Original Article

Can the Doman method improve motor competence in children of 4 years of age? A quasi-experimental study of two Physical Education programmes in preschool education

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ABSTRACT

Early childhood is a key stage for promoting Physical Education as a means for improving motor competence in children. With this in mind, is there a particular psychomotor stimulation method that can improve said competence? The aim of this study was to analyse and compare the effects on motor competence of two Physical Education and psychomotor stimulation programmes in 4-year-old children. The psychomotor profile of a sample of 49 preschool children (53.1% boys and 46.9% girls; Mage = 4.66, SD = 0.27) was examined using a quasi-experimental model and the Movement Assessment Battery for Children-2 (MABC-2). The percentiles achieved in the tests that make up the battery were measured, which were grouped into three domains: manual dexterity, aiming and catching and balance, as well as the overall psychomotor profile. The control group (n = 25, 52% boys and 48% girls) followed an annual Physical Education programme consisting of a single 50-minute weekly session. The experimental group (n = 24, 54.2% boys and 45.8% girls) followed an early psychomotor stimulation programme based on the Doman method, with 5 weekly sessions lasting 25 minutes each. The results show no significant differences in the psychomotor profile between the control and experimental groups, both in the total percentile and in the percentile of manual dexterity, aiming and catching or balance. Significant differences were found in both groups between the pre-test and the post-test, with greater differences displayed in the control group. The findings suggest that a single session of Physical Education has a greater impact on the psychomotor profile than 5 weekly 25-minute sessions following the Doman method of early stimulation. Furthermore, these findings also point to the need to provide personalised Physical Education that enhances the psychomotor profile of each child.

Keywords: Physical education; Fundamental movement skills (FMS); Motor skills; Psychomotricity; Childhood; Motor competence.

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INTRODUCTION

Early childhood is a key period for promoting the development of multiple motor skills. Fundamental motor skills (FMS) are defined as basic learned movement patterns that do not occur naturally and which, if worked on, will allow the child to acquire more complex motor skills in later stages (Barnett et al., 2016). These fall into three distinct categories: locomotor skills, object control (manipulative skills) and balance skills such as standing (Gallahue et al., 2012). Adjacent to these is motor coordination, defined as the ability to establish a combined and organised functioning of the different body parts (Turvey, 1990).

The development of these will in turn contribute towards an improvement in motor competence (Bolger et al., 2021). Higher levels of motor competence are associated with better physical fitness (Hardy et al., 2012) (Robinson et al., 2015). Conversely, low levels of daily physical activity or recreational play can lead to negative health outcomes for children associated with sedentary behaviour (Dwyer et al., 2009; Nigg et al., 2021; Sprengeler et al., 2021).

Other authors have found that when children have greater motor competence they engage in more physical activity (Barnett et al., 2009; Crane et al., 2015; Stodden et al., 2008), which in turn ensures a positive life trajectory (Lubans et al., 2010; Morgan et al., 2013). This decreases the likelihood of a sedentary lifestyle and leads to an improvement in fine motor skills in adolescence (Barnett et al., 2010). In addition, it is also associated with a lesser decrease in physical activity during adolescence and with favouring a healthy body weight throughout the time spent in school (D'Hondt et al., 2008; D'Hondt et al., 2013).

For all these reasons, didactic interventions in the Physical Education curriculum during early childhood should be mainly aimed at promoting the work of fundamental motor skills, physical condition and working on components linked to psychomotor skills, such as object control, laterality and balance, among others (Arufe, 2020). At this stage, a multidisciplinary and globalised approach should prevail, which should include activities and games to stimulate the development of values, psychological and psycho-social variables and ethical and moral aspects (Arufe, 2020; Sassano, 2003). All of this with the aim of promoting the physical and mental health of the child. A recent systematic study on the benefits of structured Physical Education programmes in Early Childhood Education demonstrates that they bring about multiple improvements in different spheres of children's development, exerting a positive influence at the motor, social, affective-emotional and psychological levels (Arufe et al., 2021).

In this sense, structured and well-planned Physical Education programmes can improve the psychomotor profile of children aged 3 to 6 years (Imbernón-Giménez, 2020; Teixeira-Costa et al., 2015; Teixeira-Costa et al., 2015). The vast majority of preschool children only receive a single session of Physical Education at any given school (Pons & Arufe, 2016). Moreover, the approach and concept followed by teachers during the Physical Education or Psychomotricity classes tends to differ from one school to another (Rodríguez-Yañez et al., 2021). The same applies to the available resources for the practical sessions (Prieto-Prieto et al., 2021). Consequently, one can find educational centres that dedicate a single session to carrying out guided games for improving multiple motor skills in children and centres that carry out motor activities on a daily basis, although the latter is less frequent.

