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Technologies for the development of physical activity for schoolchildren in out-of-school hours

[*Las tecnologías para el desarrollo de la actividad física de escolares en horario extraescolar*]

[*Tecnologias para o desenvolvimento da atividade física de escolares no horário extracurricular*]

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ABSTRACT

Nutritional patterns, time dedicated to physical activity and sedentary lifestyle are determining factors in the health of schoolchildren. This research attempted to analyze these factors in a sample of students, as well as the prevalence of overweight and obesity. A cross-sectional study was developed on a sample of 210 Elementary School students in Ceuta (Spain). After the application of a structured questionnaire of seven 24-hour

recall, the measurement of BMI, and the application of a battery of physical tests; were found: inadequate nutritional patterns, high rates of overweight and obesity, as well as a low exposure to physical activity, according to the recommended parameters for those ages, and very high levels of sedentary lifestyle. The research presented the need to modify these inadequate habits, highlighting the role of information and communication technologies as tools to expand the limited load allocated to physical education from the current curriculum in Spain. One of the implications of the study dealt with the application of a program to extend the work time of the Physical Education area at home thanks to the power of technologies.

Keywords: physical activity; nutrition; overweight; information and communication technologies; out-of-school time.

RESUMEN

Las pautas nutricionales, el tiempo dedicado a la actividad física y la vida sedentaria son factores determinantes en la salud de los escolares. Esta investigación trató de analizar estos factores en una muestra de estudiantes, así como, la prevalencia al sobrepeso y la obesidad. Se desarrolló un estudio transversal sobre una muestra conformada por 210 alumnos de Educación Primaria de Ceuta (España). Tras la aplicación de un cuestionario estructurado de siete recuerdos de 24 horas, la medición del IMC, así como la aplicación de una batería de pruebas físicas, se comprobaron patrones nutricionales inadecuados, altas tasas de sobrepeso y obesidad, así como, una exposición a la actividad física escasa, según los parámetros recomendados para esas edades, además de unos niveles muy altos de sedentarismo. La investigación presentó la necesidad de modificar estos hábitos inadecuados, poniendo en valor el papel de las tecnologías de la información y de la comunicación como herramientas para ampliar la escasa carga destinada a la educación física desde el currículo actual en España. Una de las implicaciones del estudio trató sobre la aplicación de un programa de extensión del tiempo de trabajo del área de Educación Física en los hogares gracias al poder de las tecnologías.

Palabras clave: actividad física; nutrición; sobrepeso; tecnologías de la información y de la comunicación; tiempo extraescolar.

RESUMO

As orientações nutricionais, o tempo dedicado à atividade física e o sedentarismo são fatores determinantes na saúde dos escolares. Esta pesquisa procurou analisar esses fatores em uma amostra de estudantes, bem como a prevalência de sobrepeso e obesidade. Foi desenvolvido um estudo transversal sobre uma amostra composta por 210 alunos do Ensino Primário de Ceuta (Espanha). Após a aplicação de um questionário estruturado de sete memórias de 24 horas, foi realizada a aferição do IMC, bem como a aplicação de uma bateria de testes físicos, padrões nutricionais inadequados, altos índices de sobrepeso e obesidade, além de exposição a pouca atividade física , de acordo com os parâmetros recomendados para essas idades, além de níveis muito elevados de sedentarismo. A pesquisa apresentou a necessidade de modificar esses hábitos inadequados, destacando o papel das tecnologias de informação e comunicação como ferramentas para ampliar a carga limitada atribuída à educação física no currículo atual na Espanha. Uma das implicações do estudo foi a aplicação de um programa de ampliação do tempo de trabalho na área de Educação Física nos domicílios graças ao poder das tecnologias.

Palavras-chave: atividade física; nutrição; sobrepeso; Tecnologias de informação e comunicação; horário extracurricular.

INTRODUCTION

The time of physical activity during the school period at educational centers, and during the extracurricular period, is as decisive in childhood obesity as is the diet itself. According to the 10th National Sports Medicine Award (Spain), whose study was led by Gerardo Villa, the exercise performed by schoolchildren is more important than eating

behavior when it comes to preventing obesity. The World Health Organization (WHO 2012-2022) indicates that around 70% of boys and up to 88 % of girls under 10 years of age do not engage in daily physical activity that is appropriate for their age.

