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Artículos científicos

Actividad física y su relación con el rendimiento académico

Physical Activity and Its Relationship with Academic Performance

Atividade física e sua relação com o desempenho acadêmico

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Resumen

El objetivo de esta investigación fue determinar la eficacia que tiene un programa de actividad física sobre el rendimiento escolar de estudiantes de una escuela primaria pública del municipio de Querétaro, México. La metodología que se utilizó fue cuantitativa, de alcance descriptivo y correlacional. Se aplicó un diseño cuasiexperimental de pretest, postest y grupo control con una intervención durante nueve meses a 73 estudiantes. Los instrumentos de recolección de datos fueron un cuestionario, que obtuvo un coeficiente de fiabilidad de alfa de Cronbach de 0.796, una encuesta sobre el nivel socioeconómico, una batería de coordinación motriz (KTK) y un instrumento para medir el rendimiento académico (TERA). Para los análisis estadísticos se utilizaron las técnicas estadísticas de ji al cuadrado y la prueba *t* de Student. Dentro de los resultados se encontró una asociación significativa entre la actividad física y el rendimiento académico; también se halló una correlación en la actividad física y el desarrollo motriz en los estudiantes. Sin embargo, no se reveló asociación alguna entre el nivel socioeconómico y las variables de rendimiento académico y actividad física. Se concluye que no existen hábitos sobre la actividad física, que las horas destinadas a la práctica de la actividad física en las escuelas son insuficientes y que el rendimiento académico en las instituciones de nivel básico presenta atrasos educativos que deben ser atendidos de manera integral.

Palabras claves: actividad física, nivel socioeconómico, rendimiento académico.

Abstract

The objective of this research was to determine the effectiveness of a physical activity program on the school performance of students from a public primary school in the municipality of Querétaro, Mexico. The methodology used was quantitative, descriptive, and correlational. A quasi-experimental design was applied, with a pretest, posttest and control group, and with an intervention for nine months to 73 students. The data collection instruments were a questionnaire, which obtained a Cronbach's alpha reliability coefficient of 0.796, a survey on socioeconomic level, a motor coordination battery (KTK) and an instrument to measure academic performance (TERA). Within the results, a significant association was found between physical activity and academic performance; a correlation was also found in physical activity and motor development in students. However, no association was revealed between socioeconomic level and the variables academic performance and physical activity. It is concluded that there are no habits about

physical activity, that the hours allocated to the practice of physical activity in schools are insufficient and that academic performance in basic-level institutions presents educational delays that must be addressed in a comprehensive manner.

Keywords: physical activity, socioeconomic level, academic performance.

Resumo

O objetivo desta pesquisa foi determinar a eficácia de um programa de atividade física no desempenho escolar de alunos de uma escola pública de ensino fundamental do município de Querétaro, no México. A metodologia utilizada foi quantitativa, descritiva e correlacional em escopo. Um desenho quase-experimental de pré-teste, pós-teste e grupo de controle com uma intervenção de nove meses foi aplicado a 73 alunos. Os instrumentos de coleta de dados foram um questionário, que obteve coeficiente de confiabilidade alfa de Cronbach de 0,796, levantamento de nível socioeconômico, bateria de coordenação motora (KTK) e instrumento de medida de desempenho acadêmico (TERA). Técnicas estatísticas de qui-quadrado e teste t de Student foram usados para análises estatísticas. Dentre os resultados, foi encontrada associação significativa entre atividade física e desempenho acadêmico; uma correlação também foi encontrada na atividade física e desenvolvimento motor em alunos. No entanto, não foi revelada associação entre nível socioeconômico e as variáveis de desempenho acadêmico e atividade física. Conclui-se que não há hábitos quanto à atividade física, que as horas destinadas à prática de atividade física nas escolas são insuficientes e que o rendimento escolar nas instituições de nível básico apresenta atrasos educacionais que devem ser enfrentados de forma abrangente.

Palavras-chave: atividade física, nível socioeconômico, desempenho acadêmico.

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Introduction

Various studies carried out in recent years have verified and demonstrated the different benefits that regular practice of physical activity has on school performance in students at different levels (Luque et al., 2021). It is certainly a topic that has not gone unnoticed by educational researchers. Bernal (2015) refers to the study by Shephard et al. (1984) as one of the most significant in the field of physical activity and school performance. Shephard et al. (1984) selected a school 25% below school performance compared to the average of other schools and implemented a long-term physical activity program; after five years the school performance of that school increased 20%.

