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ORIGINAL ARTICLE

# Sociocultural differences in the development of obesity in adolescents in Murcia

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**Abstract**
*Background:* Childhood obesity presents alarming numbers in our country, being even higher in the population of immigrant origin. The main objective was to analyse the excess weight numbers both in native adolescents and in those children of immigrants and to determine the ethnic influence on lifestyle habits that could condition these differences in weight overload.
*Methods:* Adolescents from 1st year of Obligatory Secondary Education (E.S.O.) participated; somatometry was determined and classified according to BMI (with WHO references) and parental origin. Parents completed the survey on healthy habits (ENHASA). An analysis of variance was performed for each of the 4 dimensions of the questionnaire.
*Results:* A total of 416 adolescents participated (12.8 ± 0.62 years). Excess weight was detected in 41.2% of the participants, with significant differences between groups (p 0.018): 36.7% in Spanish, 42.9% in North Africa and 58.2% in South America. The ANOVA analysis showed differences in the section ''physical activity'' (p 0.003), highlighting the maximum disparity in the performance of extracurricular sports activities, with a lower score in both non-native groups.
*Conclusion:* We found significant differences according to ethnic origin in the number of overweight children and the amount of physical activity they do; South American adolescents are the most sedentary. We must design interventions that guarantee the access of all adolescents to sports activities to prevent the development of obesity.


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**PALABRAS CLAVE**
Adolescencia;
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Grupos étnicos;
Sobrepeso;
Obesidad;
Prevención

**Diferencias socioculturales en el desarrollo de la obesidad en adolescentes en Murcia**

**Resumen**
*Introducción:* La obesidad infantil ha alcanzado cifras alarmantes en nuestro país, siendo éstas todavía más elevadas en los grupos de población de origen inmigrante. El principal objetivo fue analizar las cifras de exceso de peso tanto en adolescentes nativos como en aquellos hijos de inmigrantes y determinar la influencia étnica sobre los hábitos de vida que podrían condicionar las diferencias en la sobrecarga ponderal.
*Material y métodos:* Participaron adolescentes de 1 ◦E.S.O; se determinó la somatometría y se clasificaron en función del IMC según referencias de la OMS y país de origen de los progenitores. Los padres cumplimentaron la encuesta sobre hábitos saludables (ENHASA). Se realizó un análisis de varianza de cada una de las 4 dimensiones del cuestionario.
*Resultados:* Participaron 416 adolescentes (12,8 ± 0,62 DE años). Se objetivó una cifra global de exceso de peso del 41.2%, con diferencias significativas entre grupos (p 0.018): 36.7% en*nativos*, 42.9% en originarios del *norte de África* y 58.2% en los *suramericanos*. El análisis ANOVA mostró diferencias en la dimensión ''actividad física'' (p 0.003), destacando máxima disparidad en la realización de actividades deportivas extraescolares, con menor puntuación en ambos grupos no nativos.
*Conclusiones:* Se encontraron diferencias significativas según el origen étnico tanto en las cifras de sobrecarga ponderal como en la realización de actividad física, siendo los adolescentes suramericanos los más sedentarios. Se deben diseñar intervenciones que garanticen el acceso de todos los adolescentes a las actividades deportivas para prevenir el desarrollo de obesidad.


## Introduction

The growing increase in the prevalence of childhood obesity and overweight is considered a public health problem.[1,2] In their recently published study, Lobstein et al. estimate that by 2025, some 268 million children worldwide between the ages of 5 and 17 could be overweight.[3] In Spain, more than one third of the child population is overweight, and most studies determine higher prevalences in ethnic minorities.[4–6]

Obesity is a complex disorder involving interwoven biological, family and environmental factors.[7,8] The environmental factors include changes in the diet, a sedentary lifestyle and the abuse of screen time. However, neither should the less-studied sociocultural factors, which can also be determinants of excess weight in childhood and adolescence, be forgotten.[4–5] These include both the acquisition of the eating habits of the society of origin together with others from the adoptive society and the abuse of ultra-processed products, which promote a positive energy balance with an increased sedentary lifestyle. Moreover, immigrants from developing countries do not perceive excess weight as a concern, but associate it with health, greater social status and prosperity.[4] For all these reasons, the parents' origin can act as an independent risk factor, as the prevalence of excess weight in the children of immigrant mothers in Spain is higher than that of native children.[4] In fact, in Spain few studies have analysed the relationship between ethnic influence and overweight or obesity in adolescence.[4,9–11]