Overweight problems in Spain, in 2019, presented alarming data in schoolchildren between 6 and 9 years of age. A 40.6 % of Spanish schoolchildren of these ages were overweight (23.3% overweight and 17.3 % obese), with obesity being more prevalent in boys and overweight in girls, and both increasing with age (Aladino, 2019). For many authors, the main cause of overweight and obesity is the imbalance between calorie intake and energy expenditure (Sáez and Mediavilla, 2022). Furthermore, many studies insist on the large amount of low-quality foods with very high caloric intake consumed today by the population, and by our children, in particular.

Likewise, there is a low rate of physical activity at early ages. Children are increasingly opting for a sedentary life, where technologies play a transcendental role. From what was once a recreational activity based on street games, today there is a playful development in front of consoles, cell phones and tablets (Guzmán & Mediavilla, 2022).

Several studies show that a sedentary lifestyle has serious physical and psychological repercussions. Educational institutions have among their fundamental objectives, the care and protection of children, therefore, they cannot remain immobile in the face of this problem. This document will present how the area of Physical Education analyzes this issue and promotes the development of a physical activity program at home through Information and Communication Technologies.

The professionals in charge of teaching this area know that the time allocated to this discipline, within the curriculum, is scarce. Likewise, all the studies show the need to have a wider timetable for physical and/or sports activity at this age group. There is a curricular tradition of "extending" the school day beyond the 175 school days of the academic year and the 5 or 6 hours of classes per day. The teachers of the different areas of the curriculum carry out countless activities in out-of-school hours that are verified and computed within the qualification criteria of their areas of knowledge.

During the confinement, channels and ways of working were opened, from each of the curricular areas, until the unexplored. Even television and social networks were able to reformulate new ways of bringing physical activities and sport closer to society. Some of them have continued to be used beyond compulsory confinement for their high value and contribution to health, as well as for the ease of customizing a job "à la carte" intended for the prevention and improvement of problems derived from a sedentary lifestyle and inadequate dietary patterns.

In this study, the New Information and Communication Technologies appear as part of the problem of sedentary lifestyles at an early age, but, at the same time, as allies to promote a change in habits in relation to physical activity in children.

This research proposes to address the following objectives:

- To analyze the dietary patterns, physical activity and sedentary lifestyle of the schoolchildren in the sample.
- To determine overweight and obesity trends in the population under study.
- To present a project that extends the intervention and time intended for the physical activity from the area of school Physical Education.
- To value the intervention made by the Physical Education area, extending the weekly time of the three sessions established by the current educational law, the LOMLOE by its acronym in Spanish (Organic Law Amending the Organic Law of Education), through the after-school program *Muévete en casa* (Let's move at home).

MATERIALS AND METHODS

This cross-sectional study was carried out with a non-experimental, descriptive-explanatory and field study design. The sample consisted of 210 schoolchildren from an Elementary School in the autonomous city of Ceuta. The criterion for belonging to the sample was age and grade, so all students who were in the range, age and grade

participated in the sample. The fieldwork was carried out between the months of September and June 2021. It must be taken into account that the researcher is also the Physical Education teacher of the groups, thus becoming a participant observer of the study itself.

A structured questionnaire was used to analyze the nutritional habits of the schoolchildren in the sample, the physical activity carried out inside and outside the educational center, the sleep patterns, as well as the tendencies towards normal weight, overweight and obesity of the subjects in the sample. The nutritional, sleep and physical activity information was collected in seven 24-hour recall periods in order to learn about these habits. In addition, data were collected on the daily intake of different types of food, the time spend by schoolchildren in front of screens, cell phones, tablets, television, books, homework, etc., without physical activity, and daily sleep patterns. Similarly, data on patterns of height, weight and body mass index (BMI) were collected within the Physical Education sessions themselves, verifying the tendencies towards normal weight, overweight or underweight of each of the subjects. All subjects in the sample participated in the development of a battery of physical tests (aerobic endurance, coordination, balance, flexibility, jumping, agility, etc.) That will be the basis for future publications on the relationship between overweight and obesity and physical condition.