The recurrent practice of physical activity, in addition to the already known physical benefits that it brings, which are reflected in an optimal state of health, is also associated with the stimulation of the mental aspect, learning, concentration and academic performance of schoolchildren (Viteri and López, 2017). Indeed, the consultation of empirical references shows that physical activity in educational spaces contributes to the development and maintenance of the cognitive functions of students, which is reflected in better academic performance (Rodríguez et al., 2020).

In Mexico, however, despite the benefits already mentioned, within educational institutions minimum levels of physical exercise are maintained with sessions of 30-50 minutes once a week, in accordance with the plans and programs of the Ministry of Education Public [SEP] (2017). Furthermore, Flores et al. (2017) found that in real terms the effective time of a 50-minute physical education class is reduced to nine minutes of moderate activities; the rest of the session is diluted in indications, demonstrations and the proper organization of the class.

The foregoing reveals the immediate need for research in Mexico to test and promote comprehensive school physical activity programs. Particularly in the state of Querétaro there is the reference of Gómez, Méndez, Salazar and Cerezo (2012), perhaps the only one with this theme, which included an intervention through an interdisciplinary program in a primary school in order to combat overweight and obesity during the 2012-2013 school year. At the end, although it was not its central objective, the study showed that the program helped to significantly improve school achievement.

By virtue of the foregoing, it was decided to carry out the present study, which is estimated quantitative, has a quasi-experimental design of pretest, posttest and control group and is correlational in scope through non-probabilistic sampling.

At this point, and before moving on to the next section, it is worth noting that here physical activity is understood as any movement produced by skeletal muscles that requires energy expenditure (World Health Organization [WHO], 2021), to exercise as all that planned and structured activity (Escalante, 2011) and to sport as that private activity that promotes the development of competencies (Britapaz y Del Valle, 2015).

Justification

Globally, low school performance has begun to increase compared to previous years, as demonstrated by the Organization for Economic Cooperation and Development [OECD] (February 9, 2016) through its International Program for Assessment of Students

(PISA, for its acronym in English), since 13 million students from the 65 countries incorporated into the OECD present low school performance.

> In 2012, 55% of students in Mexico had low performance in mathematics (OECD average: 23%), 41% in reading (OECD average: 18%), 47% in science (OECD average: 18%), and 31 % in all three subjects (OECD average: 12%) (OCDE, 9 de febrero de 2016, p. 2).

According to Nunes, Neves, Teodósio, Floriano and Lara (2014), the lack of physical activity at the primary education level is an element that affects the delay of motor development, which is usually associated with difficulties for school learning . For Manzano (2006), there is no doubt that the practice of physical activity in the school environment has cognitive benefits.

This research is carried out due to the deficient knowledge that a full-time public school registered in the National Plan for the Evaluation of Learning (Planea) test of 2018 in the subjects of Mathematics and Spanish, mainly. Another reason why the research is carried out is the little importance given to physical activity in the basic education curriculum and in other educational levels.

Due to the aforementioned, the objective of the research is to determine the effectiveness of a physical activity program on the school performance of students from a public primary school in the municipality of Querétaro. To respond to the above, the working hypotheses seek to determine the association of school performance with activity and socioeconomic level.

Methodology

This research is quantitative; It has a quasi-experimental design of pre-test, post-test and control group, and it is descriptive and correlational in scope. An intervention was carried out during the 2018-2019 school year that increased the sessions of the Physical Education subject from 60 to 300 minutes per week in an experimental group, while in a control group it remained almost without increase.

Regarding the data collection process, permits were initially requested from the corresponding authorities. Subsequently, the informed consents and assents were filled out for the application of the instruments. Afterwards, a pilot test was carried out for two months that validated the processes and instruments used. Finally, the intervention was carried out with a duration of nine months.

Sample

The study contemplated a non-probabilistic sampling of a homogeneous type for convenience. The groups were chosen during the transition that occurs between preschool and the first year of primary school. The two first-grade groups were selected from a full-time urban public school with a total of 73 students. Table 1 shows the distribution of the sample by age, sex and research group.