The financial capacity of schools is another factor that may influence the adoption of a particular methodology of Physical Education. In this sense, the Doman method entails a significant financial cost as it requires specific material, in addition to the fees for the training that may have to be carried out. Some authors even advise against it on account of its high cost when it comes to the rehabilitation of patients with brain damage,

until such time when its effectiveness has been thoroughly scientifically documented (Norum et al., 2012). This method was pioneered by Glenn Doman (Doman et al., 1960) at the Institute of Achievement of Human Potential (IAHP) and was trademarked as the Doman Method. It is based on a programme of exercises adapted according to children's ages and features materials designed specifically to enhance children's psychomotor competence and components linked to intelligence and learning. Its method is based on the theory of neurological organisation (Mac Kay et al., 1986) and was introduced in education as a form of early stimulation. Some authors consider it a neuromyth, in the sense that it lacks scientific evidence, both in its initial field of incidence (health, specifically in patients with brain damage) and in the educational field (early stimulation in able-bodied children), suggesting that its behavioural approach may have potential ramifications in terms of the child's adherence. Moreover, if this is the case, it would also entail a considerable amount of wasted time resulting from its lengthy training process (L'Ecuyer, C., 2015).

The programme used with severely brain-damaged children consisted of offering them opportunities for normal development in areas where the corresponding brain level was not damaged. Thus, this externally imposed bodily patterns of activity that would have been the task of the damaged brain regions, establishing hemispheric dominance and early unilateralism. It also provided a respiratory improvement that was measured through the vitals and some sensory stimulation to improve body awareness and positional sense (Doman et al., 1960). This method was initially focused on children with neuromotor developmental disorders and its proponents claim that it improves and stimulates psychomotor development. Due to these improvements, it has been adopted by many early childhood education centres and used in Physical Education exercises for able-bodied children. It is based on the repetition of movements similar to those of amphibians and reptiles, bearing a certain parallelism to the phylogenetic evolutionary movement.

From the 1990s to the present day, many schools have adopted this method, using material marketed as specific to the Doman method. This method, linked to the improvement of motor competence, mainly involves suspension work on a brachiation ladder, climbing up gym bars, walking along a balance beam, running, creeping and/or crawling across the floor. Centres usually carry out a daily 20-25 minute session in which they work on children's motor skills through these activities. It has been strongly criticised in scientific literature by a number of authors and academic institutions due to the lack of scientific evidence, especially regarding its impact on healthy, able-bodied children (American Academy of Pediatrics, 1982; L'Ecuyer, Catherine, 2015; Von Tetzchner et al., 2013).

Therefore, the aim of this research was to analyse and compare the psychomotor development of a sample of able-bodied preschool children who followed a structured Physical Education programme consisting of a single hour per week over the course of a year. The study aims to compare its effects with a sample of another set of able-bodied children from a different preschool that followed the Doman method programme, structured around 5 weekly Physical Education sessions lasting 25 minutes a day. The hypothesis of the study was to determine whether the Doman method yields significant benefits in terms of the psychomotor development in able-bodied preschool children who follow this programme, by obtaining higher scores in their psychomotor profile and motor competence.

METHODOLOGY

This is a quasi-experimental, longitudinal and quantitative study. It consisted in establishing two groups, a control group (CG) and an experimental group (EG), with a pre-test being conducted at the beginning of the academic year and a post-test at the end of the academic year. Although the assignment of subjects to the intervention groups was not at random, studies based on a quasi-experimental design have proven to be

effective in terms of time, cost or difficulty in finding a comparison group (Zurita-Cruz et al., 2018). However, in this case, it was difficult to find an educational centre that adhered to the Doman methodology.

Sample

The sample consisted of a total of 49 schoolchildren (53.1% boys and 46.9% girls; Mage = 4.66, SD = 0.27) from two preschools in Spain. The control group (n = 25, 52% boys and 48% girls) followed a structured Physical Education programme consisting of a single hour per week over the course of a year. The experimental group (n = 24, 54.2% boys and 45.8% girls) followed the Doman method programme, structured around 5 weekly Physical Education sessions lasting 25 minutes a day, which aims to enhance motor competence through a series of motor-centred tasks.

