Study (CORALS), a prospective ongoing multicenter study conducted in preschool children that has a 10-year expected follow-up (https://corals.es/). The main aim of the CORALS project is to identify potential risk factors for childhood obesity. Briefly, eligible participants are children aged 3-6 years attending the selected schools across 7 Spanish cities (Barcelona, Córdoba, Pamplona, Reus, Santiago de Compostela, Valencia, and Zaragoza) whose tutors had agreed to participate. To be enrolled in the study, parents or caregivers had to sign a consent form, attend the inclusion visit, and complete several questionnaires (eg, leisure time physical activity, 3-day food record, social-demographic data). The exclusion criteria include belonging to a family with difficulty participating, comprehension or language difficulties, and unstable residence.

The Ethics Committee of each recruitment center approved the study protocol (reference nos. 051/2019, 4155/2019, 2019/18, 9/19, 09/2019, 19/27, and 2019/131), which was conducted following the standards of the Declaration of Helsinki.

Children aged 3-6 years recruited between March 2019 and June 2021 were selected (n = 1371). Participants who attended the baseline visit and completed the provided questionnaires, as well as those who had available data in the duration of breakfast, lunch, and dinner, were included in the present analyses. Children with current diagnosis of chronic diseases, such as diabetes mellitus type 2, hypertension, and familiar hypercholesterolemia, were excluded from these analyses.

Eating speed was assessed through the question "How long does it usually take for your child to eat in each meal?" Speed was calculated by summing the total time (in minutes) reported by parents in the 3 main meals (breakfast, lunch, and dinner). Then categories for slow, moderate, and fast-eating speed were determined by tertiles. These categories were recategorized so that the highest tertile represents the fast-eating category. Additional analyses were performed using as exposure variable the "slowness in eating" scale from the validated Child Eating Behaviour Questionnaire (CEBQ),[17] which has been recently validated in Spanish children of the same age.[18] The possible responses included on the CEBQ "slowness in eating" scale are "my child finishes his/her meal quickly," "my child eats slowly," "my child takes more than 30 minutes to finish a meal," and "my child eats more and more slowly during the course of a meal." This scale was categorized by tertiles that were recategorized, with the third tertile as the fast-eating category.

Body weight (in kilograms) and body fat mass (in kilograms) were assessed with a precision scale (Tanita MC780SMA; Tanita Europe, B.V.). Body fat mass was assessed by octopolar multifrequency bioelectrical impedance. Height (in centimeters) was assessed using a portable stadiometer (seca 213, Escala 20-205 cm; SECA). These assessments were performed with the child in light clothing, without shoes, and according to standard procedures. BMI was calculated as weight (in kilograms) divided by height (in meters squared) and classified as underweight/normal weight or overweight/obesity using the cutoff points defined by Cole et al.[19] Waist circumference was determined with a measuring tape (seca 201), midway between the lowest rib and the iliac crest. The fat mass index (FMI) was estimated as body fat mass (in kilograms)/squared height (in meters).[20]

Blood pressure was determined in the nondominant arm and measured 3 times (with 5-minute intervals between measurements) using an automatic oscillometer (Omron M3 Intellisense HEM-75051-EV; IOMRON Healthcare Europe B.V.) with a child-adapted cuff. Blood pressure was recorded as the mean of the 3 measurements for both systolic and diastolic blood pressures.

Blood samples were collected after a minimum of 8 hours of fasting. Serum samples were used to determine levels of fasting plasma glucose, total cholesterol, high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), and triglycerides by standard procedures. Non-HDL-c was calculated with the equation suggested by Frost et al.[21]

Diet quality was assessed by an ad hoc questionnaire of 18 items adapted to children from a 14-item Mediterranean diet questionnaire validated in an elderly population.[22] This questionnaire evaluates the consumption of typical foods in the Mediterranean diet (eg, olive oil, fruits, vegetables, cereals, nuts, seeds, cheese, yogurt, legumes, fish, seafood, poultry, rabbit), as well as additional foods that are not included in this dietary pattern (ie, butter, cream, carbonated/sugary beverages, junk food, dairy desserts, and precooked/ready-to-eat foods). The number of servings has been adapted for several items, and certain typical foods consumed by children (eg, gummy worms, sweets, petit suisse) are also included in this questionnaire (**Table I**; available at www.jpeds.com). Compliance with each of the 18 items was scored as 1 point; thus, the total score ranged from 0 to 18, with 0 representing no adherence and 18 representing the greatest adherence.

A set of self-administered questionnaires completed by parents or caregivers at home was used to collect information on early life factors, maternal data (eg, age, BMI, educational level, socio-professional status), and lifestyle patterns, among others. Weight at birth (kilograms), mother's weight gain during pregnancy (kilograms), and breastfeeding (months of age) were recorded.

