Feeding practices, physical activity, and fitness in Spanish preschoolers. Influence of sociodemographic outcome measures

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ABSTRACT

Introduction. Preschool age is critical for the development of adequate eating and physical activity habits.

Objective. The purpose of this study was to analyze the nutritional status, physical activity (PA) and fitness levels in preschool children in relation to gender and parental sociodemographic outcome measures.

Material and methods. Preschool children selected from 30 school facilities in Southern Spain were included. Children's PA and fitness parameters, anthropometry, and nutritional status, and parental sociodemographic outcome measures were recorded.

Results. A total of 1287 children aged between 3 and 6 years old (643 boys and 644 girls) participated in the study, together with 1267 parents (72.4%: mothers, 27.6%: fathers). Girls had a lower overweight and obesity rate than boys. Significant differences were observed by gender in the consumption of certain food: girls ate more dairy products at breakfast and olive oil, whereas boys ate more fast food and pasta or rice. Boys had a better fitness level. Children from a lower socioeconomic level had a higher body mass index, a worse nutritional status, and a lower PA level. Children whose parents had completed university education had a lower body mass index and a better nutritional status.

Conclusions. Preschoolers had a high overweight and obesity rate, and a low PA level, compared to international references. The fitness level of girls was lower than that observed in boys. Children whose parents had a low socioeconomic level and no education had a poor nutritional status.

Key words: *preschoolers, fitness, physical activity, obesity, nutrition.*

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INTRODUCTION

The increasing overweight and obesity rate worldwide is a reality and one of the biggest challenges for health protection. The worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010. Based on such trend, it is expected to reach 9.1% by 2020, as a result of a change likely to occur in nutrition and physical activity (PA) patterns.[1] In addition, adiposity and low levels of aerobic fitness and PA are associated with a risk for cardiovascular disease in children, and its high prevalence is a major public health problem.[2]

It is necessary to analyze certain modifiable factors (parental influence, social environment, school, leisure time, etc.) and other non-modifiable ones (gender and age) to establish a comprehensive approach to overweight and obesity in preschoolers and its relation to PA. Among modifiable factors, PA stands out because it is inversely associated with overweight.[3] Several studies have demonstrated that PA level is low in preschool children.[4-6] Besides, fitness is an important biomarker of health from an early age.[7] Overweight and adiposity have a negative influence on children's level of fitness,[8] and a significant connection has been observed between growth and fitness.[9,10] In addition to PA, diet is also one of the most important exogenous factors for child growth.

Preschool age is an ideal period to develop adequate eating and PA habits; it is a critical time for obesity prevention, which is associated with negative consequences on health that may persist through adolescence and adulthood.[8,11,12] Therefore, assessing the nutritional status and PA level of preschoolers should be an essential element for health monitoring and follow-up in this population.

Considering the preceding information, the proposed hypothesis is that, at preschool age, eating and PA habits may be affected by gender and certain parental sociodemographic characteristics. The purpose of

this study was to assess the nutritional status, weight status, PA and fitness levels of preschool children in relation to gender and other parental sociodemographic outcome measures.

POPULATION AND METHODS

Preschool children were randomly selected from 30 school facilities in Southern Spain and included in the study. Inclusion criteria were being in the Preschool Education system and not having a physical and/or intellectual disability. Parents signed an informed consent form for voluntary participation in this study (essential for children inclusion). The study was done in accordance with the principles of the Declaration of Helsinki (2013 version). The study was approved by the Ethics Committee of Universidad de Jaén.