For the selection of the schools and subjects participating in the study, a non-probabilistic and non-random convenience sampling method was used. This approach allows the researcher to have easy and more accurate access to a sample with certain characteristics (Otzen & Manterola, 2017). We chose an educational centre that had already implemented the early motor stimulation programme of the Doman method (Experimental Group). This method consists in carrying out a daily 25-minute physical activity programme involving a series of fixed exercises, scheduled from Monday to Friday. For the selection of the control group, we opted for a preschool educational centre that followed a Physical Education programme consisting of a single weekly 50-minute session, which included directed motor play focusing on the different content related to motor competence as stipulated in the preschool curriculum.

Design and Procedure

Initially, the school administration was informed of the objective of the study. They in turn informed the respective preschool PE teachers and the families of the children in the selected classrooms. The families were informed that they could withdraw from the study at any time. The teachers participating in the study were also informed about the importance of adhering to the scheduled Physical Education programme in the control group and the Doman programme in the experimental group. This included ensuring that the lessons followed the contents established in the educational curriculum (Ministry of Education and Science of the Government of Spain, 2008).

At the beginning of the academic year, the children's motor competence was measured by assessing their psychomotor profile using the Movement Assessment Battery for Children-2 (MABC-2).

Throughout the school year, the control group followed a Physical Education programme consisting of a single weekly 50-minute session, based on motor games led by the teacher. These games focused on a comprehensive approach, working on a wide range of content from the educational curriculum and which is included in the article by Arufe, V. (2020), such as basic motor skills (jumping, turning, throwing, climbing, running, walking, among others), psychomotor activities (fine and gross motor skills, laterality, balance, tonic control, among others) and also aspects linked to physical condition (games involving lower and upper body strength, endurance, speed, flexibility and agility). The Physical Education sessions in the control group took place on a weekly basis in a single 50-minute session.

The experimental group participated in a Physical Education programme based on the Doman method. This programme consisted of different exercises involving suspension by means of a brachiation ladder whereby the children moved from one side to the other with or without the teacher's help (depending on their level of strength), balancing themselves on a balance bar placed at a height of about 20 centimetres, as well as creeping, crawling, walking and running through a space with different obstacles.

At the end of the school year, the MABC-2 battery was repeated to record the psychomotor profile of the children, along with other variables that could influence the psychomotor profile of the children such as sex, weight, height and Body Mass Index (BMI), which was calculated in accordance with the US Centers for Disease Control and Prevention calculator (U.S. Department of Health & Human Services, 2021). In addition, some socio-ecological factors (Bronfenbrenner, 1994) relating to the individual, family and environment were also taken into account, such as participation in extracurricular sporting activities, as well as the amount of time spent on these activities, in case they could also have an influence on the psychomotor profile measurements.

Measuring instrument

In order to analyse the impact of the two Physical Education programmes on the motor competence of the children, the MABC-2 Battery was used, which has been internationally referenced in multiple research projects linked to the study of the psychomotor profile and motor competence of children and adolescents and has been validated in its English version (Schulz et al., 2011) as well as in its adapted Spanish version (Ruiz-Pérez & Graupera-Sanz, 2003).

This battery is a tool for testing the performance of fundamental motor skills classified into three age groups (3 to 6, 7 to 10 and 11 to 16 years of age). Although its initial objective was to identify motor development disorders in children, its easy application has led to its use in multiple investigations to determine the level of motor development and motor competence of both able-bodied children and children with possible psychomotor disorders (Niño-Cruz et al., 2019).

The variables used were: sex, decimal age, weight, height, BMI, educational centre, percentile in manual dexterity, percentile in the aiming and catching test, percentile in the balance test, total percentile and extracurricular sports practice.

Data analysis

The statistical analysis was carried out using SPSS version 28 (SPSS Inc, IBM, USA). Initially, a descriptive analysis of the target variables was carried out through a normality test using the Shapiro-Wilk statistic for quantitative variables. Next, hypothesis testing was carried out using the non-parametric Mann-Whitney U test, in order to study the possible relationship between the percentile of the psychomotor development of the children in the control group and the children in the experimental group. Finally, the Wilcoxon test was conducted to analyse the statistically significant difference between the PRE and POST status of the different variables linked to the psychomotor profile, as well as to measure the Spearman correlation coefficient between variables.

Ethical aspects

The study complied at all times with the recommendations and ethical principles for educational research as established by various national and international reference publications (American Psychological Association, 2020; Paz-Maldonado, 2018; Sañudo, 2006). We also obtained all the necessary permissions and approvals from the school's administration as well as the consent from families and teachers. The families of the participating children were informed about the objective of the research and the protocol, and they were given the opportunity to voluntarily withdraw from the study at any time. All the data concerning the participating schools and the sample under study were kept confidential from the onset of the research, and the data extracted from each of the participating children was codified.