A physical activity questionnaire based on the Outdoor Playtime Checklist and the Outdoor Playtime Recall Questions[23] was provided. An additional ad hoc questionnaire with 13 components based on leisure physical activity that includes sedentary behaviors was used to determine the active lifestyle score (**Table II**; available at www.jpeds.com).

Sleep pattern was explored with the questions "how long does your child sleep at night during weekdays and on weekend days or holidays?" and "how long does your child nap during weekdays and on weekend days or holidays?" The total sleep duration (hours per day) was calculated summing night sleep hours and nap time on weekdays and weekend days or holidays divided by 7 (ie, the total days of the week).

Trained dietitians assessed the dietary intake using a semi-quantitative 125-item food frequency questionnaire adapted from a food frequency questionnaire validated in adults.[24] The 9 possible answers ranged from "never" to "more than 6 times per day" and were transformed into grams or milliliters per day using the standard portion size of each item. The CESNID (Centre d'Enseyament Superior de Nutrició i Dietètica) database was used to calculate total energy and nutrient intake.[25] Total energy intake was estimated according to Goldberg cutoffs adapted to children[26]; participants with missing data or implausible reported energy intake were excluded from the analyses.

The present analyses were conducted using the CORALS database updated to December 2021. To compare general characteristics and dietary variables among categories of eating speed, one-factor ANOVA, the Kruskal–Wallis test, or $\chi^2$ test was used. The data were presented as mean ± SD or median (IQR) for quantitative variables and as percentage (number) for qualitative variables. The Kolmogorov–Smirnov test was used to assess the normal distribution of variables. Missing data <10% on covariates was imputed to the mean.[27] Multiple linear regression models were fitted to assess associations between eating speed (exposure) and different outcomes—waist circumference, FMI, systolic blood pressure, diastolic blood pressure, fasting plasma glucose, total cholesterol, HDL-c, LDL-c, non-HDL-c, triglycerides, and Mediterranean diet score—which were reported as β coefficients and 95% CIs. Logistic regression models were fitted to explore the association between eating speed and weight status (outcome), expressed as OR and 95% CIs. All models were adjusted by the following confounders: center, sex, age, maternal BMI, and mother's educational level, total energy intake, breastfeeding, total minutes of physical activity a week, and total hours of sleep per day. In our analyses, the slower category of eating speed served as the reference. Interaction analyses were performed by sex, maternal factors (BMI and educational level), weight at birth, and sedentary behaviors.

Sensitivity analyses were performed for FMI excluding those participants aged 3-4 years owing to a lack of validation of bioimpedance equations (Tanita MC780SMA) in children aged <5 years. Correlation analyses were performed between the variable calculated from the CEBQ "slowness in eating" scale and the eating speed variable estimated in minutes per day as well as between the 18-item and the 14-item questionnaires of adherence to the Mediterranean diet. All analyses were conducted using Stata 14 (StataCorp), and statistical significance was set at a 2-tailed $P$ value <.05.

## Results

Among the total of 1371 participants who attended the first visit, 49 were excluded for not meeting the inclusion criteria. Subsequently, 193 children had missing data for the time spent at breakfast, lunch, and/or dinner, precluding estimation of eating speed. In addition, 143 participants were excluded because of missing data or implausible reported energy intake. Finally, 30 participants with a current diagnosis of chronic diseases also were excluded from the analyses. Therefore, a total sample of 956 children (49% girls) were included in the analyses (**Figure**). For 88% of the study sample, the questionnaires were completed by the mother.

The main characteristics of the sample according to category of eating speed at baseline are shown in **Table III**. The mean age was 4.8 ± 1 years. Compared with participants in the slow-eating category, children with fast eating speed were more likely to have overweight or obesity, larger waist circumference, greater FMI, and higher systolic blood pressure and fasting plasma glucose concentration ($P < .05$). Mothers whose children were categorized as fast-eaters had higher BMI and weight status, as well as lower educational level ($P < .05$), compared with slow eaters. No other significant between-group differences were observed.