In the organization and processing of the data on nutritional habits, the NOVA classification was followed, which orders and categorizes foods according to the level of transformation to which they have been subjected. This made it possible to distinguish those foods with a high nutritional value from those that are "enemies of health." From this classification we found four food groups:

- Group 1: unprocessed or minimally processed natural foods. They are foods that have undergone little or no processing (fruits, fish, vegetables, legumes, whole/semi-skimmed/skimmed milk, eggs, poultry, seafood, fermented milk such as yogurt, grains -white rice, pasta-, homemade pastries, natural juice, coffee and water).

- Group 2. Foods with processed culinary ingredients. This type uses the combination of foods of group 1 with those of group 2 (vegetable oils - olive, sunflower, corn, chilies, salt, sugar, spices, lard, butter...)
- Group 3. Processed foods. These are foods from group 1 that have undergone a transformation process and have a short list of ingredients (condensed milk, canned food, cured cheeses, cured hams, packaged fruit, white breads, beer, wine, canned vegetables...)

Group 4. Ultra-processed foods. Foods manufactured from complex industrial procedures. Designer food products based on combining components of all kinds, with many additives, sweeteners, flavorings and texturizers, binders, cohesive, colorants, emulsifiers, thickeners, foaming agents, stabilizers, sensory "enhancers" such as flavorings and aromatics, preservatives, flavorings and solvents. Some examples are: *petit suisse*, custard, flan, pudding, ice cream, packaged hams, processed meats chorizo, salami, *mortadella*, sausage, hamburgers, blood sausage, *pâté*, *foei gras*, spicy sausages, meatballs, potatoes, breakfast cereals, pizzas, prepared cakes, margarine, cookies, muffins, donuts, croissants, pastries, *churros*, chocolate, candies, sweetened beverages, carbonated beverages, fruit drinks, smoothies, instant soups and creams, croquettes, mayonnaise, alcoholic beverages.

There are many organizations, including the WHO, FAO, etc., that have warned of the problematic nature of Group IV foods because of their poor nutritional quality being energy-dense and containing very high amounts of critical nutrients. If consumed regularly, they can lead to the development of chronic non-communicable diseases, such as obesity, hypertension and type 2 diabetes. (FAO, 2019) (Figure 1).

Fig. 1. - *NOVA food classification*

To analyze how the sample behaved with respect to the WHO tables on normal weight, BMI was analyzed. This variable, measured in kg/m², was calculated by the subjects themselves in the Physical Education classes, with the help of their tutor-specialist, the author of this study. Based on weight and height, and taking into account age, the BMI variable was calculated. Once the BMI was calculated, it was analyzed according to the WHO tables for age and gender, coding it according to the categories of: underweight, normal weight, overweight and obesity, according to the cut-off points indicated in the tables mentioned above.

To collect the data on the nutritional habits of the subjects in the sample, the 24-hour recall technique was used, as already mentioned. The 24-hour recall is a method used by professionals in the nutrition field. It consists of collecting data on recent intake (Ferrari, 2013). Seven 24-hour recalls were taken. Although the authors usually take two, the recording of seven helped to know if the five daily meals are respected both on school days and holidays, the contribution of different nutrients, the consumption of processed foods, as well as the amounts of intake over a week. The reason for collecting data on school days (Monday to Friday) and weekends was because Saturdays and Sundays tend to have very different patterns of behavior in relation to weekdays.

In relation to the variable sedentary life and physical activity, it was analyzed whether they do daily physical exercise, the amount and type of it, and whether, throughout the day, they lead a sedentary life in front of the television, cell phone, tablet, computer, books, homework, etc.

Regarding the hours of sleep, we tried to determine whether they took naps, the time they went to bed and the total daily sleep time dedicated by the boys and girls. Other variables such as sex and age were controlled.

As the researcher was the Physical Education teacher of the schoolchildren in the sample, the whole process of collecting information, analysis and application of corrective measures from the area of Physical Education was carried out in a formative process with a research-action nature. The boys and girls have been able to analyze the results,

taking an active role in knowing the data, understanding the dimension of the same, as well as initiating interventions that could improve the situation. Likewise, family members have been informed of all the actions developed in this program and research process, inside and outside the center.