RESULTS

The descriptive analysis, the testing of the hypothesis and the correlational analysis of the variables under study are indicated as follows.

Descriptive analysis

The sample did not have a normal distribution in several of the variables, and so, together with the low sample size, non-parametric statistical tests were chosen.

Table 1. Descriptive analysis of sample.

	N	Sex	Mage	Td	Min	Max	Extracurricular sporting activity
Control Group	25	52% M 48% F	4.69	.26	4.24	5.15	80% Yes
Experimental Group	24	54.2% M 45.8% F	4.63	.27	4.20	5.11	54.2% Yes

Note. N: Number of subjects; Mage; Medium age; Td; Typical deviation; Min; Minimum; Max. Maximum.

Testing of hypotheses

Both groups showed an increase in the percentile of the psychomotor profile in the post-test (at the end of the academic year) compared to the pre-test (beginning of the academic year). No statistically significant differences were found between the two groups. Therefore, it is possible to assert, with an accuracy level of 95%, the hypothesis that there is no statistically significant difference in the mean value between the control group and the experimental group, thereby refuting the hypothesis of the research that "*schoolchildren who follow the Doman method achieve a higher motor competence as measured through the study of the psychomotor profile, as opposed to schoolchildren who follow a structured Physical Education programme consisting of a single weekly session*".

Table 2 shows the Mann-Whitney U-test values for the main variables.

If we compare the intra-group increase in the difference between the children's mean percentile in the post-test and the pre-test, we can observe that there was a greater increase in the control group, which showed a statistically significant increase in the manual dexterity test, aiming and catching and total percentile.

Figure 1 shows that the control group obtained a greater mean difference in improvement in the post-test compared to the pre-test in all the analysed dimensions.

In relation to sex, a higher percentile of the psychomotor profile was observed in girls than in boys, both in the pre-test and in the post-test, although this was not statistically significant.

No statistically significant differences were found, in relation to sex, in any of the tests performed or in the total score.

Table 2. Results of Movement Assessment Battery for Children-2 (MABC-2) test based on group.

Percentile of variables	**Experimental Group**		**Control Group**		**Total**	
	Mean	Dev.	Mean	Dev.	Mann-Whitney U-test value	Asymptotic sig. (bilateral)
Manual Dexterity pre-test	68.5833	24.21267	63.4400	23.07430	238.500	.218
Manual Dexterity post-test	70.7500	24.59807	68.5600	24.33632	279.000	.672
Aiming & Catching pre-test	58.0000	26.96374	49.5200	25.71660	237.500	.211
Aiming & Catching post-test	60.8750	27.76503	55.5600	26.36298	262.500	.449
Balance pre-test	56.9167	20.87211	60.7600	26.61497	261.500	.441
Balance post-test	60.6250	21.26195	65.8400	26.38920	245.000	.264
Overall Score Pre-test	68.0833	24.27007	63.3600	25.58463	263.500	.465
Overall Score Post-test	70.8750	24.41367	69.0400	26.27178	298.000	.968

Table 3. Difference between the means of the improvement obtained between the post-test and pre-test percentiles.

	Experimental		**Control**		**Total**		**Mann-Whitney**	**Asympt. sig.**
	Mean	Dev.	Mean	Dev.	Mean	Dev.	**U-test value**	**(bilateral)**
Percentile difference in Manual Dexterity	2.1667	1.30773	5.1200	2.81839	3.6735	2.64880	93.000	.000
Percentile difference in Aiming & Catching	2.8750	1.29590	6.0400	3.15542	4.4898	2.88763	98.500	.000
Percentile difference in Balance	3.7083	2.07426	5.0800	2.62869	4.4082	2.44880	208.500	.064
Percentile difference in Overall Score	2.7917	1.61458	5.6800	3.02379	4.2653	2.81939	120.000	.000

Table 4. Statistical analysis of the sex variable and the dimensions under study.

	Mann-Whitney U-test value	**Wilcoxon W**	**Z**	**Asymptotic sig. (bilateral)**
Manual dexterity pre-test percentile	296.500	572.500	-.050	.960
Manual dexterity post-test percentile	287.500	563.500	-.232	.816
Aiming and catching pre-test percentile	299.000	575.000	.000	1.000
Aiming and catching post-test percentile	293.000	644.000	-.121	.903
Balance pre-test percentile	263.500	614.500	-.712	.477
Balance post-test percentile	254.000	605.000	-.915	.360
Pre-test Overall Score percentile	273.500	624.500	-.511	.609
Post-test Overall Score percentile	291.000	642.000	-.162	.871

Table 5. Correlations between the variable age and BMI and the psychomotor profile dimensions.