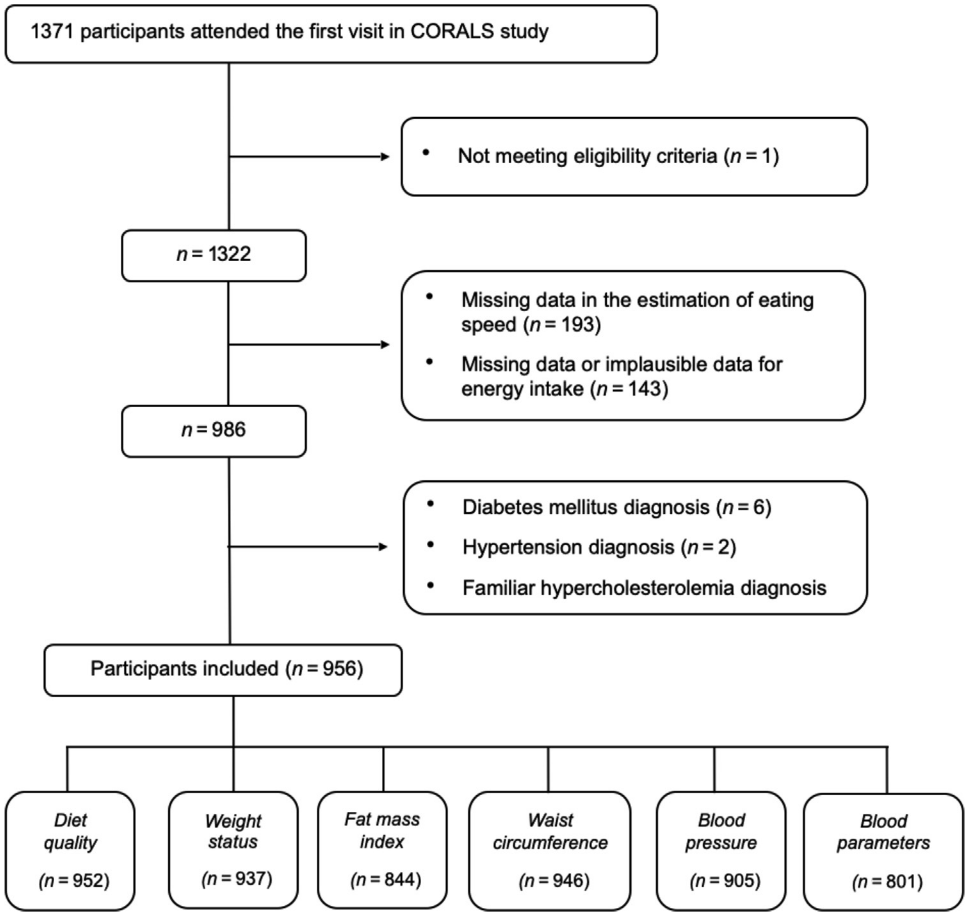


**Figure.** Flow diagram for the CORALS cohort.

Table IV lists the dietary characteristics according to eating speed categories. The percentage of total daily energy intake from carbohydrates differed significantly across the eating speed categories, higher in the fast-eating category. Participants in the fast-eating category also were more likely to have lower intakes of total fatty acids, monounsaturated fatty acids, and protein per body weight, as well as lower nut consumption and adherence to the Mediterranean diet.

The associations between eating speed category and outcome are shown in Table V. Compared with children in the slow-eating category, in unadjusted models and after adjusting for potential confounders, participants in the fast-eating category showed a higher risk for overweight/obesity (OR, 2.9; 95% CI, 1.8-4.4; $P < .01$). Compared with slower eaters, fast eaters had higher values for waist circumference, FMI, systolic blood pressure, and fasting plasma glucose concentration, as well as lower diet quality (β, −0.5; 95% CI, −0.9 to −0.1; $P < .05$). When we excluded those children aged <5 years from the association with FMI, the results remained significant in the full adjusted model (β, 0.5; 95% CI, 0.2-0.8; $P < .01$). Compared with the slow-eating category, an inverse association was found between the fast-eating category and total cholesterol in the full adjusted model. No significant associations were observed between eating speed and the other cardiometabolic risk factors.

Data on eating speed measured by the CEBQ “slowness in eating” scale also showed positive associations between the fast-eating category and overweight/obesity (OR, 4.2; 95% CI, 2.7-6.4; $P < .01$), waist circumference (β, 3.1; 95% CI, 2.1-4.2; $P < .01$), and FMI (β, 0.7; 95% CI, 0.5-0.9; $P < .01$). No significant associations were observed for other cardiometabolic risk factors, but the direction of the associations was the same.

In correlation analyses, both eating speed variables (minutes/day and the CEBQ “slowness in eating” scale) were positively correlated ($r = 0.43$; $P < .001$), as well as the 2 questionnaires assessing adherence to the Mediterranean diet (the 18-item and 14-item questionnaires) ($r = 0.39$; $P < .01$).

Interaction analyses between eating speed category, sex, mother’s BMI and educational level, weight at birth, and sedentary behaviors were not significant.