The study began with tutorials with families in which the intentions of the study and the needs for family collaboration to improve the health of their sons and daughters were explained. The tests were developed during the Physical Education classes, as well as the follow-up of the nutritional diary (questionnaire), both at home and in the tutorials.

It should be noted that each of the data that emerged in the analysis was taken to the Physical Education classes, so that if, for example, inadequate sleeping patterns were observed, the risks of these were analyzed and the need to adopt the correct ones. These recommendations were explained to the students in class, as well as to the families in the tutorials. This turned the study, from the beginning, into a research-training process.

RESULTS AND DISCUSSION

1. Participation rate and valid sample percentage

The study could be completed for a total of 210 subjects. This number represented a 90.13 % participation in each and every one of the experiences and tests carried out. Of the 23 participants who represented the sample death: three of them had resigned to participate in part of the same, although, they had to follow the recommendations and the formative research-action work classes, since they were part of the qualification criteria of the area; ten could not complete all the data of the questionnaire; two did not finish the course; and the remaining eight did not participate in the *Muévete en casa* program, because they claimed not to have digital devices.

2. Study variables

The sample consisted of 210 subjects, of whom 55.23 % were girls (116) and 44.77 % were boys (94).

Eating habits and diet characteristics

This section of the questionnaire yielded data from the following fields: number of meals per day (both weekdays and weekends), if the child does not eat all the meals recommended by the agencies in charge of studying and promoting health, which meals are skipped and on which days, whether the family and the child consider that he/she eat healthy, and the nutritional contribution of his/her diet.

The results showed data of great interest. An 88.57 % of the families/students have the perception of eating healthy, while 11.43 % understand that they do not carry out healthy nutritional habits. These data contrast with the high percentage of schoolchildren who do not usually eat five meals a day, who do not usually consume a diet rich in nutrients of the group I, and who consume a large amount of ultra-processed foods.

A high percentage of the children surveyed provided very alarming data on the quality of their daily diet, both on school days and on weekends (even worse on Saturdays and Sundays), despite their conviction to eat healthy:

- 88.09 % of the sample said that they habitually eat group III and IV foods (processed and ultra-processed).
- Only 23.33 % of the sample stated that they regularly eat group I and II foods (minimally processed and with processed ingredients).
- The consumption of group I and/or II foods, such as fruits, vegetables, fish and meats, has a very insignificant impact on the diet. Ultra-processed foods have found their way into households to such an extent that a high number of subjects report that they do not eat or even like vegetables (38.09 %, to be precise).

In reference to the *caloric quantity* of the same, 70.47 % of the sample presents a high energy consumption than expenditure. This explains in part why 34.04% of the boys and 40.52 % of the girls are in the overweight profiles, and 15.51 % of the boys and 10.64 % of the girls, with overweight, are in the obesity profiles. This means that 37.62 % of the sample is overweight and 13.33 % is obese.

Another fact to be taken into account is the almost generalized situation of not eating five meals a day. A total of 85.24 % of children say that they do not eat five meals a day, 37.43 % of those who do not eat five meals do not eat breakfast at home before going to school and 56.98 % of those who usually have a snack-dinner, combining the last two intakes in one.

Physical activity and/or sports (PA/S)

From the point of view of the amount of physical exercise and/or sports that the individuals in the sample engage in, it should be said that there are notable differences between boys and girls. Boys have higher participation rates than girls. Some 65.24% say that they usually do PA/S outside school hours, with 34.76 % of the sample subjects being children who only do PA/S in Physical Education classes (three sessions of 50 minutes a week). This data differentiated by gender indicates that 81.91 % of the boys and 51.72 % of the girls perform some physical activities beyond those of the school Physical Education area.

When analyzing the number of days and the time spent, the data indicate that, of the percentage of the sample that performs some activity outside the school, 70.07 % do only one activity, 17.52 % do two and 12.40% do three or more. The most significant data regarding the amount of PA/S activities carried out outside of the school are found in the time spent doing them. The subject in the sample indicate that 51.09 % spent between 1 and 3 hours per week, 24.09 % between 3 and 6 hours, 15.32 % between 6 and 10 hours and 9.49 % more than 10 hours.