Spearman's rho		**% MD PRE**	**% MD POST**	**% AC PRE**	**% AC POST**	**% BPRE**	**% B POST**	**% OS PRE**	**% OS POST**
Age	r	.472**	.508**	.298*	.320*	.387**	.342*	.541**	.582**
	Sig.	.001	.000	.038	.025	.006	.016	.000	.000
BMI	r	-.229	-.257	.133	.139	-.362*	-.363*	-.190	-.230
	Sig.	.113	.074	.363	.342	.011	.010	.191	.112

*Note. MD: Manual Dexterity, AC: Aiming & Catching, B: Balance, OS; Overall Score *. Correlation is significant at the .05 level (bilateral). **. Correlation is significant at the .01 level (bilateral).*

Table 6. Correlations between the sex variable and the dimensions of the psychomotor profile.

	Post-test Total		**Post-test Balance**		**Post-test Manual Dexterity**	
	r	Sig	r	Sig	r	Sig
Girls	.673**	.000	.504*	.014	.466*	.025
Boys	.508**	.008	.244	.230	.514*	.010

*Note. *. Correlation is significant at the .05 level (bilateral).**. The correlation is significant at the .01 level (bilateral).*

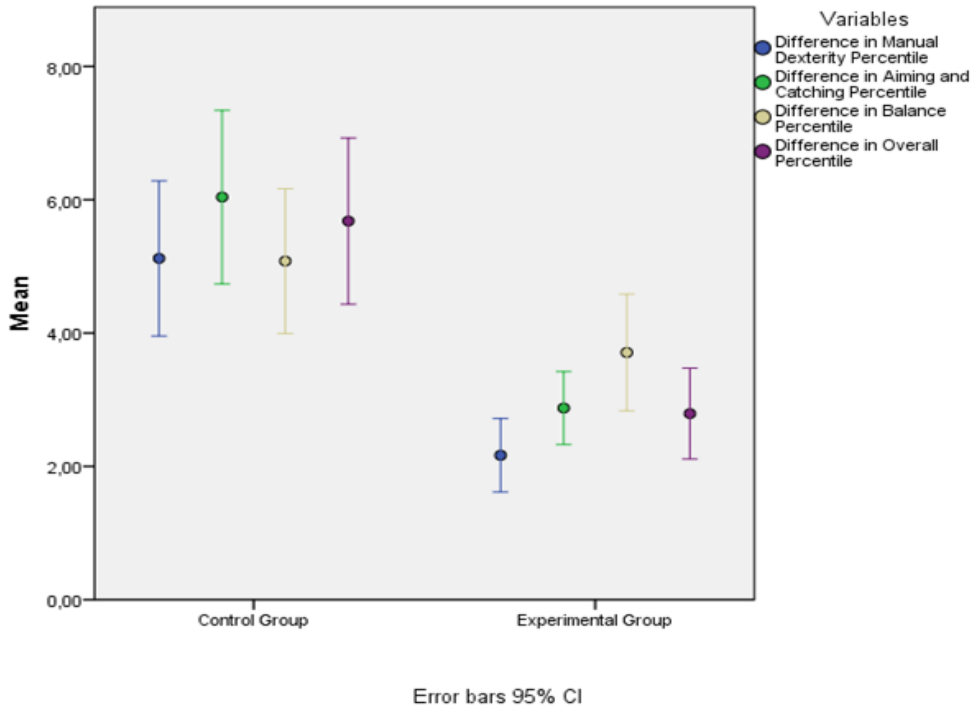

Figure 1. Graphical representation of the improvements in each group as recorded in the post-test and the pre-test.