A specially designed sociodemographic questionnaire was used to collect information about parents, including their level of education, marital status, and socioeconomic level (based on their self-perception). Anthropometric parameters included height (cm), measured with a stadiometer (Seca 222, Hamburg, Germany); weight (kg), measured with a scale (Seca 634, Hamburg, Germany); and body mass index (BMI), which was recorded using the BMI= weight (kg)/height (m)^2 equation. Waist circumference was also measured at the level of the umbilicus using a Seca 201 ergonomic circumference measuring tape. Fitness was analyzed using the test battery proposed by Latorre et al. (2015),[13] which includes basic components of physical and motor status, such as strength, endurance, speed, and balance. A manual dynamometry was also included to assess handgrip strength. Nutritional status, screen time (activities done in front of a screen, such as watching TV, using a tablet, playing video games, or using a mobile phone or a computer, etc.), and PA were analyzed using the Krece Plus questionnaire, which is made up of 16 questions related to diet and 2 questions on screen time and PA outside school.[14] Parental sit-down time was recorded using item 7 from the International Physical Activity Questionnaire - Short Form (IPAQ-SF).[15]

Every test was conducted in the school, either the sports facilities or classrooms, by expert researchers and in the presence of each student group's teachers. Parents completed the self-administered questionnaires at home. Then children were assessed in two separate sessions with a 48-hour interval during their school day (9 am to 2 pm), for approximately 40 minutes each time. On the first day, the following tests were done: handgrip strength (two attempts with each hand), balance (two attempts with each leg), and long jump (two attempts). On the second day, the 20 m sprint (two attempts) and the 10 x 20 m sprint (one attempt) were completed. Prior to physical tests, children did warm-up exercises based on continuous running and joint mobilization; besides, the research team demonstrated the tests, and children completed familiarization activities. The best attempts achieved in each test were selected, except for the manual dynamometry and the balance test, for which the average result of both hands and legs, respectively, was selected as the best attempt. All children were motivated to give their maximum physical performance through oral instructions encouraging them to run faster, jump further, etc.

The sample size for an infinite population with an unknown prevalence, where $p= q= 0.50$, with a 99% confidence level and a 5% error, was 645 subjects. Data provided by the Regional Government of Andalusia on Andalusian Preschool Education were used for sample selection.

Data were analyzed using the SPSS statistical software, v.19.0 for Windows (SPSS Inc., Chicago, USA). The significance level was established at $p < 0.05$, with a 95% confidence level. Data were described as mean descriptive statistics, standard deviation, and percentage. The normal distribution of data and homogeneity of variances were verified using the Kolmogorov-Smirnov test and the Levene's test, respectively. Differences among gender, level of education, and socioeconomic level were analyzed using an analysis of variance (ANOVA) and a *post hoc* test with Bonferroni's correction. Weight status and the Krece Plus questionnaire were analyzed by item in relation to gender using the χ^2 test. Lastly, Pearson's correlation among the different outcome measures was also implemented.

RESULTS

The study was conducted between April and May of 2015. A total of 1287 children aged 3 to 6 years old participated (age= 50.90 months, BMI= 16.03 ± 2.13 kg/m^2), 643 boys and 644 girls, and 1267 parents (72.4%: mothers, 27.6%: fathers).

Figure 1 shows the flow chart of participants. *Table 1* describes the sociodemographic outcome measures corresponding to one of the parents.

Differences were significant in terms of

weight status by gender (p = 0.004): girls had lower overweight and obesity levels, 7.0%-9.2% versus 9.7%-13.9%, respectively; and the overall overweight and obesity prevalence was 8.3% and 11.5%, respectively.

Table 2 shows the results of the Krece Plus questionnaire in terms of percentage of response to each item. Significant differences by gender were observed in the consumption of certain food: girls ate more dairy products at breakfast and olive oil, whereas boys ate more fast food and pasta or rice.

TABLE 1. *Parental sociodemographic characteristics*

Marital status	**n (%)**
Single	53 (4.2)
Married or living with a couple	826 (65.2)
Divorced/separated	372 (29.4)
Widowed	16 (1.2)
Total	*1267 (100)*
Socioeconomic level	
Low	107 (8.6)
Middle	814 (65.6)
High	319 (25.8)
Total	*1240 (100)*
Education level	
No education	32 (2.5)
Primary education	316 (25)
Secondary education	483 (38.2)
University education	433 (34.3)
Total	*1264 (100)*
Daily sit-down time in minutes	
Mean (SD)	248.20 (168.31)

SD: standard deviation.