Tabla 1. Distribución de la muestra

Variable	Frecuencia	Porcentaje
Edad		
5 años	28	38.4 %
6 años	45	61.6 %
Sexo		
Mujer	35	47.9 %
Hombre	38	51.1 %
Grupo		
Experimental	43	58.9 %
Control	30	41.1 %

Fuente: Elaboración propia

Instruments

To measure the time, type and frequency of physical activity, an instrument consisting of 20 items with a Likert scale of five response options and a Cronbach's alpha reliability coefficient of 0.796 was designed, validated and applied. In addition, to obtain the academic performance of the students, the "Test of evaluation of academic performance" (TERA) was used, through 24 indicators corresponding to the fields of language and mathematics (González, Delgado, Martín and Barba, 2004) . Additionally, to assess essential coordinative physical capacities, the "Kiphard-Schilling Body Coordination Test" (KTK) (1974) was used. Finally, the survey was used to find out the socioeconomic level (SES) of the participants created by the Mexican Association of Market Intelligence and Opinion Agencies. [AMAI] (2018).

Statistic analysis

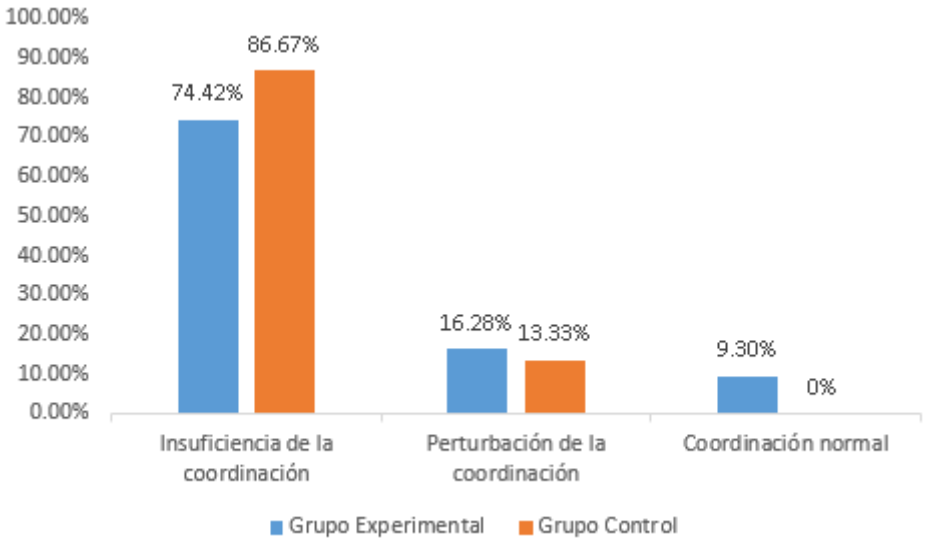
The statistical techniques Student's t test and chi-square were applied and a descriptive analysis was carried out through graphs and tables using the Statistical Package for the Social Sciences (SPSS) version 25 software.

Results

Next, the results obtained in the investigation are offered. First, a descriptive analysis of the variables studied is shown. Subsequently, the associations obtained through the statistical techniques Student's t test and chi-square are shown.

Figure 1 shows that in the pretest of the KTK battery 86.6% of the students in the control group and 74.4% of the students in the experimental group presented coordination failure or disturbance and only 9.30% of the participants in the experimental group were classified as having coordination. normal.

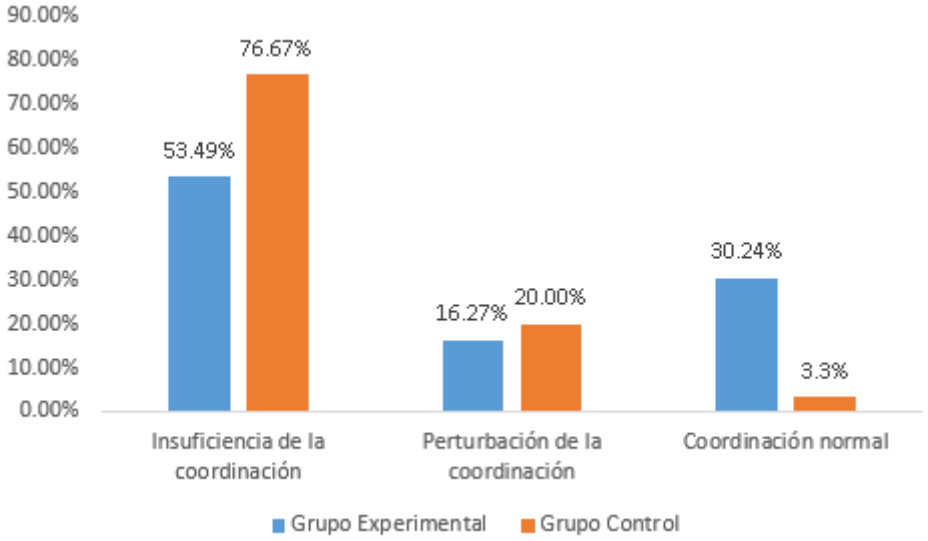
Figura 1. Pretest de la batería de coordinación motriz global (KTK)