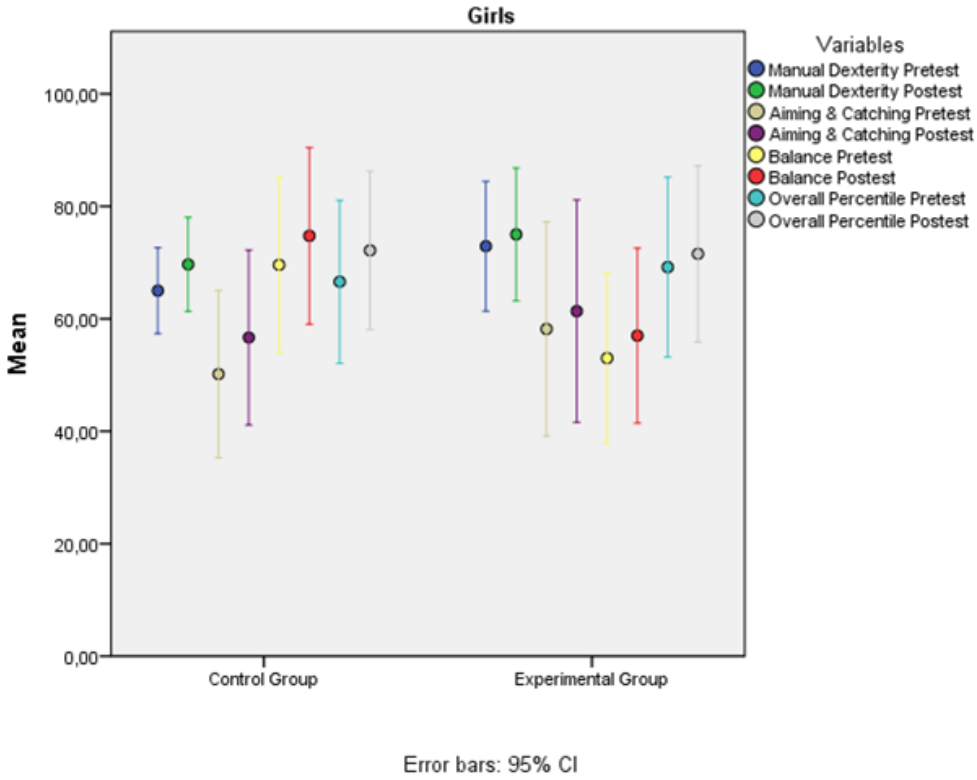

Figure 2. Mean percentiles achieved by girls in each group in terms of the psychomotor profile dimensions.

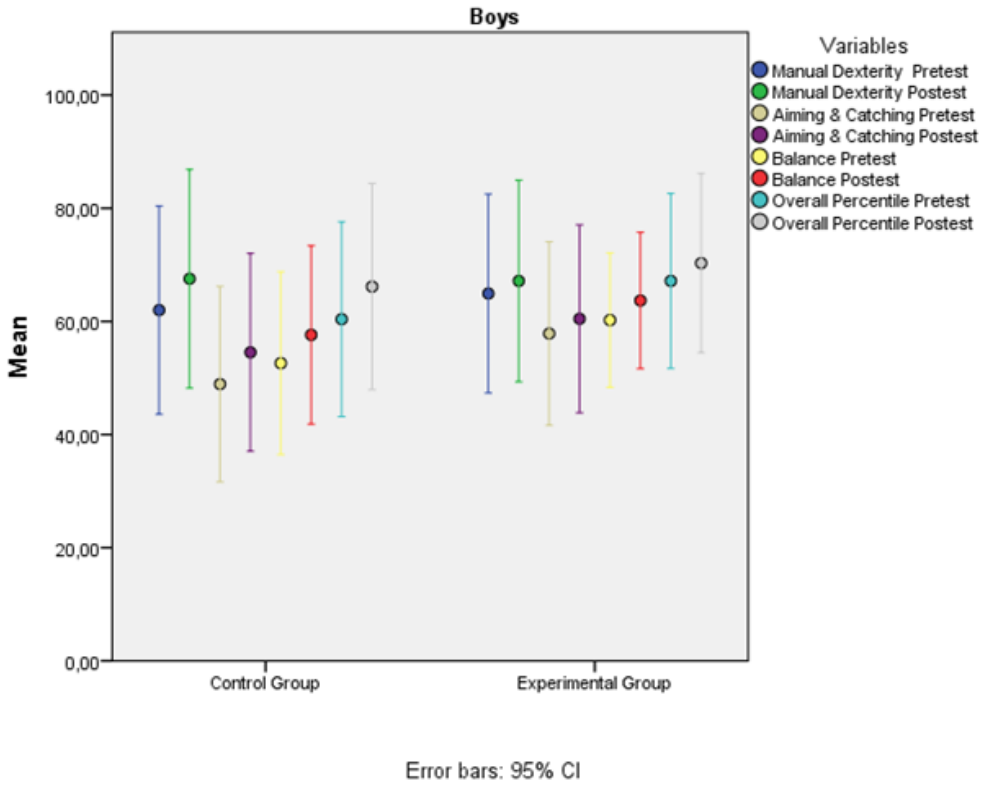

Figure 3. Mean percentiles achieved by boys in each group in terms of the psychomotor profile dimensions.