The migratory phenomenon is one of the most significant demographic events to have occurred in our country in recent decades. The immigrant population is currently comprised of more than 5.4 million people. In areas such as the Region of Murcia and Melilla, this group accounts for over 15%–20% of the population, with even higher figures in rural areas. The most numerous groups of immigrants come from South America, followed by those from North Africa and other European countries.[12] In view of this social phenomenon, our studies must include the most vulnerable group of immigrant children. The main objective of this study was therefore to analyse excess weight figures in native adolescents and in the children of immigrants and to ascertain the ethnic influence on lifestyle habits which may lead to overweight and obesity.

## Material and methods

Cross-sectional study which included students from 12 to 14 years of age from Health Area V of the Region of Murcia during the 2017–2018 and 2018–2019 school years. Using data from the Spanish National Institute of Statistics, a minimum sample size of 350 participants was calculated with a maximum error of 4.92% and a confidence interval of 95% (95% CI). To obtain this sample, the seven secondary schools in the area were asked to participate. Five agreed to collaborate (four public and one maintained); two did not take part, claiming a lack of time in the teaching calendar. The sample was selected maintaining proportionality, according to each school. The inclusion criterion was being enrolled in the first year of compulsory secondary education [ESO], and the exclusion criteria were having a chronic illness or endocrine disease that affected nutritional status, having a diagnosed eating disorder and/or either the parents or the actual pupil refusing to take part in the study. The project was authorised by the Independent Ethics Committee of Hospital Virgen de la Arrixaca in Murcia.

The data were collected in two phases. In the first phase, the students' parents were given a copy of the Ëncuesta sobre hábitos saludables en adolescentes(ENHASA) [Survey on healthy habits in adolescents][13] to complete at home. This is a validated, reliable, easy-to-apply survey with 26 items contained in four dimensions (diet, physical activity, new technologies and environment) that analyses the main healthy behaviours of adolescents. It uses an odd-numbered 0–10 point Likert scale in which the higher the score the better the habits. The survey was sent to each family, together with the informed consent forms and an information sheet about the study, explaining the objectives, voluntary nature, anonymity of the answers and confidentiality according to the Spanish Law on Data Protection of 15 December 1999 (Ley Orgánica de Protección de Datos [LOPD] 13/1999) in force at the time the study began.

In the second phase, a health team comprised of two registered nurses and two paediatricians went to the respective schools to take anthropometric measurements from the pupils. The German SECA® column scale with height rod (model 788) was used to obtain the participants' weight and height. This model was used because it is an approved scale, precise (100-g division), with a high maximum load capacity (200 kg). It is also easy to transport because it is light and is fitted with wheels. The built-in telescopic stadiometer, with a measurement range of 60–200 cm, allowed height and weight to be measured in a single operation, speeding up the collection of the anthropometric data. The adolescents stood on the scale barefoot, wearing light clothing and with their heads in the Frankfurt plane. All the measurements were taken twice by the same person and the mean of both was regarded as valid.

Once the data had been collected, the participants were classified according to their parents' country of origin (native Spanish, South American, North African or other) and into two groups, normal weight and excess weight (overweight and obesity), according to their weight status. This task was carried out using the World Health Organization (WHO) body mass index (BMI) z score[14] on account of its methodological quality and international impact: $\leq$1 standard deviation (SD) normal weight, 1–2 SD for overweight and >2 SD. Finally, to study the relationship between the survey scores and the participants' ethnic origin, a one-way analysis of variance (ANOVA) was performed and the $\chi^2$ test was used for the relationship between groups for body weight. The modelling was carried out using the SPSS version 18 (SPSS Inc., Chicago, United States) statistical software.

## Results

A total of 421 pupils (52% female) with a mean age of $12.8 \pm 0.62$ (SD) years took part, signifying a participation of 74.2%. Three groups were formed depending on the parents' origin: native Spaniards (75.3%), South America (19%) and North Africa (5%). Eight pupils were excluded: three (one of Asian origin and two from other European countries) as they did not represent a sufficient sample to generate an independent group; four for having chronic illness (Turner syndrome, uncontrolled hypothyroidism, trichorhinophalangeal syndrome and maturity-onset diabetes of the young [MODY]) and one pupil with reduced mobility.