Fuente: Elaboración propia

While in figure 2 an increase of students who presented normal coordination can be observed: the control group up to 3.33% and the experimental group 30.24%. Although in both groups the incidence of those with insufficient coordination decreased, in the experimental group the change was more pronounced.

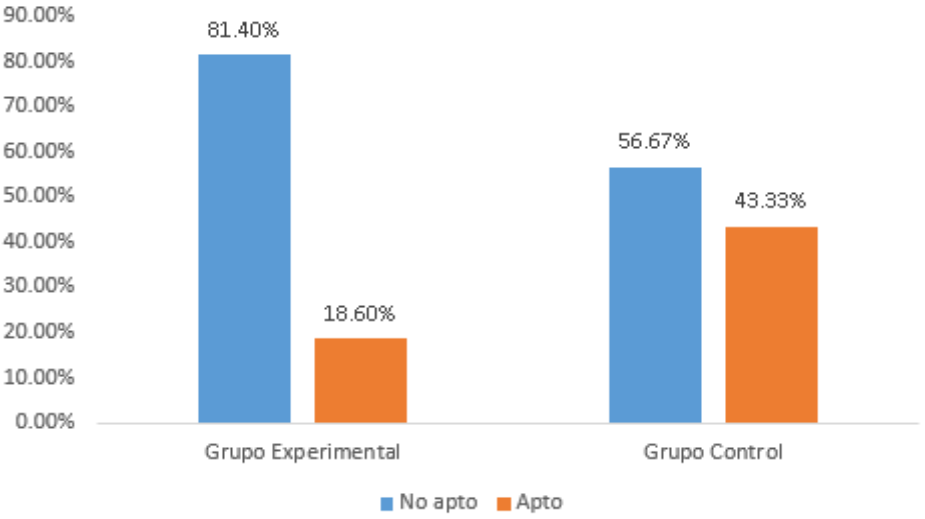
Figura 2. Postest de la batería de coordinación motriz global (KTK)



Fuente: Elaboración propia

For its part, Figure 3 shows the results of the TERA pretest. In the control group, more than 55% presented poor knowledge and only 43.33% had good knowledge, while in the experimental group only 18.60% were considered suitable, according to the fulfillment of certain items.

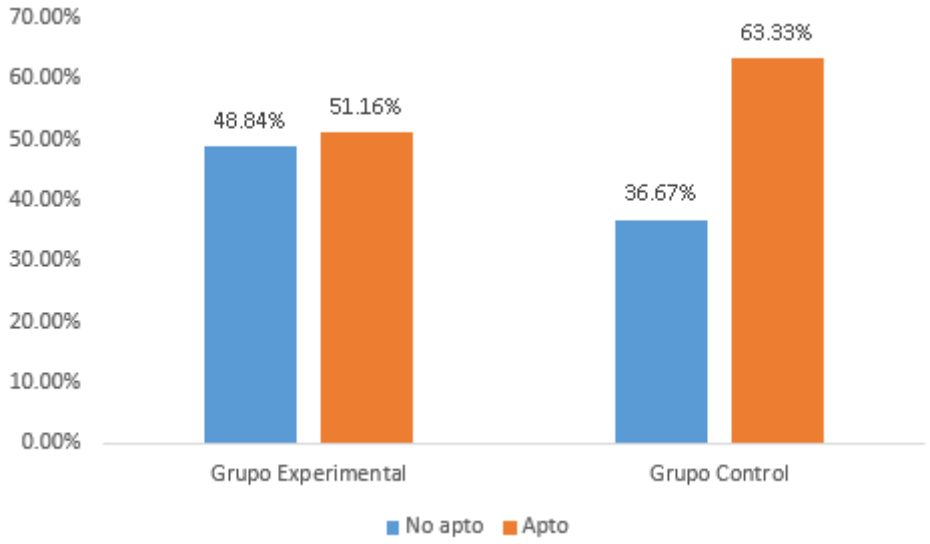
Figura 3. Pretest del rendimiento escolar TERA



Fuente: Elaboración propia

Later, when having the post-test results of the application of the TERA, it was possible to identify that both groups presented an improvement in their school performance. The control group was the one that showed the highest incidence (63.33%), although the experimental group registered a slightly lower figure (51.16%) (see figure 4).