**Table III. General characteristics of the study population according to eating speed categories**

| Characteristics | Eating speed categories: Slow (>85 min), N = 291 | Moderate (66-85 min), N = 325 | Fast (<65 min), N = 340 | *P* value* |
|---|---|---|---|---|
| Eating speed, total min/day/3 main meals, mean ± SD | 108.3 ± 18.3 | 76.2 ± 4.9 | 53.8 ± 9.2 | **<.001** |
| Age, y, mean ± SD | 4.8 ± 1.1 | 4.8 ± 1.0 | 4.9 ± 1.0 | .100 |
| Girls, % (n) | 50.5 (147) | 48.9 (159) | 48.2 (164) | .845 |
| Adiposity | | | | |
| Weight status, % (n) | | | | **<.001** |
| Underweight or normal weight | 87.5 (251) | 79.2 (251) | 70.3 (234) | |
| Overweight or obesity | 12.5 (36) | 20.8 (66) | 29.7 (99) | |
| Waist circumference, cm, mean ± SD | 50.3 ± 7.5 | 52.4 ± 6.0 | 53.4 ± 8.3 | **<.001** |
| FMI, kg/m$^2$, mean ± SD | 3.7 ± 1.2 | 3.8 ± 1.4 | 4.1 ± 1.3 | **.003** |
| Cardiovascular risk factors | | | | |
| Systolic blood pressure, mmHg, mean ± SD | 102.0 ± 12.9 | 103.1 ± 13.2 | 105.2 ± 12.9 | **.009** |
| Diastolic blood pressure, mmHg, mean ± SD | 64.5 ± 12.6 | 63.9 ± 12.5 | 66.1 ± 12.0 | .068 |
| Fasting glucose, mg/dL, mean ± SD | 75.8 ± 8.8 | 77.8 ± 8.7 | 78.8 ± 9.9 | **<.001** |
| Total cholesterol, mg/dL, median (IQR) | 167 (149-186.5) | 166 (149-184) | 162 (145-179) | .055 |
| HDL-c, mg/dL, median (IQR) | 56 (48.5-66) | 58 (50-67) | 56.4 (49-64.7) | .495 |
| LDL-c, mg/dL, median (IQR) | 96 (83-112) | 95 (83-112.6) | 92 (78-105.1) | .083 |
| Non-HDL-c, mg/dL, median (IQR) | 107 (94-123.5) | 107 (93-126) | 104 (90-119) | .215 |
| Triglycerides, mg/dL, median (IQR) | 53 (44.5-67.5) | 53 (42-65) | 52 (43-66) | .556 |
| Early life factors | | | | |
| Weight at birth, kg, mean ± SD | 3.3 ± 0.5 | 3.3 ± 0.5 | 3.2 ± 0.6 | .554 |
| Breastfeeding duration, % (n) | | | | .872 |
| <6 mo | 40.3 (94) | 42.7 (108) | 41.6 (106) | |
| ≥6 mo | 59.7 (139) | 57.3 (145) | 58.4 (149) | |
| Mother's weight gain during pregnancy, kg, mean ± SD | 12.5 ± 4.7 | 12.7 ± 4.6 | 12.3 ± 4.5 | .589 |
| Lifestyle factors | | | | |
| Sports and physical activities, min/wk | 197.2 ± 117.7 | 179.0 ± 105.1 | 178.7 ± 115.2 | .069 |
| Total sleep duration per day, h | 10.4 ± 0.9 | 10.4 ± 1.1 | 10.4 ± 1.3 | .667 |
| Active lifestyle score, 0-13 points | 9.2 ± 1.6 | 9.1 ± 1.6 | 9.1 ± 1.6 | .726 |
| Maternal factors | | | | |
| Age, y, mean ± SD | 40.7 ± 4.5 | 41.4 ± 7.4 | 40.6 ± 5.8 | .162 |
| BMI, kg/m$^2$, mean ± SD | 24.3 ± 4.6 | 25.1 ± 4.8 | 25.1 ± 5.4 | **.049** |
| Weight status, % (n) | | | | **.022** |
| Underweight or normal weight | 67.7 (197) | 56.9 (185) | 61.2 (208) | |
| Overweight or obesity | 32.3 (94) | 43.1 (140) | 38.8 (132) | |
| Educational level, % (n) | | | | **.021** |
| Primary or lower | 7.2 (21) | 9.5 (31) | 12.1 (41) | |
| Secondary | 40.2 (117) | 35.1 (114) | 43.8 (149) | |
| Academic–graduated or underreported | 52.6 (153) | 55.4 (180) | 44.1 (150) | |
| Socio-professional category, % (n) | | | | .583 |
| Homemaker/student/retired/unemployed | 26.5 (77) | 30.2 (98) | 27.8 (93) | |
| Employee | 73.5 (214) | 69.9 (227) | 72.2 (242) | |

**P* values calculated using the $\chi^2$ test for categorical variables and ANOVA for continuous variables. A *P* value <.05 was considered significant (bold type).