If we consider the quality of the activity carried out, 88.32 % of the subjects who engage in PA/S outside school do so in team sports. It is known that the effective time of physical work in this type of modalities does not imply the effective use of the time of dedication.

Guidelines and routines involving sedentary lifestyle

The results shown by the weekly diaries present very worrying data. A 79.52 % of the sample says that they are in regular contact with cell phones, computers, tablets, game consoles, apps, etc. When looking at the time spent in front of these types of devices, 46.67 % say they use them between one and two hours a day, with 9.05% reporting a daily exposure time of more than two hours.

Another interesting fact is the number of children who usually come to school by means of transportation, 67.61 %. Only 32.39 % come to school walking.

In the research, other data appear, such as sleep patterns, physical condition of children, etc., but it is believed that the exposure of these data are more than enough to observe the problems presented by a large number of subjects in the sample in relation to the two most determining variables for physical health and the problems of overweight and obesity: poor nutritional habits and the lack of physical activity recommended by international organizations. These data are enough to justify the obligatory attention of teachers in the face of this explosive cocktail, especially specialists in the area of Physical Education. It is here where the implementation of a program that attempts to increase the physical activity of these children in out-of-school hours arises.

The results of this research are in line with the studies on the prevalence of overweight and obesity carried out in Spain, which although it had an improvement from 2016 (Garrido-Miguel *et al*., 2019), with the epidemic of the coronavirus it rebounded again. Sedentary life has become a pandemic at a general level, and very especially, in young populations, with the risks it carries for physical and psychological health (Macías *et al*., 2018, García, 2019).

Similar results to the ALADINO study (2019) were confirmed, with differences between sexes, with overweight being more frequents in girls and obesity in boys. These differences between sexes can be explained by the time spent in physical activity outside the school, with girls being the worst off, both due to less exposure to physical activities and/or sports activities and to higher levels of sedentary lifestyle. It should be noted that there are quite a few families with boys and girls at school, within which there are different patterns when choosing extracurricular activities for their offspring, with their sons participating in more activities involving PA/S than their daughters.

About 10 % of the sample is close to the daily physical activity time recommended by the WHO for this age group. This data is even lower than that presented by this organization in its studies, with 21 % of children of these ages meeting the recommended PA/S time for their age.

In this study, the crossing of variables has not been presented, because the objective of this study has been to show the way in which the area of Physical Education has proposed alternatives to expand the possibilities of physical activity and/or sports in schoolchildren, in the afternoon. Macro data have been presented in an attempt to demonstrate the scarcity of daily physical activity and sports practice, sedentary lifestyle habits and inadequate nutritional patterns, in order to highlight the urgent need to propose strategies for change from the schools themselves. Although, preparing the presentation of this cross-referenced data for other publications, it can be said that, coinciding with the ALADINO 2019 study, schoolchildren who are far from normal weight are those who have the worst eating habits, both in terms of not eating five meals a day and in terms of a diet of lower nutritional quality, together with less physical activity and, consequently, a more sedentary lifestyle. This corroborates that weight problems are determined by an imbalance of intake and expenditure, as *other studies have shown*. The strategies followed in recent years both in Spain with the NAOS (by its acronym in Spanish), program, in the EU Action Plan against Childhood Obesity 2014-2020, as well as the National Strategic Plan for the reduction of childhood obesity 2022-2030, insist on the need for interventions in different areas, such as: nutrition, physical

activity and advertising. Circumstance that has increased since the emergence of the pandemic and confinement.

In the context of the study center, from the area of Physical Education, work has begun on the three: conducting the field study with the children on their nutritional habits and the mentoring work associated with the results, the analysis of misleading advertising that makes them have undesirables habits in their diet, which is the subject of another publication, and the *Muévete en casa* program, which is the subject of this article.