Figura 4. Postest del rendimiento escolar TERA



Fuente: Elaboración propia

Now, in table 2 we can see the impact that having increased physical activity to one hour a day, instead of a single hour a week, on the development of global motor coordination, with a 0.001 degree of significance.

Tabla 2. Asociación de la actividad física con la coordinación motriz global del grupo experimental

Variables	Diferencias relacionadas					T	Gl	Sig. (bilateral)
	Media	Desv. típica	Error típico de la media	Inferior	Superior			
Coordinación global (pre) Coordinación global (pos)	-0.41860	0.73136	0.11153	-0.64368	-0.19353	-0.3.753	42	0.001**

Fuente: Elaboración propia

While Table 3 shows the degree of significance obtained in the control group by adding one more hour of weekly physical activity in addition to that of their Physical Education class. While it is true that there were improvements, they did not have a significant impact.

Tabla 3. Asociación de actividad física con la coordinación motriz global del grupo control

Variables	Diferencias relacionadas					T	gl	Sig. (bilateral)
	Media	Desv. típica	Error típico de la media	Inferior	Superior			
Coordinación global (pretest) Coordinación global (postest)	-0.1333	0.50742	0.09264	-0.32281	-05614	-1.439	29	0.161

Fuente: Elaboración propia

Now, in table 4 the relationship that exists between physical activity and school performance can be observed. Using the Student's t technique, 0.000 was obtained. That is, having increased the time and days of physical activity in the experimental group was highly significant.

Tabla 4. Asociación de actividad física con el rendimiento escolar del grupo experimental

Variables	Diferencias relacionadas					T	gl	Sig. (bilateral)
	Medía	Desv. típica	Error típico de la media	Inferior	Superior			
Rendimiento escolar (pre) Rendimiento escolar (pos)	0.32558	0.47414	0.07231	0.17966	-47150	4.503	42	0.000***

Fuente: Elaboración propia

And in table 5 it is shown that in the control group there was also significance, due to the weekly overtime, but it was not as significant as that obtained in the experimental group.

Tabla 5. Asociación de actividad física con el rendimiento escolar del grupo control

Variables	Diferencias relacionadas					T	gl	Sig. (bilateral)
	Medía	Desv. típica	Error típico de la media	Inferior	Superior			
Rendimiento escolar (pre) Rendimiento escolar (pos)	0.23333	0.43018	0.07854	0.07270	0.39397	2.971	29	0.006**

Fuente: Elaboración propia

Finally, Table 6 shows the relationship between the student's socioeconomic level and other variables. Here, the interaction with the variables related to the educational level of the father or mother and the means of transport that the student uses to get to school was highly significant.

Tabla 6. Relación del nivel socioeconómico con las variables TERA, KTK y actividad física utilizando la prueba de ji al cuadrado

Variables	χ^2_{Cal}	Pvalue
Actividad física (frecuencia)	8.746	0.890
Actividad física (tiempo)	17.211	0.639
Nivel de estudios	98.956	0.000***
Pretest TERA	9.756	0.082
Pretest KTK	12.919	0.228
Postest TERA	6.655	0.248
Postest KTK	5.156	0.881
Medio de transporte	24.993	0.005**
***Altamente significativo **Muy significativo *Significativo		

Fuente: Elaboración propia

Discussion

The objective of the study focused on analyzing the impact that increasing the volume of physical activity would have in elementary school students who obtained insufficient grades for school performance in the Planea 2018 test.

Regarding academic performance, the OECD (February 9, 2016) reported that in recent years low school performance has increased to 11%, especially in the areas of mathematics, science and language. Here, the results obtained by the TERA pretest revealed that in the intervention group 81.4% of the students obtained deficient (not suitable) levels of knowledge in the areas of Spanish and mathematics. However, the panorama changed with the application of the physical activity program, which lasted nine months, since the data obtained by the post-test describe a decrease in the number of students with poor condition, standing at 48.84%, which supports the positive association that the practice of regular physical activity has on school performance in primary-level students.