Table 3 describes the different outcome measures by gender. Significant differences were observed in BMI, which was higher in boys. In turn, boys had better results in the long jump, speed, endurance, and handgrip strength tests.

Table 4 indicates the results of the different outcome measures by parental socioeconomic level. Children from a lower socioeconomic level had a higher BMI, a worse nutritional status, and a lower PA level. Screen time was shorter in those who had a higher socioeconomic level but their performance in physical tests, e.g. long jump and speed, was worse.

Table 5 describes the different outcome measures by parental level of education. Children whose parents had completed university education had a lower BMI, a better nutritional status, and a better result in the long jump test.

FIGURE 1. *Flow chart of participants*

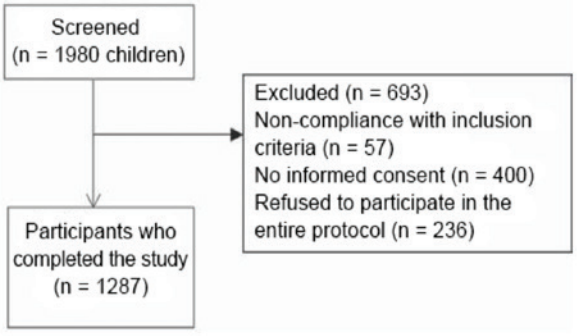

TABLE 2. *Results from the Krece Plus questionnaire as per parents' percentage of response to each item in the overall sample and by gender*

Items	**N parents**	**Total percentage**	**Girls (%)**	**Boys (%)**	***p*-value**
Skips breakfast	1248	1.5	1.5	1.6	0.817
Has dairy products (milk or other) for breakfast	1257	93.3	94.9	91.7	0.024
Has cereals or cereal products for breakfast	1254	68	66.6	69.4	0.290
Has cake or pastries for breakfast	1243	27.8	26.9	28.8	0.442
Eats a fruit or drinks fruit juice every day	1263	79.2	78.4	79.9	0.516
Eats a second serving of fruit every day	1257	38.9	37.7	40.2	0.360
Has a second serving of dairy products throughout the day	1257	85.7	85.6	85.9	0.862
Regularly eats fresh or cooked vegetables once a day	1265	62.9	63.9	61.8	0.439
Eats fresh or cooked vegetables more than once a day	1262	23	21.8	24.2	0.315
Regularly eats fish (more than twice or thrice a week)	1264	76.9	77.5	76.3	0.617
Eats burgers, hot dogs or pizza once or more times a week	1266	29.7	25	34.3	< 0.001
Likes legumes (eats lentils, beans; more than once a week)	1267	84.1	84.7	83.5	0.572
Eats candies and sweet snacks several times a day	1266	22.9	23	22.8	0.930
Eats pasta or rice almost daily (more than 5 times a week)	1267	31.6	28.3	34.9	0.012
Uses olive oil at home	1267	95.6	97.1	94.1	0.008
Drinks alcohol (≥ 1/week)	1266	0	0	0	--

Pearson's correlation did not reveal a significant association between parental daily sit-down time and studied outcome measures.

DISCUSSION

The most relevant finding of this study is that, in the studied population, child gender and socioeconomic level, and parental level of education had an effect on different aspects of the weight status, the nutritional status, and PA and fitness levels of preschoolers.

In terms of gender, girls had a lower overweight and obesity prevalence than boys, whereas boys had a better fitness level, with no differences observed in nutritional status, PA level, and screen time. In addition, no association was found between BMI and PA level, screen time, nutritional status, and the rest of fitness tests, except for handgrip strength.

In relation to nutritional status, and considering the scale proposed by Serra et al.,[14] preschool children included in this study had a mean nutritional status, which required diet improvements and a visit to their pediatrician six months later. However, children whose parents had a low socioeconomic level and no education had a very low nutritional status, which required urgent diet modifications and a visit to their pediatrician.