**Table 1** Participants' demographic characteristics.

| | |
|---|---|
| Participants | Included: 416<br>Excluded: 5<br>Total: 421 |
| Gender | Female: 216 (51.9%)<br>Male: 200 (48.1%) |
| Age | 12 years old: 279 (67%)<br>13–14 years old: 137 (33%) |
| Origin | Spain: 313 (75.3%)<br>South America: 79 (19%)<br>North Africa: 21 (5%)<br>Other: 3 (0.7%) |
| Type of school | Public: 395 (95%)<br>Maintained: 21 (5%) |

The main characteristics of the sample are shown in Table 1. No differences were found between the groups according to the type of school (28.5% in public schools vs 24.3% in maintained schools). Overall, excess weight was detected in 41.2% of the participants. By ethnic origin, excess weight was identified in 36.7% of the adolescents of Spanish origin, 42.9% of those of North African origin and 58.2% of those of South American origin, whose association analysed by ANOVA was significant (p 0.018). Differences by gender were found, with excess weight figures of 45.5% in North African girls and 65.9% in Latin American girls (Table 2). In terms of the degree of excess weight, as shown in Figure 1, the rate of obesity among the South American-origin participants was twice that of North African pupils and three times that of the Spanish pupils, which was significant with a p-value of 0.03.

The mean scores obtained in the ENHASA questionnaire for each of the three groups are shown in Table 3. The largest differences in scores were found in the *physical activity* dimensions, where the native Spaniards had better habits, and in the use of *new technologies*, where Spaniards and South Americans had a very similar score, although those of North African origin achieved better results (with a difference of up to 16% between them). No significant differences were found in the other two dimensions studied, *diet* and the *environment*. Following the ANOVA analysis of each of the dimensions assessed in the questionnaire, statistically significant differences were found only in the block pertaining to *physical activity* (p 0.003). Although there were differences in scores in the other dimensions (up to 4 points of variation between native Spaniards and South Americans in *diet* and more than 5 points between native Spaniards and North Africans in *environment*), these relationships were not significant. Figure 2 provides a graphic representation of the mean score and dispersion according to the ethnicity of each one of the blocks. Lastly, from the results obtained, and as *physical activity* was identified as the greatest determinant of the differences between groups, each of the items in that block was studied separately, with the results shown in Figure 3. As can be seen, the group of Latin American-origin pupils returned worse scores in all the items in that dimension. These differences were greatest in the items pertaining to *performing physical activity for 60 min at least three times a week* according to the WHO recommendations for regular physical exercise for childhood and adolescence;

**Table 2** Classification by weight status according to the participants' gender and origin.

| | Spanish | | | South American | | | North African | | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | Girls | Total | Boys | Girls | Total | Boys | Girls | Total | Boys | Girls | Total |
| Normal weight | 90 | 108 | 198 | 17 | 16 | 33 | 6 | 6 | 12 | 113 | 130 | 243 |
| | 57.7% | 68.7% | 63.2% | 53.1% | 34.1% | 41.8% | 60% | 54.5% | 57.1% | 57% | 60.5% | 58.8% |
| Excess weight | 66 | 49 | 115 | 15 | 31 | 46 | 4 | 5 | 9 | 85 | 85 | 170 |
| | 42.3% | 31.3% | 36.7% | 46.9% | 65.9% | 58.2% | 40% | 45.5% | 42.9% | 43% | 39.5% | 41.2% |
| Total | 156 | 157 | 313 | 32 | 47 | 79 | 10 | 11 | 21 | 198 | 215 | 413 |