Likewise, with regard to physical activity, the WHO (November 26, 2020), within its global recommendations on physical activity for health, indicates that children and adolescents between 5-17 years old should perform at least 60 minutes a day moderate or vigorous activity. However, the study data showed that in the experimental group 58.13% of the students do not comply with the minimum amounts of physical activity, a situation that, in addition to representing a factor for the development of diseases such as overweight and obesity (WHO, November 26, 2020), is also a major obstacle to academic achievement.

By virtue of the above, the intervention program managed to increase the volume of physical activity from 60 to 300 minutes per week, and brought with it tangible and substantial modifications for the students, both in increasing school performance and in improving coordinative physical abilities. The results obtained are added to the empirical references that have shown that a greater amount of physical activity is associated with better indicators of school performance, as demonstrated by Trullén (2020) in Spanish primary school students and Quílez (2020) in secondary school students . Also, the results reflect consistency with the increase in coordination capacities through physical activity, as emphasized in the study by Benálcazar (2020) in Ecuadorian children. Furthermore, as in the research by Urquidez et al. (2017), the intervention with physical activity provided improvements in educational and health aspects.

Even more: the findings share similarity with intervention studies carried out in other countries, such as the one carried out in Sweden by Fritz, Cöster, Rosengren,

Karlsson and Karlsson (2020), who, as in the present study, increased physical activity in children aged 6-8 years from 60 to 200 minutes per week, although they did so over a period of nine years. Despite the difference in implementation time, an association between increased physical activity and increased school performance was found in both (although with respect to this last indicator, it was measured differently, there through school grades [Sweden] and here by means of a standardized test [Mexico]). Furthermore, although both investigations considered the sex variable, only the study by Fritz et al. (2020) found a significant association when recognizing that girls had better levels of school performance.

On the other hand, it is important to recognize that despite having obtained conclusive results on the impact that physical activity has on school performance and the coordinative physical abilities of students, the research did not yield significant data on the relationship between variables such as level socioeconomic status or gender, although it should be noted that the intervention was carried out in a school with a typical-high middle economic level. The foregoing suggests the possibility of expanding the scope of the intervention program to schools in different localities and different socioeconomic levels.

Conclusions

Based on the results of the study, the working hypothesis H1 is rejected, since the socioeconomic level of the family does not influence the academic performance of the students and the working hypothesis H2 is also discarded, since children who have a low socioeconomic level did not have better motor development. On the contrary, it is accepted that children's motor development improves with regular physical activity. And also that some variables of physical activity (duration, frequency, intensity, hydration, among others) were associated with a decrease in body weight or changes in body composition.

A significant correlation was also found between the time and frequency used to perform physical sports activities and academic performance. Similarly, a highly significant association was observed between children who perform physical sports activities daily and school performance. In addition, there was a highly significant association in poor school performance and poor coordination. Likewise, a link was observed between insufficient school performance and the variables of physical activity (no sports practiced, days a week, time during the week and time on weekends). And a highly significant association was detected between poor school performance and the

days they watch television and the time they spend playing video games (time spent on weekdays, time spent on weekends, days spent on weekdays and days spent on weekends).

In addition to all of the above, a highly significant association between poor school performance and insufficient global coordination was detected in almost the entire sample and a highly significant association between the physical activity program and improved motor development.

A significant contribution of the present study lies in pointing out that the cognitive process that the students undertook in the present investigation (six to seven years) was linked to the deficit of global coordination, the level of attention-concentration, sedentary lifestyle and muscle tone , Inter alia. Therefore, carrying out a scheme of physical sports activities benefits the population to get out of a sedentary lifestyle, to improve global coordination, to improve myelination processes for a better synaptic connection, with an increase in oxygenation in cells, which it causes an increase in attention-concentration and produces autonomy, self-confidence and recognition of the corporeity, essential for good global coordination.

It should be noted that the type of full-time school was associated in a highly significant way with very low levels of physical activity and little performance of sports and extracurricular physical activity. People who were found not to have an adequate academic performance according to the TERA test, after completing the physical activity program, went on to have it according to the same test. Therefore, the physical activity program was linked to Spanish and Mathematics. Interventions of this type keep students active, reinforce classroom themes, have fun and learn in a kinesthetic way, all of which result in being more academically capable.