## Discussion

Our results on eating speed and adiposity are in line with previous observational studies reporting that self-reported fast eating speed is associated with higher weight status and larger waist circumference in adults[28,29] and Asian children.[12,30] In addition, a longitudinal study conducted in Japanese girls reported a positive association between eating speed and body fat mass percentage, but FMI was not assessed.[31] Moreover, an 8-week interventional trial in American children that aimed to decelerate eating speed through nutritional education, timers, and interactive activities with families resulted in a decrease in eating speed in association with lower BMI.[32]

The association between eating speed and blood pressure also has been explored in Asian adults, in which fast eating was associated with higher blood pressure.[33] Similarly in children, Yamagishi et al observed higher systolic blood pressure in boys with continuous fast-eating speed; the association was not significant in girls, however.[34] In line with our results regarding eating speed and fasting plasma glucose concentration, Nohara et al reported men, but not women, who reported fast-eating speed had higher fasting glucose concentrations and blood pressure values.[35] Another study of middle-aged Japanese adults reported an independent and positive association between fast eating and insulin resistance; however, the association with blood glucose level was not assessed.[36] To date, no published studies have explored the association between eating speed and fasting plasma glucose in children. In contrast with a recent review that reported significant associations between eating speed and triglyceride and lower HDL-c levels in adults,[2] our results did

**Table IV. Dietary characteristics according to eating speed category**

| Characteristics | Eating speed category: Slow (>85 min), N = 291 | Moderate (66-85 min), N = 325 | Fast (<65 min), N = 340 | *P* value* |
|---|---|---|---|---|
| Dietary intake contribution | | | | |
| Total energy intake, kcal/day, mean ± SD | 1698 ± 340 | 1688 ± 351 | 1714 ± 370 | .632 |
| Carbohydrates, %, mean ± SD | 42.0 ± 5.5 | 42.9 ± 5.4 | 43.7 ± 5.5 | **<.001** |
| Proteins, %, mean ± SD | 15.1 ± 2.1 | 15.0 ± 2.2 | 14.9 ± 2.0 | .505 |
| Total fatty acids, %, mean ± SD | 42.9 ± 5.9 | 42.1 ± 5.7 | 41.4 ± 5.9 | **.007** |
| Saturated fatty acids, %, mean ± SD | 14.1 ± 1.9 | 14.0 ± 2.0 | 13.8 ± 2.1 | .184 |
| Monounsaturated fatty acids, %, mean ± SD | 19.6 ± 4.7 | 18.9 ± 4.4 | 18.4 ± 4.4 | **.006** |
| Polyunsaturated fatty acids, %, mean ± SD | 6.2 ± 1.4 | 6.1 ± 1.7 | 6.2 ± 1.8 | .941 |
| Protein intake per body weight, g/kg/d, mean ± SD | 3.5 ± 0.9 | 3.3 ± 0.8 | 3.2 ± 1.0 | **<.001** |
| Fiber, g/1000 kcal, mean ± SD | 8.5 ± 2.3 | 8.5 ± 2.4 | 8.5 ± 2.3 | .985 |
| Source goal, % (n) | | | | .674 |
| <14 g/1000 kcal | 95.9 (279) | 96.9 (315) | 97.1 (330) | |
| ≥14 g/1000 kcal | 4.1 (12) | 3.1 (10) | 2.9 (10) | |
| Sodium, mg/dL, mean ± SD | 2308 ± 736 | 2320 ± 719 | 2307 ± 684 | .967 |
| Diet quality | | | | |
| Mediterranean Diet Score, 0-18 points | 11.1 ± 2.9 | 10.7 ± 2.8 | 10.5 ± 2.5 | **.015** |
| Dairy products, mean ± SD | | | | |
| Milk, g/day | 324.9 ± 239.1 | 312.6 ± 221.7 | 320.9 ± 234.1 | .795 |
| Yogurt, g/day | 105.0 ± 79.2 | 111.2 ± 85.7 | 117.6 ± 110.9 | .240 |
| Cheese, g/day | 12.5 ± 10.8 | 12.3 ± 12.9 | 12.6 ± 12.3 | .959 |
| Derivative dairy products, g/day | 80.2 ± 82.9 | 85.5 ± 93.9 | 90.4 ± 99.5 | .389 |
| Protein foods, mean ± SD | | | | |
| White meat, g/day | 24.7 ± 9.8 | 23.9 ± 9.0 | 23.9 ± 9.2 | .492 |
| Unprocessed red meat, g/day | 18.8 ± 11.9 | 18.9 ± 13.2 | 19.0 ± 13.3 | .974 |
| Processed and derivatives meat products, g/day | 26.3 ± 16.6 | 25.7 ± 14.4 | 24.5 ± 14.7 | .319 |
| Egg, g/day | 23.5 ± 8.6 | 23.2 ± 8.5 | 23.2 ± 10.2 | .889 |
| Fish and seafood, g/day | 34.9 ± 17.0 | 33.9 ± 17.4 | 32.5 ± 17.9 | .222 |
| Vegetables and fruits, mean ± SD | | | | |
| Vegetables, g/day | 76.8 ± 52.8 | 77.4 ± 51.1 | 75.8 ± 52.7 | .921 |
| Tubers, g/day | 40.3 ± 18.6 | 39.9 ± 19.2 | 41.4 ± 20.3 | .576 |
| Fruits, g/day | 188.6 ± 113.2 | 190.0 ± 124.1 | 181.4 ± 122.9 | .611 |
| Nuts, g/day, mean ± SD | 4.2 ± 5.7 | 3.3 ± 4.4 | 3.5 ± 4.6 | **.045** |
| Cereals and legumes, mean ± SD | | | | |
| Legumes, g/day | 14.0 ± 6.4 | 14.0 ± 6.2 | 14.3 ± 8.5 | .815 |
| Refined bread, cereals, and pasta, g/day | 70.3 ± 32.2 | 72.7 ± 34.9 | 74.5 ± 38.4 | .333 |
| Brown bread, cereals, pasta and rice, g/day | 5.5 ± 13.5 | 3.7 ± 10.7 | 4.5 ± 11.2 | .163 |
| Miscellaneous, mean ± SD | | | | |
| Oil and fats, g/day | 27.7 ± 16.6 | 26.4 ± 15.7 | 25.4 ± 15.3 | .212 |
| Pastries, g/day | 38.3 ± 29.4 | 40.6 ± 28.6 | 41.2 ± 30.5 | .454 |
| Sugars and candies, g/day | 12.9 ± 10.5 | 13.2 ± 10.6 | 13.6 ± 11.0 | .696 |
| Beverages, mean ± SD | | | | |
| Water, g/day | 852.6 ± 390.9 | 859.0 ± 371.8 | 348.9 ± 363.2 | .941 |
| Sugary beverages, g/day | 110.5 ± 126.9 | 104.4 ± 130.8 | 124.8 ± 130.5 | .111 |
| Tea and infusions, g/day | 5.3 ± 28.3 | 6.0 ± 24.7 | 8.8 ± 32.9 | .276 |