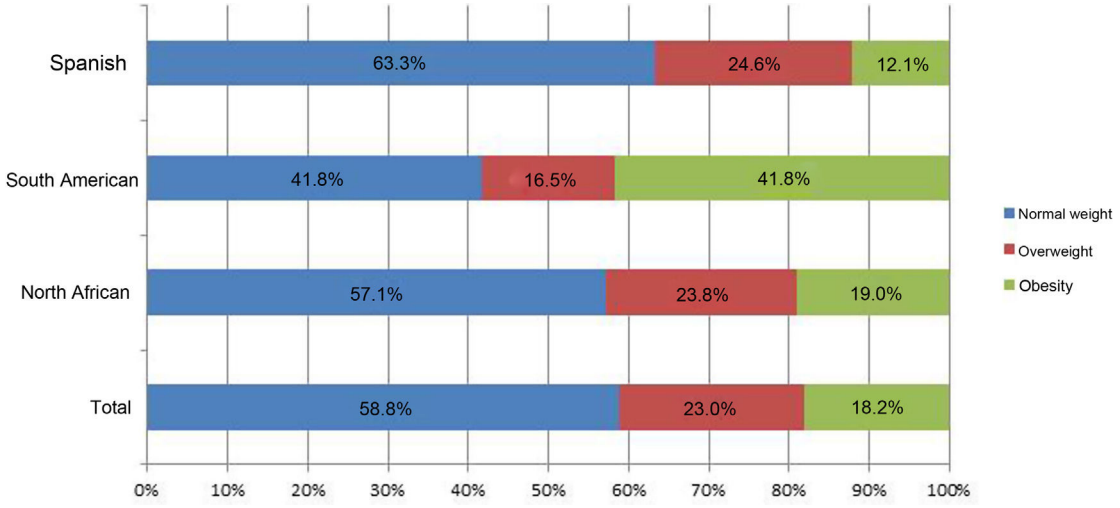


**Figure 1** Classification according to the participants' nutritional status by place of origin.

**Table 3** Mean scores obtained in each one of the dimensions according to the participants' origin.

| Dimension | No. items | | Spanish | South American | North African |
|---|---|---|---|---|---|
| Diet | | Mean | 58.79 | 54.91 | 57.32 |
| | 8 | SD | 11.28 | 11.82 | 13.13 |
| | | Range | 17–63 | 20–79 | 26–78 |
| Physical activity | | Mean | 26.45 | 20.69 | 26.73 |
| | 4 | SD | 8.26 | 8.83 | 10.17 |
| | | Range | 6–34 | 2–37 | 5–40 |
| New technologies | | Mean | 28.23 | 28.58 | 33.64 |
| | 7 | SD | 14.26 | 15.12 | 16.71 |
| | | Range | 0–65 | 0–61 | 4–61 |
| Environment | | Mean | 58.71 | 57.85 | 61.09 |
| | 7 | SD | 11.70 | 11.89 | 9.92 |
| | | Range | 15–70 | 24–70 | 38–70 |

SD, standard deviation.

and particularly in doing *extracurricular sports activities*. The practice of *physical activity as a family* and the availability of *free time to have fun* had very similar scores in the three groups. Finally, the association between the score obtained in physical activity and weight status within the groups was studied. The biggest difference was found in the South American group, where those with normal weight showed better habits than those overweight (a mean of 23.5 vs. 17.6 points); this association was significant (p = 0.001).

## Discussion

In our study, 24.7% of the participants came from an immigrant family, a figure similar to other regions of Spain.[15] Overall, excess weight figures were similar to those described in the literature,[6,16] although a large discrepancy was found after the analysis according to the origin of the parents with higher figures, primarily for the Latin American-origin participants (53.9% vs. 36.6% in native Spaniards). This disparity was greater than the reports of