On the other hand, the study identified an association between school performance and time spent in physical activity or sport, with whom the student lives, parents' educational level, time spent watching television and time spent playing video games. By having knowledge of these associated factors, the importance of physical activity is emphasized, at least four days a week with 30 minutes per day, with a balanced diet and good hydration practice, having support from family members or tutors to strengthen Desires to continue doing physical activity and consolidate values and habits, have conversations with parents or guardians, as well as with colleagues, about their physical activity to maintain or improve self-confidence, autonomy, decision-making and attention-concentration , attitudes that will be beneficial to continue improving school performance and reducing television and video game time.

Finally, it is important to emphasize that insufficient or unfit school performance is a phenomenon that is associated with home habits and physical activity time. It is a problem for the development of the community that requires prevention to avoid risks such as overweight, obesity, psychological problems, chronic diseases, among other things, without neglecting stagnation and the little use in daily life that schoolchildren will have due to poor school performance.

Future lines of research

Finally, for future research, the area of socio-emotional skills, values and healthy lifestyles is considered as interesting areas of opportunity, since implicit results were observed in the improvement of the interaction of children, the increase of attention and concentration, the presence of values such as respect, tolerance, honesty, empathy and the ability to dialogue with their peers. Also, habits were detected such as carrying a bottle of natural water for the Physical Education class, procuring a fruit to consume at the end of the class, frequent body hygiene, decreasing absenteeism in classes and reducing the weekly time dedicated to television and the videogames.

By virtue of the above, emerging lines of research are proposed in the field of physical education for health and comprehensive well-being, where variables such as nutritional status, eating habits, physical self-concept and use of free time are considered. Likewise, it is suggested that a longer intervention time and a larger population will allow interesting and significant correlations for future studies.

References

Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión [AMAI]. (2017). Nivel Socio Económico AMAI 2018. Recuperado de http://www.cua.uam.mx/pdfs/coplavi/s_p/doc_ng/metodologia-nse-2018-amai.pdf.

Bernal, D. (2015). Educación física: una asignatura para mejorar el rendimiento académico, la cognición y los valores. (Trabajo de fin de grado de maestría). Universidad de Salamanca, Salamanca. Recuperado de https://gredos.usal.es/jspui/handle/10366/125965.

Benálcazar, Y. (2020). Relación de la coordinación motora y el rendimiento académico en niños de 6 a 8 años que asisten a la unidad educativa Jorge Peñaherrera del cantón Pimampiro. (Tesis de licenciatura). Universidad Técnica del Norte, Ibarra. Recuperado de http://repositorio.utn.edu.ec/handle/123456789/10194.

Britapaz, L. y Del Valle, J. (2015). Significado del deporte en la dimensión social de la salud. Salus, 19, 27-33.

Escalante, Y. (2011). Actividad física, ejercicio físico y condición física en el ámbito de la salud pública. Revista Española de Salud Pública, 85(4), 325-328.

Flores, P. J., Salazar, C., Gómez, J. A., Barreto, Y., Valdovinos, O., Vicente, J. U. y Del Río, J. E. (2017). Medición del tiempo efectivo de la clase de educación física y su impacto en el gasto calórico en escolares de nivel primaria del municipio de Colima, México. Sportis. Scientific Journal of School Sport, Physical Education and Psychomotricity, 3(1), 34-49. Recuperado de http://dx.doi.org/10.17979/sportis.2017.3.1.1766.

Fritz, J., Cöster, M., Rosengren, B., Karlsson, C. and Karlsson, M. (2020). Daily School Physical Activity Improves Academic Performance. Sports, 8(6). Retrieved from https://www.mdpi.com/2075-4663/8/6/83.

Gómez, O. A., Méndez, J. C., Salazar, M. E. y Cerezo, F. (2012). Programa interdisciplinario de intervención para la prevención de la obesidad infantil. Universidad Autónoma de San Luis Potosí. Recuperado de https://onedrive.live.com/?authkey=%21AAwSe8g3ZJGyL8I&cid=BECB78822F793C0D&id=BECB78822F793C0D%211607&parId=BECB78822F793C0D%21354&o=On eUp.

González, M. J., Delgado, M. J., Martín, I. y Barba, M. J. (2004). Test de evaluación del rendimiento académico en educación infantil y primaria (TERA). (Trabajo no publicado). Universidad de Málaga, Málaga.