In terms of PA level, preschool children

TABLE 3. *Age, anthropometric outcome measures, nutritional status, physical activity level, screen time, and fitness level by gender*

	Boy Mean (SD) n= 643	**Girl Mean (SD) n= 644**	***p*-value**
Age (months)	51.13 (10.41)	50.68 (10.86)	0.493
BMI (kg/m^2)	16.19 (2.17)	15.87 (2.08)	0.007
Hip circumference (cm)	55.01 (5.71)	55.46 (5.92)	0.228
Total Krece Plus score (0-10)	6.52 (2.06)	6.56 (2.00)	0.716
Weekly physical activity level (hours)	1.87 (1.63)	1.71 (1.55)	0.079
Daily screen time (hours)	3.14 (6.64)	3.13 (6.63)	0.971
Long jump (cm)	73.28 (25.83)	65.98 (25.55)	< 0.001
20 m sprint (s)	6.16 (1.21)	6.55 (1.26)	< 0.001
Endurance (s)	83.04 (19.54)	85.75 (19.65)	0.016
Balance (s)	8.85 (9.67)	9.30 (10.43)	0.435
Handgrip strength (kg)	5.80 (2.03)	5.33 (1.99)	< 0.001

SD: standard deviation. BMI: body mass index.

TABLE 4. *Age, anthropometric outcome measures, nutritional status, physical activity level, screen time, and fitness level by parental socioeconomic level*

	Low Mean (SD)[a] n= 102	**Middle Mean (SD)[b] n= 768**	**High Mean (SD)[c] n= 293**	***P*-value**	***Post hoc* test**
Age (months)	50.37 (10.32)	51.21 (10.65)	52.13 (10.85)	0.709	
BMI (kg/m^2)	16.53 (2.53)	15.94 (1.99)	16.02 (2.36)	0.038	a > b*
Hip circumference (cm)	54.88 (6.86)	54.94 (5.62)	53.27 (5.81)	0.563	
Total Krece Plus score (0-10)	5.91 (2.39)	6.53 (1.98)	7.21 (1.77)	< 0.001	a < b*, a < c***, b < c***
Weekly physical activity level (hours)	1.42 (1.54)	1.83 (1.60)	2.02 (1.63)	0.006	a < c**
Daily screen time (hours)	3.29 (6.15)	3.70 (8.01)	1.85 (0.93)	< 0.001	b > c***
Long jump (cm)	70.32 (28.29)	72.13 (26.44)	61.50 (22.50)	< 0.001	a > c*, b > c***
20 m sprint (s)	6.30 (1.17)	6.26 (1.21)	6.66 (1.32)	< 0.001	b < c***
Endurance (s)	87.02 (24.05)	84.15 (19.86)	81.99 (16.41)	0.092	
Balance (s)	10.16 (11.84)	9.00 (9.61)	9.59 (11.03)	0.475	
Handgrip strength (kg)	5.69 (1.74)	5.57 (2.08)	6.33 (2.24)	0.359	

SD: standard deviation. BMI: body mass index.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

assessed in this study evidenced a very low weekly PA level as per international recommendations.[16] In addition, daily screen time was longer than weekly time devoted to PA; this together with a high overweight and obesity prevalence as per reference data by De Onis et al.,[17] indicated that this population is highly sensitive to health problems related to overweight and a sedentary lifestyle. In this regard, Van Stralen et al.[18] highlighted a positive association among a sedentary lifestyle –mainly screen time– and BMI and waist circumference. Hinkley et al.[19] indicated that most young children did not take part in adequate PA but spent excessive time in front of a screen. In relation to gender, and consistent with this study, other authors found no differences between preschool boys and girls in terms of PA level, regardless of whether the assessment was completed objectively (accelerometry) or through parental reports.[20] In addition, overweight children were significantly less active, though no important differences were observed among girls.[21]

Considering the influence of parental sociodemographic characteristics on the different outcome measures, children whose parents had a high sociodemographic level had a better nutritional status, and spent more time doing PA and less time using the screen. Children whose parents had completed university education had a lower BMI, a better nutritional status, and a better result in the long jump test. In this sense, Sotos et al.[22] underlined that both education level and socioeconomic status affected nutritional status during childhood.