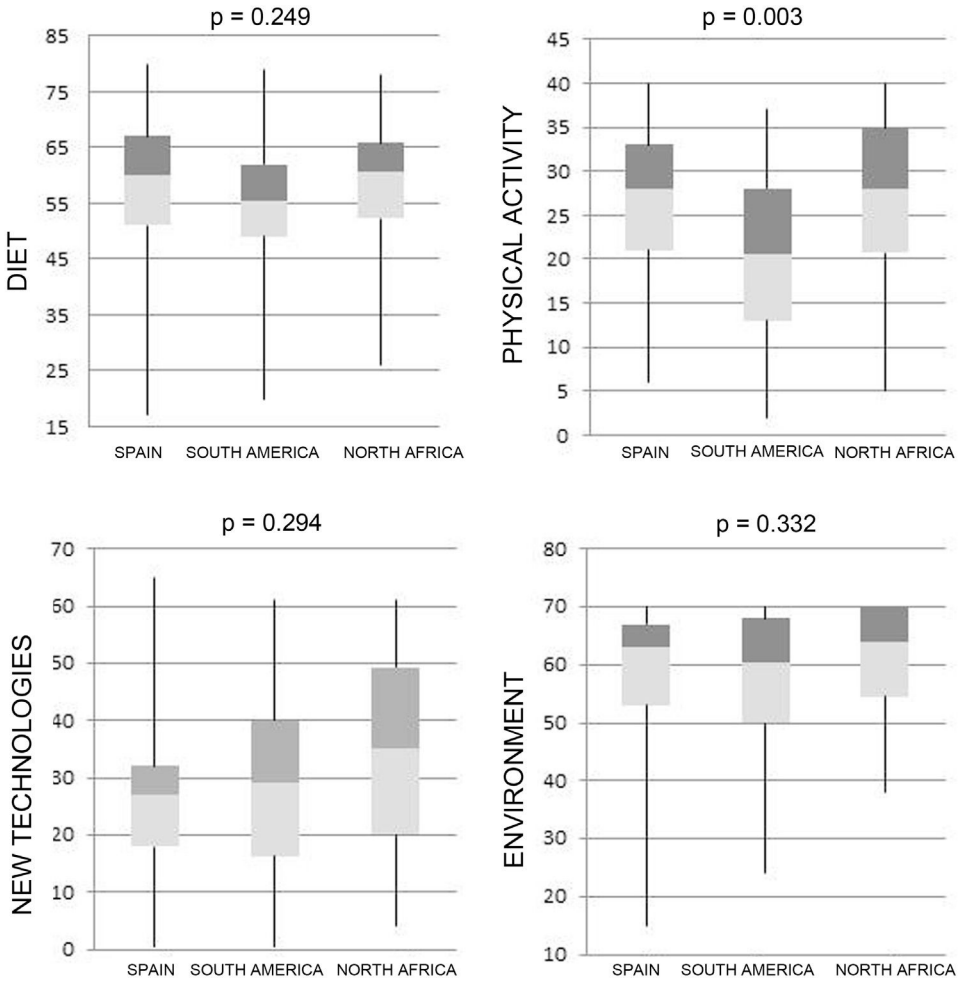


**Figure 2** Box-and-whisker plot in which the mean scores of each dimension are represented based on the origin and p-value resulting from the ANOVA.

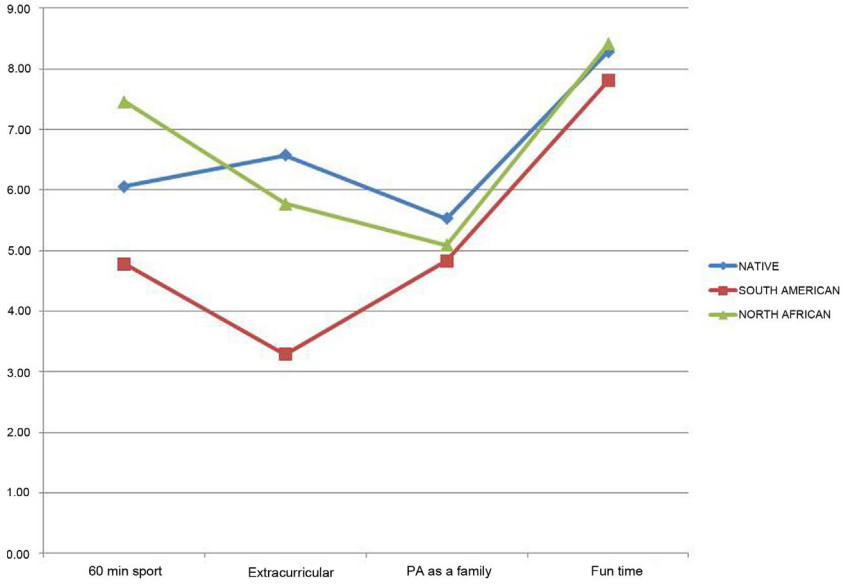


**Figure 3** The mean scores obtained in each of the four items of the physical activity block are represented, according to the participants' origin.

other studies,[5] probably determined by the origin and sociocultural traditions of the immigrant population covered by Area V, mostly of Latin American origin, unlike other reviews in which the Moroccan population is predominant.[11,15] Immigrants from Latin America form a large part of the population currently living in Europe and appear to be at particular risk of becoming overweight and obese, probably determined to a large extent by a genetic predisposition.[4]