Kiphard, E, J. and Schilling, F. (1974). Körperkoordinationstest für Kinder. Germany: Weinheim.

Luque, A., Gálvez, A., Gómez, L., Escámez, J., Tárraga, L. y Tárraga, P. (2021). ¿Mejora la actividad física el rendimiento académico en escolares? Una revisión bibliográfica. Journal of Negative & No Positive Results, 6(1), 84-103. Recuperado de https://revistas.proeditio.com/jonnpr/article/view/3277.

Manzano, J. (2006). Educación física y desarrollo integral. Isla de Arriarán, (28), 275-294.

Nunes, L. de C., Neves, D., Teodósio, G. de F., Floriano, P. M. e Lara, S. (2014). Perfil de estudantes dos anos iniciais com baixo rendimento escolar: importância da educação física na escola. Reviste Brasilera de Ciência e Movimento, 22(2), 36-46.

Organización Mundial de la Salud [OMS]. (2004). Estrategia mundial sobre régimen alimentario, actividad física y salud. Ginebra, Suiza: Organización Mundial de la Salud.

Organización Mundial de la Salud [OMS]. (26 de noviembre de 2020). Actividad física. Recuperado de https://www.who.int/es/news-room/fact-sheets/detail/physical-activity.

Organización para la Cooperación y el Desarrollo Económicos [OCDE]. (9 de febrero de 2016). Estudiantes de bajo rendimiento: Por qué se quedan atrás y cómo ayudarles a tener éxito. Resumen México. Recuperado de https://www.oecd.org/centrodemexico/medios/PISA%20Low%20Performing%20Students%20Press%20Handout%20MEXICO%20FINAL.pdf.

Quílez, M. (2020). Relación entre la actividad física y el rendimiento académico. Análisis y comparación por sexo y edad. Campus Educación. Revista Digital Docente, 5(17). 32-37. Recuperado de https://www.campuseducacion.com/revista-digital-docente/numeros/17.

Rodríguez, A., Rodríguez, J., Guerrero, H., Arias, E., Paredes, A. y Chávez, V. (2020). Beneficios de la actividad física para niños y adolescentes en el contexto escolar. Revista Cubana de Medicina General Integral, 36(2). Recuperado de http://scielo.sld.cu/pdf/mgi/v36n2/1561-3038-mgi-36-02-e1535.pdf.

Secretaría de Educación Pública [SEP]. (2017). Aprendizajes clave para la educación integral. Educación Física. Educación básica. Plan y programas de estudio, orientaciones didácticas y sugerencias de evaluación. Ciudad de México, México: Secretaría de Educación Pública. Recuperado de https://www.planyprogramasdestudio.sep.gob.mx/descargables/biblioteca/basica-educ-fisica/1LpMEducacion-Fisica_Digital.pdf.

Secretaría de Educación Pública [SEP]. (2018). Plan Nacional para la Educación de los Aprendizajes. Informe de resultados de mi escuela. Recuperado de http://143.137.111.129/PLANEA/planea_re_18_basica/content/pages/basica/escuela.php.

Shephard, R., Volle, M., Lavallée, H., LaBarre, R., Jéquier, J. and Rajic, M. (1984). Required physical activity and academic grades: A controlled study. In Hmarinen, J. and Välimäki, I. (eds.), Children and Sport (pp. 58-63). Verlag, Germany: Springer.

Trullén, C. (2020). Relación entre factores sociodemográficos, actividad física extraescolar y rendimiento académico en estudiantes de educación primaria. Revista Digital de Educación Física, 11(63). 60-79. Recuperado de http://emasf.webcindario.com/Relacion_entre_factores_sociodemograficos_actividad_fisica_extraescolar_y_rendimiento_academico.pdf.

Urquidez, R., Ramírez, D., Ramos, A., Rodriguez, A., Wall, A., Díaz, B. A., Medrano, G., Quizán, T. y Esparza, J. (2017). Promoción de la actividad física en niños del norte de México: efectividad de una intervención educativa. Acta Universitaria, 27(2), 32-38.

Viteri, M. F. y López, I. A. (2017). La actividad física en el rendimiento académico de los niños de quinto, sexto y séptimo año en la Escuela de Educación Básica Gregoire Girard. (Proyecto de investigación). Universidad Técnica de Ambato, Ambato. Recuperado de http://repositorio.uta.edu.ec/jspui/handle/123456789/25172.

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