**P* values calculated by the $\chi^2$ test for categorical variables and ANOVA for continuous variables. *P* values <.05 were considered significant (bold type).

not show any significant associations in a sample of children. Inconclusive results in these studies may be related to variations in populations (eg, ethnicity, age, culture), as well as additional differences in methodology.

In the present study, we observed an inverse association between eating speed and the adherence to Mediterranean diet. This result could be explained by the main characteristics of the Mediterranean diet, such as its high content of plant-based foods (which provide high amounts of dietary fiber) and fish/seafood and low content of red meat/processed meat products.[37] Even though there were no significant differences in the majority of food groups in our analyses, the overall beneficial effect of the Mediterranean diet is greater than the effects of its individual components. Furthermore, in a meta-analysis[38] and a randomized-crossover study,[39] positive effects were observed between the consumption of fiber or protein and appetite suppression as well as satiety, which might have an impact on eating speed.[7] Additionally, associations between faster eating,[16] sweet-tasting foods,[10] and ultra-processed foods[40] have been reported. Ultra-processed foods are characterized by their high energy, salt, sugar, and fat content,[41] which may contribute to food reinforcement and a higher overall energy intake,[41] perhaps because of their high palatability.[40] On the other hand, an unexpected result in our analyses was the association between fast eating speed and lower total cholesterol. In this sense, a potential association between lower fat intake and a decrease in total cholesterol and LDL-c has been reported,[42] which could partially explain this result, as our analyses showed a lower percentage of total fatty acids in those participants in the fast-eating category.

**Table V. Crude and multivariate β-coefficients (95% CI) or OR (95% CI) of adiposity, diet quality, and cardiometabolic risk factors according to eating speed categories in the total population**