Also, in this study, a parental sedentary lifestyle was not associated with any of the analyzed outcome measures. However, Hinkley et al.[23] pointed out that children whose parents had an active lifestyle tended to be more active. Likewise, Hesketh et al.[24] indicated that maternal daily PA levels were associated with every PA intensity levels in preschoolers.

Therefore, PA is one of the factors that has an impact on the healthy development of children, but most preschoolers tend to have a sedentary lifestyle.[25] O'Dwyer et al.[26] suggested that school accounted for an environment that promoted a sedentary lifestyle. In Spain, the situation is the same as pointed out by other authors[27] in relation to PA at school; thus, although schools may offer a unique opportunity for structured PA, there is a tendency to cut off physical education classes in pursuit of improving academic outcomes. Summerbell et al.[28] recommended a series of guidelines to conduct interventions in the setting of preschool PA, such as boosting active transportation for short distances, discouraging the installation of screens in the bedroom, promoting non-competitive PA, improving all playground areas, providing comfortable clothes, offering games during school breaks, encouraging children to be active, and reducing overall classroom sedentary time.

A limitation of this study is its cross-sectional nature, so we must be careful regarding results

TABLE 5. *Age, anthropometric outcome measures, nutritional status, physical activity level, screen time, and fitness level by parental level of education*

	No education Mean (SD)[a] n= 26	Primary education Mean (SD)[b] n= 289	Secondary education Mean (SD)[c] n= 446	University education Mean (SD)[d] n= 414	*p*-value	*Post hoc* Test
Age (months)	48.00 (8.72)	51.47 (10.65)	51.54 (11.07)	50.53 (10.29)	0.327	
BMI (kg/m^2)	16.88 (3.21)	16.28 (2.28)	15.95 (2.17)	15.86 (1.90)	0.017	
Hip circumference (cm)	54.30 (5.79)	54.67 (5.48)	54.84 (6.34)	55.07 (5.22)	0.879	
Total Krece Plus score (0-10)	5.92 (2.93)	6.55 (1.99)	6.66 (1.98)	6.85 (1.89)	0.042	
Weekly physical activity level (hours)	1.75 (1.64)	1.74 (1.61)	1.77 (1.54)	1.98 (1.66)	0.163	
Daily screen time (hours)	2.75 (1.43)	2.98 (6.15)	3.11 (6.87)	3.27 (7.09)	0.939	
Long jump (cm)	64.41 (29.41)	65.28 (25.60)	69.75 (25.37)	71.97 (26.68)	0.009	b < d**
20 m sprint (s)	5.98 (1.11)	6.35 (1.30)	6.36 (1.25)	6.37 (1.20)	0.495	
Endurance (s)	90.88 (23.96)	83.04 (18.20)	83.69 (19.75)	84.19 (19.73)	0.281	
Balance (s)	11.69 (10.49)	10.07 (11.36)	9.36 (10.30)	8.72 (9.68)	0.255	
Handgrip strength (kg)	5.90 (1.55)	5.44 (2.07)	5.62 (1.93)	5.59 (2.13)	0.707	

SD: standard deviation. BMI: body mass index.** $p < 0.01$

and refrain from making causal inferences. Another limitation is that other factors that may have influenced on studied outcome measures were not considered, such as social and physical setting, e.g. sports facilities, urban planning, transportation systems, parks and trails, etc.

Nevertheless, a strength of this research is that the sample was ample enough, and that recorded outcome measures had scarcely been approached in other similar studies, such as fitness.

In practical terms, interventions aimed at improving PA in preschoolers, both in and outside the school, are essential, especially if accompanied by nutritional education provided to parents with less financial resources and a poor level of education.

CONCLUSIONS

To sum up, preschoolers included in this study had a high overweight and obesity rate, and a low PA level, compared to international references. The fitness level of girls was lower than that observed in boys. Lastly, children whose parents had a low socioeconomic level and no education had a poor nutritional status. ■

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