From the analysis of the dimensions of the survey according to the participants' ethnic origin, physical activity was found to be the only significantly decisive dimension conditioning excess weight. Many studies relate lack of exercise to obesity[15,17,18] and other health problems such as increased adiposity, high blood pressure, diabetes and osteoporosis.[19–21] Some authors, such as Gutierrez-Hervas,[15] found no association between engaging in physical activity and parental origin, most likely because the vast majority of the immigrant population in that study was of Moroccan origin. This contrasts with our study population, the majority of Latin American origin, in which other genetic and cultural variables would be factored in; for example, the fact that there is less culture of exercise related to health in these countries of origin.[4] It should not be forgotten that the WHO recommends at least 60 min of moderate-to-vigorous physical activity a day in the child population.[22] However, in Spain, these recommendations cannot be achieved with the exercise time allocated in schools (around 2 hours per week). That is why extracurricular sports activities are so important, as they complement school activities and help to achieve the WHO recommendations. However, lower scores were also detected in the *extracurricular sports activities* item in the non-native-Spaniard groups. This is consistent with the fact that the immigrant population in Spain participates almost three times less than the native population in this type of activity and may be a determining factor in the increase in obesity figures in this population.[23] All the factors that hinder the practice of physical/sports activities in these groups need to be assessed and universal access by all minorities ensured.

No significant differences were found in any of the other dimensions. The few studies that have been carried out in Spain on the eating habits of the immigrant population highlight the generalised widespread acceptance of Spanish food, adapting to national customs, barring small variations, contributing their own richness and variety.[24] This would account for the absence of significant differences between groups. In addition, the study population belongs to a rural area in which there could be a greater adherence to the Mediterranean diet, as some authors have reported.[25] As regards new technologies, the current generations of adolescents live in a hyper-connected world, in which screens are used for study, work, leisure and personal relationships, referred to as a multiscreen environment. All this leads to an increase in the total number of screen hours and, consequently, sedentary hours, which in turn leads to obesity.[26,27] In Spain, studies show that the immigrant population has less access to this type of technology, mainly for financial reasons,[28,29] which may explain the more limited use of new technologies by North Africans in our study. Policies need to be introduced to facilitate access to these devices in order to mitigate the impact of the digital divide, while promoting a rational use of them at the same time. Finally, we also found no significant differences in the environment-related habits dimension. Although numerous studies have linked a hostile environment during adolescence to excess weight and other problems such as difficulty in social relationships or mental disorders,[30] in this case, we found no such association, probably because the study area has a great tradition of accepting migrants because of the availability of work in rural environments, and one in every four pupils in this study was an immigrant or the child of an immigrant. In other words, we believe that young people who are not native Spaniards are established and integrated into the social and school environment of the native population of the area.

The main limitation of our work is that it is a cross-sectional study in one specific health area. There is a potential information bias, as it was a self-reported questionnaire on healthy habits. Our aim was to perform a simple randomisation, but this could not be carried out due to the lack of participation by the schools. Nevertheless, the sample size achieved was larger than required. Particular strengths include the use of a validated questionnaire for a paediatric population and that the anthropometric data were obtained objectively.

## Conclusions

The data found related to excess weight in the population studied are alarming, and the figures are higher in the population of immigrant origin. There is no question that excess weight has a genetic component, but it is essential to determine which external conditions, such as the practice of physical exercise, have a direct influence and can therefore help to protect ethnic minorities, particularly from obesity. A sedentary lifestyle was more prevalent in the Latin American origin group, mainly due to their engaging in fewer extracurricular sports activities. Prevention and intervention programmes need to guarantee universal and free access to this type of activity. As the immigrant population is one of the most vulnerable to childhood obesity, specific targeted strategies need to be developed according to the characteristics of the population and adapting to sociocultural changes.

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## Conflicts of interest

The authors declare that they have no conflicts of interest.

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## References

1. Akowuah PK, Kobia-Acquah E. Childhood obesity and overweight in Ghana: a systematic review and meta-analysis. J Nutr Metab. 2020;2020:1–11, http://dx.doi.org/10.1155/2020/1907416.