| | Eating speed category | | |
|---|---|---|---|
| Variables | Slow (>85 min) | Moderate (66-85 min) | Fast (<65 min) |
| Adiposity | | | |
| Weight status, n | 287 | 317 | 333 |
| Crude model | 1 (ref) | 1.8 (1.2-2.9)† | 2.9 (1.9-4.5)† |
| Model 1 | 1 (ref) | 1.8 (1.1-2.8)* | 2.8 (1.8-4.4)† |
| Model 2 | 1 (ref) | 1.8 (1.1-2.8)* | 2.9 (1.8-4.4)† |
| Waist circumference, n | 285 | 323 | 338 |
| Crude model | 0 (ref) | 1.9 (0.7-3.0)† | 2.9 (1.8-4.0)† |
| Model 1 | 0 (ref) | 1.7 (0.6-2.7)† | 2.5 (1.4-3.6)† |
| Model 2 | 0 (ref) | 1.7 (0.6-2.8)† | 2.5 (1.4-3.8)† |
| FMI, n | 258 | 283 | 303 |
| Crude model | 0 (ref) | 0.2 (−0.1 to 0.4) | 0.4 (0.2-0.6)† |
| Model 1 | 0 (ref) | 0.1 (−0.1 to 0.3) | 0.3 (0.1-0.5)† |
| Model 2 | 0 (ref) | 0.1 (−0.1 to 0.3) | 0.3 (0.1-0.5)† |
| Cardiovascular risk factors | | | |
| Systolic blood pressure, n | 274 | 304 | 325 |
| Crude model | 0 (ref) | 1.0 (−1.1 to 3.2) | 3.2 (1.1-5.3)† |
| Model | 0 (ref) | 0.8 (−1.3 to 2.9) | 2.8 (0.7-4.9)† |
| Model 2 | 0 (ref) | 0.8 (−1.3 to 3.0) | 2.8 (0.6-4.9)* |
| Diastolic blood pressure, n | 275 | 305 | 325 |
| Crude model | 0 (ref) | −0.6 (−2.6 to 1.4) | 1.6 (−0.4 to 3.6) |
| Model 1 | 0 (ref) | −0.7 (−2.7 to 1.3) | 1.6 (−0.4 to 3.6) |
| Model 2 | 0 (ref) | −0.8 (−2.8 to 1.2) | 1.5 (−0.5 to 3.5) |
| Fasting glucose, n | 241 | 270 | 290 |
| Crude model | 0 (ref) | 2.0 (0.4-3.6) * | 3.0 (1.5-4.6)† |
| Model 1 | 0 (ref) | 2.2 (0.7-3.7)† | 2.8 (1.3-4.3)† |
| Model 2 | 0 (ref) | 2.1 (0.6-3.6)† | 2.7 (1.2-4.2)† |
| Total cholesterol, n | 240 | 271 | 287 |
| Crude model | 0 (ref) | −0.5 (−5.4 to 4.4) | −4.5 (−9.4 to 0.3) |
| Model 1 | 0 (ref) | −0.2 (−5.1 to 4.6) | −4.5 (−9.4 to 0.3) |
| Model 2 | 0 (ref) | −0.6 (−5.4 to 4.3) | −5.0 (−9.8 to −0.2)* |
| HDL-c, n | 240 | 270 | 286 |
| Crude model | 0 (ref) | 0.0 (−2.3 to 2.4) | −1.0 (−3.3 to 1.3) |
| Model 1 | 0 (ref) | 0.2 (−2.2 to 2.5) | −0.9 (−3.3 to 1.4) |
| Model 2 | 0 (ref) | 0.2 (−2.1 to 2.6) | −0.9 (−3.2 to 1.5) |
| LDL-c, n | 225 | 255 | 273 |
| Crude model | 0 (ref) | 0.3 (−4.1 to 4.7) | −3.2 (−7.4 to 1.0) |
| Model 1 | 0 (ref) | 0.3 (−4.1 to 4.6) | −3.2 (−7.5 to 1.0) |
| Model 2 | 0 (ref) | 0.1 (−4.2 to 4.5) | −3.7 (−7.9 to 0.6) |
| Non-HDL-c, n | 240 | 270 | 286 |
| Crude model | 0 (ref) | −1.0 (−5.4 to 3.4) | −3.5 (−7.8 to 0.9) |
| Model 1 | 0 (ref) | −0.8 (−5.2, to 3.6) | −3.5 (−7.9 to 0.9) |
| Model 2 | 0 (ref) | −1.2 (−5.6 to 3.2) | −4.1 (−8.4 to 0.3) |
| Triglycerides, n | 240 | 271 | 286 |
| Crude model | 0 (ref) | −1.6 (−5.3 to 2.1) | −2.3 (−6.0 to 1.3) |
| Model 1 | 0 (ref) | −2.3 (−5.9 to 1.2) | −3.4 (−7.0 to 0.1) |
| Model 2 | 0 (ref) | −2.4 (−6.0 to 1.2) | −3.5 (−7.1 to 0.1) |
| Diet quality | | | |
| Mediterranean Diet Score, points | 289 | 324 | 339 |
| Crude model | 0 (ref) | −0.3 (−0.8 to 0.1) | −0.6 (−1.1 to −0.2)† |
| Model 1 | 0 (ref) | −0.3 (−0.7 to 0.1) | −0.5 (−0.9 to −0.1)* |
| Model 2 | 0 (ref) | −0.3 (−0.7 to 0.1) | −0.5 (−0.9 to −0.1)* |

Multiple linear regressions models were fitted and expressed in β coefficients (95% CI). For weight status, logistic regressions models were fitted and expressed in OR (95% CI). The weight status is a dichotomous outcome (underweight or normal weight -1- and overweight or obesity -2-).
Model 1 adjusted by center, sex, age, maternal BMI, and mother's educational level.
Model 2 adjusted additionally by total energy intake, breastfeeding, total minutes of physical activity per week, and total hours of sleep per day.
*Associations with $P < .05$.
†Associations with $P < .01$.

This study has some limitations that merit mention. First, because it is a cross-sectional study, we cannot draw cause-and-effect conclusions or discard bidirectional associations. Second, our study sample included Spanish preschool children, and thus our findings cannot be extrapolated to other populations. Third, we cannot dismiss the possibility that associations might be related to residual confounding or that undetected cardiometabolic disorders in our study population may exist because of age. Fourth, equations for bioelectrical impedance analysis have not been designed for children aged <5 years; however results from the analyses excluding children aged 3-4 years remained similar to those in the total population. Fifth, although eating speed was self-reported, it was estimated according to the time reported by main caregivers, not based on self-perception. Moreover, analyses from the CEBQ "slowness in eating" scale showed similar results as those observed in the main analyses for adiposity. Sixth, the 18-item Mediterranean diet questionnaire has not been validated in children; nevertheless, it was positively correlated to the validated 14-item Mediterranean diet questionnaire, and results should be interpreted cautiously.