ICTs have become tools that, depending on their use, can be allies or elements of risk for children. In this case, we have used these tools, and the experience we had during the confinement; to find an easily accessible, attractive and fun strategy for schoolchildren to extend the time they dedicate to physical activity outside of school hours, as well as to present an alternative to sedentary lifestyles.

In the tutorials, families were presented with the idea of using the blog assigned to the subject to systematically present daily work to improve and maintain physical fitness that they could do at home without the need for complex materials or spaces. Through the programming that the fitness teacher Cesc Escolà had prepared for times of pandemic that was broadcast on Spanish television, an annual physical preparation program was planned.

The proposal that was designed maintained the name under which the program was broadcast during the confinement period, *Muévete en casa* (Let's move at home). In order to follow this planning, students had to update every day the subject's portal, where they would find, on a daily basis, the activities assigned to them. In it, the materials to be used, the type of exercise to be developed and the sequences that made up the day's program were indicated. The monitoring of the activity was carried out in three ways: the observation record of the families in which they noted the days, programs and times of use; the rubric, in which the students recorded the follow-up of the weekly work (to be filled in during the return to the calm of the Physical Education classes). And the work followed some programs in the classes themselves, in which we verified that certain

sessions, chosen at random, had actually been practiced. Obviously, the tracking and analysis of Blogger traffic also indicated the level of participation in the program.

The program has been implemented for one school year, specifically during the 2022/2023 school year. However, during this academic year it continues to be implemented together with other measures that emerged from the research (Figure 2).

After the first year of application, it can be said that it has been a complete success:

- The average daily follow-up was 54.28%. Alternating its use by different subjects in the sample. On days when they had extracurricular activities, they did not carry out the activity, as a general behavior and agreed upon by the families and the specialist. On weekends, the average participation rate was 75.23 %.

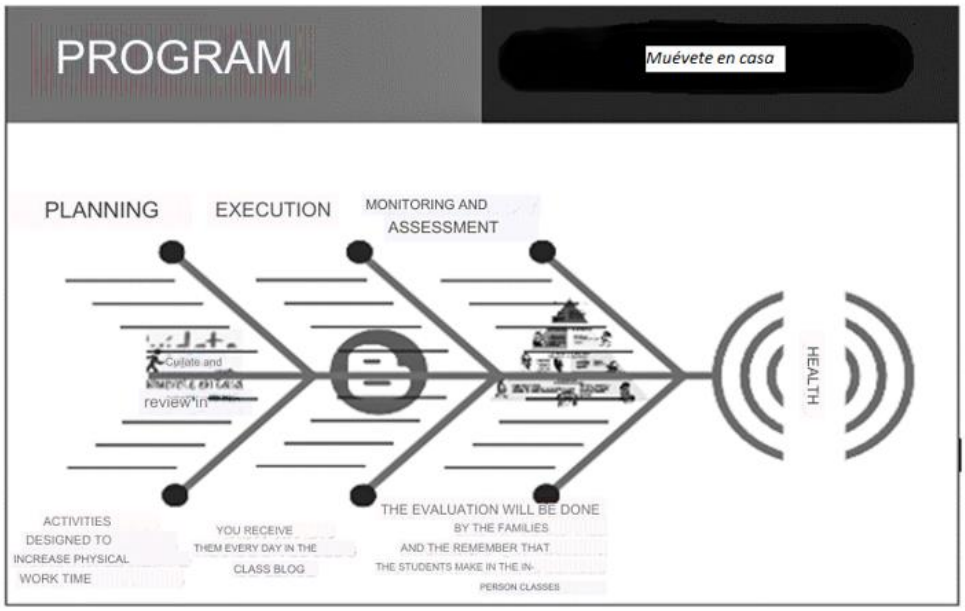

Fig. 2. - *Work plan for after-school hours*

- 96.57 % of the initial sample (before the sample death) was able to access and participate in the project.

- Numerous families commented at tutoring meetings that they had become a routine at home. Not only did the boys and girls do the planned work, but, on numerous occasions, they exercised together with one or more family members.
- A high percentage of families appreciated the implementation of the project, since they could access this type of *a la carte routines*, without leaving home, with a flexible schedule and an opportunity to work with their sons and daughters.