2. Yáñez Ortega JL, Arrieta-Cerdán E, Lozano-Alonso JE, Gil Costa M, Gutiérrez-Araus AM, et al. Prevalencia de sobrepeso y obesidad infantil. Estudio de una cohorte en Castilla y León, España. Endocinol Diabetes Nutr. 2019;66(3):173–80.
3. Lobstein T, Jackson-Leach R. Planning for the worst: estimates of obesity and comorbidities in school-age children in 2025. Pediatr Obes. 2016;11(5):321–5, http://dx.doi.org/10.1111/ijpo.12185.
4. Oliván GG. Prevalencia de sobrepeso y obesidad en adolescentes inmigrantes. Rev Pediatr Aten Primaria. 2018;20(77):27–32.
5. Serral Cano G, Bru Ciges R, Sánchez-Martínez F, Ariza Cardenal C, Grupo de Evaluación del Proyecto POIBA (Prevención de la Obesidad Infantil en Barcelona). Sobrepeso y obesidad infantil según variables socioeconómicas en escolares de tercero de Primaria de la ciudad de Barcelona. Nutr Hosp. 2019;36(5):1043–8, http://dx.doi.org/10.20960/nh.02205.
6. Gobierno de España/Ministerio de Consumo/Agencia Española de Seguridad Alimentaria y Nutrición. Estudio sobre la Alimentación, Actividad Física. Desarrollo Infantil y Obesidad en España 2019 (ALADINO). 2020 [accessed 6 Jun 2021]. Available from: https://www.aesan.gob.es/AECOSAN/web/nutricion/detalle/aladino_2019.htm.
7. Yánez-Ortega JL, Arrieta-Cerdán E, Lozano-Alonso JE, Gil-Costa M, Gutiérrez-Araus AM, Cordero-Guevara JA Grupo de Trabajo para la Investigación de Sobrepeso, Obesidad y Desarrollo Infantil en Castilla y León. Prevalencia de sobrepeso y obesidad infantil. Estudio de una cohorte en Castilla y León, España. Endocrinol Diabetes Nutr. 2019;66(3):173–80, http://dx.doi.org/10.1016/j.endinu.2018.10.004.
8. Jiménez Candel MI, Mondéjar Jiménez J, Gómez Navarro AJ, Monreal Tomás AB. Family influence on childhood excess weith in the Region of Murcia, Spain. Argent Pediatr. 2021;119(2):99–105, http://dx.doi.org/10.5546/aap.2021.eng.99.
9. Enes Romero P, Cano Gutiérrez B, Álvarez Gil N, Martín-Frías M, Alonso Blanco M, Barrio Castellanos R. Influencia étnica en la prevalencia de síndrome metabólico en población pediátrica obesa. An Pediatr (Barc). 2013;78:75–80, http://dx.doi.org/10.1016/j.anpedi.2012.04.010.
10. Escobedo Portillo MT, Hernández Gómez JA, Estebané Ortega V, Martínez Moreno G. Modelos de ecuaciones estructurales: características, fases, construcción, aplicación y resultados. Rev Cienc Trab. 2016;18(55):16–22, http://dx.doi.org/10.4067/S0718-24492016000100004.
11. Esteban-Gonzalo L, Veiga OL, Regidor E, Martínez D, Marcos A, Calle ME. Immigrant status, acculturation and risk of overweight and obesity in adolescents living in Madrid (Spain): the AFINOS study. J Immigr Minor Heal. 2015;17(2):367–74, http://dx.doi.org/10.1007/s10903-013-9933-2.
12. Instituto Nacional de Estadística. Avance de la Estadística del Padrón Continuo a 1 de enero de 2021 [Available from: https://www.ine.es/prensa/pad_2021_p.pdf].
13. Jiménez Candel MI, Carpena Lucas PJ, Ceballos-Santamaría G, Mondéjar Jiménez J. Design and validation of a questionnaire to study healthy habits among adolescents aged 12-14 years. Arch Argent Pediatr. 2021;119(3):177–84, http://dx.doi.org/10.5546/aap.2021.eng.99.
14. De Onis M, Garza C, Onyango AW. WHO child growth standards. Acta Paediatr. 2006;95:5–101.
15. Gutierrez-Hervasa A, Cortés-Castell E, Juste-Ruíz M, Rizo-Baeza M. Qué variables influyen en el cumplimiento de las recomendaciones de actividad física en preescolares? An Pediatr (Barc). 2020;92(3):156–64, http://dx.doi.org/10.1016/j.anpedi.2019.05.017.