In conclusion, eating fast is associated with higher levels of adiposity and certain cardiometabolic risk factors, as well as lower adherence to the Mediterranean diet in Spanish children. However, further long-term studies and clinical trials are needed to confirm these associations. ■

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## Data Statement

Data sharing statement available at www.jpeds.com.

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**Table I. The 18-item questionnaire of adherence to the Mediterranean diet in children**

| Questions | Criterion for 1 point |
|---|---|
| 1. Do you use extra-virgin olive oil as the main culinary fat? | Yes |
| 2. Do you consume 3 or more tablespoons of olive oil per day (including that used for frying, salads or in meals away from home)? (1 tbsp=10 ml) | Yes |
| 3. Do you consume 2 or more servings of vegetables per day? During the week, do you eat any of these servings as raw vegetables or salad? (1 serving= 50-80 g) | Yes |
| 4. Do you consume 3 or more small fruits per day? (small fruit = 100 g) | Yes |
| 5. Do you consume whole grains (bread, cereals, pasta, or rice) 3 or more times a week, instead of refined grains? | Yes |
| 6. Do you consume at least 1 serving per day of fermented milk, plain yogurt or goat's or sheep's cheese? (1 commercial portion of fermented milk or yogurt or 25 g of cheese) | Yes |
| 7. Do you consume 2-3 or more servings a week of legumes? (1 serving = 40 g raw weight) | Yes |
| 8. Do you consume 3 or more servings a week of fish/seafood? (1 serving = 40-70 g) | Yes |
| 9. Do you consume at least 3 servings a week of nuts? (1 serving = 15-20 g) | Yes |
| 10. Do you consume preferably chicken, turkey, or rabbit instead of beef, pork, hamburgers, or sausage? | Yes |
| 11. Do you consume 2 or more times a week cooked vegetables, pasta, rice, or other dishes seasoned with tomato, garlic, onion, or leek sauce simmered with olive oil (sofrito)? | Yes |
| 12. Do you eat red meat, hamburgers, sausages, or derivative/processed meat products less than 2 times a week? | Yes |
| 13. Do you eat less than 1 serving per day of butter or cream? (1 serving = 12 g) | Yes |
| 14. Do you drink less than 2 glasses a week of carbonated and/or sugary beverages (sodas, coke, juices, nectars)? | Yes |
| 15. Do you consume chips, gummy worms, sweets less than 1 time a week? | Yes |
| 16. Do you consume dairy desserts, such as custard, ice cream, dairy smoothies, petit Suisse, vegetable drinks, etc, less than 1 time a week? | Yes |
| 17. Do you consume pastries, stuffed cookies, sweets, or cakes less than 2 times a week? | Yes |
| 18. Do you consume precooked or ready-to-eat foods less than 1 time a week? | Yes |

**Table II. Questionnaire for evaluating an active lifestyle in children**

| Questions | Criterion for 1 point |
|---|---|
| 19. Does she/he walk or cycle to the school at least 3 days a week? | Yes |
| 20. Does she/he play outdoors such as in parks or playgrounds, during leisure time, at least 3 days a week? | Yes |
| 21. Does she/he participate in extracurricular sports or recreational activities like basketball, soccer, athletics, cycling, swimming, rhythmic gymnastics, other sports, traditional games, etc, at least 2 days a week? | Yes |
| 22. Does she/he do strength and flexibility activities like dancing, yoga, or martial arts at least 4 days a week? | Yes |
| 23. Does she/he preferentially use the stairs, such as at home? | Yes |
| 24. Does she/he walk every day for at least 30 minutes, even if it is not continuous? | Yes |
| 25. Does she/he participate in outdoors activities with the family during weekdays at least 1 time per week? (cycling, playing ball) | Yes |
| 26. Does she/he participate in outdoors activities like family excursions during the weekends, at least 2 times per month? | Yes |
| 27. During the leisure time, does she/he participate in activities that require more movement such as dancing, running, jumping, instead of activities like painting, sitting down to play, using the computer, etc? | Yes |
| 28. Does she/he like the physical education classes at school? | Yes |
| 29. During breaks at school, does she/he prefer activities like running, jumping or other activities instead to nonmoving games (talking, sitting down, playing with cars or dolls, etc)? | Yes |
| 30. During weekdays, does she/he use audiovisual media, such as television, computers, tablets, or cell phones, less than 2 hours a day? | Yes |
| 31. During weekends, does she/he use audiovisual media, such as television, computers, tablets, or cell phones, less than 2 hours a day? | Yes |