CONCLUSIONS

During this academic year, 2023/2024, all the patterns evaluated in this research will be analyzed. The objective is to see the prevalence of overweight problems, the rates of AF/S, the nutritional habits and general physical condition of the subjects in the sample that still remain in the center and the incidence that the program has had, the actions in relation to nutrition and misleading advertising in the new promotions, where, in many cases, there are brothers and sisters of the subjects participating in this study.

At the end of the present course, it was possible to assess the real impact of each of the interventions that have been implemented in the area of Physical Education in the last two courses. Although it was assured that the main intervention that concerns us as teachers has already been carried out successfully: "to face the problem of sedentary lifestyle, nutrition and the physical and psychological state of the children." Whether the change has been noticeable or scarce, it is the first step to continue implementing measures to protect children.

BIBLIOGRAPHIC REFERENCES

Agencia Española de Consumo, Seguridad Alimentaria y Nutrición (2019). *Estudio ALADINO sobre la Alimentación, Actividad Física, Desarrollo Infantil y Obesidad en España*. Ministerio de Sanidad, Servicios Sociales e Igualdad. Gobierno de España.

https://www.aesan.gob.es/AECOSAN/web/nutricion/detalle/aladino_2019.htm

Alto Comisionado contra la Pobreza Infantil (2022). *Plan estratégico Nacional para la reducción de la obesidad infantil 2022-2030, En Plan Bien*. Gobierno de España.

EU (2014). *Action Plan on Childhood Obesity 2014-2020.* https://ec.europa.eu/health/sites/health/files/nutrition_physical_activity/docs/childhoodobesity_actionplan_2014_2020_en.pdf

FAO. (2019). Alimentos ultraprocesados, calidad de la dieta y salud utilizando el sistema de clasificación NOVA. Roma.

Ferrari, M. A. (2013). Estimación de la Ingesta por Recordatorio de 24 Horas. *Diaeta. 31,* 20-25. https://doi.org/10.4067/S0718-34292013000200004

Garcia, W. (2019). Sedentarismo en niños y adolescentes: Factor de riesgo en aumento. *Recimundo,* 3(1), 1602-1604. https://doi.org/10.26820/recimundo/3.(1).enero.2019

Garrido-Miguel, M., Cavero-Redondo, I. Álvarez-Bueno, C., Rodríguez-Artalejo, F., Moreno, L. A., Ruiz, J.R., Ahrens, W., & Martínez-Vizcaíno, V. (2019). Prevalence and Trends of Overweight and Obesity in Europa Children From 1999 to 2016: A Systematic Review and Meta-Analysis. JAMA pediatrics, 173(10), e192430. https://doi.org/10.1001/jamapediatrics.2019.2430

Guzmán, C. A., & Mediavilla, C. M. (2022). Actividad física y sedentarismo en estudiantes de 12 años: Aplicación de una estrategia física recreativa. *Dominio de las Ciencias, 8*(3). http://dx.doi.org/10.23857/dc.v8i3

Macías, A., Calle, A., Piguave, J., Cedeño, D., & Vélez, M. (2018). Sedentarismo Y Obesidad En Adolescentes. *Revista Caribeña de Ciencias Sociales, 12,* 126.

Organización Mundial de la Salud (2022). *Enfermedades no transmisibles (ENT)*. https://www.who.int/es/news-room/fact-sheets/detail/noncommunicable-disease

Organización Mundial de la Salud (2012). *Recomendaciones sobre actividad física para la salud.* https://www.paho.org/es/noticias/9-5-2012-recomendaciones-mundiales-sobre-actividad-fisica-para-salud

Villa, G. (2008). *Ejercicio físico y prevención de obesidad en escolares*. *Premio Nacional de Investigación de Medicina del Deporte.* Universidad de Oviedo.

Saez, Y. A. & Mediavilla, C. M. (2022). Actividad física innovadora para disminuir el sedentarismo en los estudiantes. *Religación: Revista de Ciencias Sociales y Humanidades*, *7*(34). e210974. https://doi.org/10.46652/rgn.v7i34.974

***Conflict of interest*:**

The author declares no conflicts of interest.

Authors' contribution:

The author has participated in the drafting of the work and analysis of the documents.