16. Espin Riosa MI, Pérez Flores D, Sánchez Ruiz JF, Salmerón Martinez D. Prevalencia de obesidad infantil en la Región de Murcia, valorando distintas referencias para el indice de masa corporal. An Pediatr. 2013;78(6):374–81, http://dx.doi.org/10.1016/j.anpedi.2012.09.007.
17. World Health Organization. Global Strategy on Diet, Physical Activity and Health 2004. [Available from: https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf].
18. Zurriaga O, Quiles Izquierdo J, Gil Costa M, Anes Y, Quiones C, Margolles M, et al. Factors associated with childhood obesity in Spain. the OBICE study: a case-control study based on sentinel networks. Public Health Nutr. 2010;14(6):1105–13, http://dx.doi.org/10.1017/S1368980010003770.
19. Tarp JCA, White T, Westgate K, Bugge A, Grontved A, Wedderkopp N, et al. Physical activity intensity, bout-duration, and cardiometabolic risk markers in children and adolescents. Int J Obes. 2018;42(9):1639–50, http://dx.doi.org/10.1038/s41366-018-0152-8.
20. Andermo S, Hallgren M, Nguyen TTD, Jonsson S, Petersen S, Friberg M, et al. School-related physical activity interventions and mental health among children: a systematic review and meta-analysis. Sports Med. 2020;6:1–27.
21. Ravi S, Kujala UM, Tammelin TH, Hirvensalo M, Kovanen V, Valtonen M, et al. Adolescent sport participation and age at menarche in relation to midlife body composition, bone mineral density, fitness, and physical activity. J Clin Med. 2020;9(12):3797, http://dx.doi.org/10.3390/jcm9123797.
22. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020;54:1451–62.
23. Delgado L, Montes R. Práctica de actividad física extraescolar y preferencias deportivas en niños preescolares españoles e inmigrantes: un estudio piloto. TOG [revista en Internet]. 2015;12(22):1–12.
24. García Bartolomé J, Nielsen AC. Hábitos alimentarios de los inmigrantes en España. Ministerio de Agricultura, Pesca y Alimentación, Madrid, 2004. Rev Int Sociol. 2005;63(40):274–6.
25. Grao-Cruces A, Nuviala A, Fernández-Martínez A, Porcel-Gálvez AM, Moral-García JE, Martínez-López EJ. Adherencia a la dieta mediterránea en adolescentes rurales y urbanos del sur de España, satisfacción con la vida, antropometría y actividades físicas y sedentarias. Nutr Hosp. 2013;28(4):1129–35, http://dx.doi.org/10.3305/nh.2013.28.4.6486.
26. LeBlanc AG, Broyles ST, Chaput JP, Leduc G, Boyer C, Borghese MM, et al. Correlates of objectively measured sedentary time and self-reported screen time in Canadian children. Int J Behav Nutr Phys Act. 2015;12(1):1–12, http://dx.doi.org/10.1186/s12966-015-0197-1.
27. LeBlanc AG, Katzmarzyk PT, Barreira TV, Broyles ST, Chaput JP, Church TS, et al. Correlates of total sedentary time and screen time in 9-11 year-old children around the world: The international study of childhood obesity, lifestyle and the environment. PLoS One. 2015;10(6):e0129622, http://dx.doi.org/10.1371/journal.pone.0129622.
28. Tovar Parra JC. Brecha digital e inmigración en España: el papel y uso de las TICs entre asociaciones de inmigrantes; 2017 [Available from: https://dialnet.unirioja.es/servlet/tesis?codigo=171132&info=resumen&idioma=SPA].

29. Círez Tambo MF, Domínguez Alegría AG, López Montero R. Brechas 2.0. Impacto de las brechas digitales en niñas y niños de familias migrantes y refugiadas [Internet]. Accem. 2019 [accessed 17 Jun 2021]. Available from: https://www.accem.es/informe-brechas-2-0/

30. Kansra AR, Lakkunarajah S, Jay MS. Childhood and adolescent obesity: a review. Front Pediatr. 2021;8:581461, http://dx.doi.org/10.3389/fped.2020.581461.