Correlational analysis

In the correlational analysis, a moderate positive correlation was detected in both groups with respect to age in manual dexterity (both pre-test and post-test) and in the total percentile (pre-test and post-test), with an r between 0.4 and 0.6. And a low negative correlation between BMI and balance and manual dexterity ($0.2 < r < 0.4$).

A higher positive correlation was also found in girls compared to boys in relation to the post-test total percentile and the percentile obtained in the balance test. And in the post-test manual dexterity variable it was slightly higher in boys than in girls.

DISCUSSION

Motor competence measured through the psychomotor profile of children using the MABC-2 battery takes into account three main aspects of fundamental motor skills: manual dexterity, aiming and catching, and balance. Together, these form a psychomotor profile of the children which is measured by means of a scalar score and ultimately assigned a percentile. This test is a reliable measurement tool that can be used to assess motor competence in children in different contexts: educational, clinical and for research purposes (Consejo General de la Psicología, 2020).

The results obtained in this study did not reveal a greater improvement in the psychomotor profile of the children who followed the Doman method compared to the children who carried out a single weekly Physical Education session involving teacher-directed games. These findings are similar to those obtained in a two-

year observational study (Von Tetzchner et al., 2013) involving two groups of children aged 2 to 15 years; one group followed the Doman method and the Family Hope Center method, while the other stuck to the standard curricular programme. Small changes in motor and cognitive function were found to be well below the claims made by these programmes, and there were few differences between this group and the control group.

In a literature review (Vergara-Díaz et al., 2011) on the possible benefits of the Doman method in the psychomotor rehabilitation of children with cerebral palsy, a total of 15 articles were analysed, with significant errors being found in the scientific protocol in the articles advocating for this method. In the comparative studies, no significant differences were found between the application of this method and other standard physiotherapeutic methods. The authors concluded that it is not possible to determine the efficacy of the method and that further studies with appropriate scientific protocols are needed.

In another study (Bridgman et al., 1985) on a sample of children following the Doman method, which looked at the effects on neuromotor aspects, there was no significant difference between the groups in the rates of improvement in the motor subtest.

In their review of empirical evidence on neuroplasticity, (Sibaja-Molina et al., 2016) point out that there is no denying the fact that early stimulation offers a wide range of sensory, physical and social experiences, but to claim that the changes observed in infants are the product of the implementation of specific methods is questionable.

Our study has shown that even a single weekly 50-minute session of Physical Education conducted by a teacher can lead to statistically significant improvements in children's motor competence as compared to the progress observed in the experimental group that followed the Doman method, carrying out 5 sessions with a duration 25 minutes each. This raises the question of whether it is advisable for an educational centre to invest large amounts of money on materials sold under the Doman method brand, such as the brachiation ladder, balance beam or gym bars. As this research was carried out on able-bodied children, it would be advisable to conduct further research on children with cerebral palsy, the primary target group for whom this method was developed.

It would also be advisable to establish a further line of research in order to assess the motor competence levels shown by the two groups after an interval of one or two months. Perhaps, following this short period of time, different results to those found in this research could be obtained. If this were the case, it could be related to the load effective stimulus principle, based on Schultz-Arnold's Threshold Law and Hans Selye's Theory of General Adaptation Syndrome. An effective stimulus is one that is presented for the first time and causes the organism to make the necessary adjustments to cope with and overcome it. When a task is repeated constantly over time, the effective stimulus disappears. In this sense, by repeating the same exercises every day throughout the academic year, the neuromuscular systems may adapt without any further improvement beyond what was achieved at the beginning, as the components that make up the internal and/or external load of the task do not change. In the structured Physical Education programme consisting of a single 50-minute weekly session with teacher-directed games, the games varied over time and involved a greater volume of effective stimuli. In line with Piaget's Theory of Cognitive Development (Simatwa, 2010), these may provide the child with a more intensive interaction with the environment through the medium of assimilation and accommodation.

A number of previous studies (Arufe et al., 2021; Teixeira-Costa et al., 2015) that addressed the effects of structured Physical Education programmes in early childhood education also confirm several improvements in the psychomotor profile of children. Some researchers even emphasise cognitively reinforced motor work. Thus, a recent pilot study (Biino et al., 2021) that analysed motor competence in children aged 3 to 6 years found that children in the experimental group who followed a cognitively enriched extracurricular physical activity programme, which included cognitive challenges, achieved greater significant improvements in gross motor skills and working memory than children who took part in swimming classes or children in the control group. Another experimental design study (Hudson et al., 2021) examined whether participation in cognitively challenging motor skills activities was causatively related to improvements in motor skills as well as improvements in two key indicators of school readiness: executive function and basic arithmetic skills. The study showed significant effects on all indicators. This opens up a new line of research as to whether cognitively challenging physical activities can further improve children's motor competence as well as influence executive functions.

This could be a further argument for avoiding the repetition of daily motor tasks, which seem to have no influence over executive functions and motor competence. Another study (Jiménez-Díaz & Araya-Vargas, 2009) carried out on a sample of children aged 5-6 years concluded that participation in a structured motor intervention programme with a pedagogical approach, in addition to the Physical Education class, leads to greater improvements in gross motor skills, both in terms of locomotion and manipulation, without presenting significant effects on the academic performance or creativity of the children.

With regard to the sex of the children and motor competence, our study confirmed non-significant statistical differences, with girls showing slightly higher levels of motor competence in the overall percentile, which is in keeping with the findings of other studies (Barnett et al., 2010; Bolger et al., 2021; Morgan et al., 2013). A moderate positive correlation was also found between boys and manual dexterity, which is consistent with a recent systematic review (Bolger et al., 2021) indicating that boys exhibit higher object control competence than girls. The latter could be related to findings corroborated by other authors (O'Brien et al., 2021) who have studied the levels of motor competence in adolescents. They found that boys display higher levels of this competence in the object control subset of the FMS, compared to girls. Finally, a low negative correlation was found between BMI and the different tests of the MABC-2 battery, with the exception of the aiming and catching test, where the correlation was positive but very low. The highest value of negative correlation was recorded in the balance test. These findings have also been confirmed in a recent systematic review (Trecroci et al., 2021) which examined the real and perceived motor competence in boys and girls and how it relates to their BMI, with an inverse relationship being observed between the two. These authors also highlight that, during childhood, weight status seems to affect the locomotor and stability skills more than the object control skills, something that we have also observed in our own research. It is important to note that most studies that analysed the relationship between BMI and motor competence did so on the basis of weight and height, with some researchers (Webster et al., 2021) recommending the use of bioelectrical impedance analysis for such measurement. This last study showed that fat-free mass was associated with different aspects of FMS competence and that excess body fat may be a morphological constraint to motor competence.

The results presented in this paper should always be interpreted in the context of the research conducted. There were some limitations, such as the small sample size, which means that more work is needed to address the potential usefulness of the Doman method in enhancing motor competence in early childhood. Nevertheless, as noted, a large part of the research carried out to date shows no indication that it provides any significant benefits for children's psychomotor development. Furthermore, although the MABC-2 battery has been validated and widely used in international research, some researchers (Wood Logan et

al., 2011) who assessed children's motor competence using different tests (Test of Gross Motor Development and MABC-2), found that each assessment provided a similar general description of motor competence in preschool children, but that the scores presented different information about motor performance, meaning that studies should always aim to compare results using the same battery.

CONCLUSION

The aim of this study was to analyse and compare the psychomotor profile of a sample of children from a preschool educational centre which follows a structured Physical Education programme consisting of a single hour per week versus a preschool educational centre which follows the programme of the Doman method consisting of 5 Physical Education sessions with a duration of 25 minutes per day. After analysing the obtained results, we found that the Doman method of early stimulation (based on the repetition of a series of motor tasks involving climbing, grasping and suspension, balance, creeping and crawling and walking and running) did not produce any greater improvement in the motor competence of 4-year-old children than the standard Physical Education programme conducted over the course of an academic year, which consisted of a single hour of Physical Education per week and followed the contents of the educational curriculum, which in turn is based on directed play.

A greater increase in motor competence was observed in the children in the control group, especially in the manual dexterity, aiming and catching tests and in the final total percentile. In this sense, we encourage Physical Education teachers in Preschool Education to use directed play to work on a variety of content related to basic motor skills, components of psychomotor skills and physical abilities. We also recommend that teachers vary the games and activities so as to avoid the repetition of the same bodily actions and motor sequences, thus enriching the psychomotor profile of the children and improving their motor competence. Finally, it is important to personalise and adapt Physical Education exercises to the morphological, neuromuscular and psychomotor characteristics of each child in order to maximise their motor competence and to have a positive impact on other variables such as psychological variables or towards them leading a healthy lifestyle.

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