Ann Appl Sport Sci, 11(2): e1162, 2023.
http://www.aassjournal.com; e-ISSN: 2322–4479; p-ISSN: 2476–4981. 10.52547/aassjournal.1162

ORIGINAL ARTICLE

The Effects of Inactivity During The COVID-19 Pandemic on the Psychomotor Skills of Kindergarten Students

[1]Nuridin Widya Pranoto, [1]Ahmad Chaeroni*, [1]Muhamad Sazeli Rifki, [1]Ilham, [1]Nugroho Susanto

[1]Department of Health and Recreation, Faculty of Sports Science, Universitas Negeri Padang, Padang, Indonesia.

Submitted October 17, 2022; Accepted in final form January 22, 2023.

ABSTRACT

Background. Possession of motor skills from an early age by interacting with the outdoor environment has a long-term effect on physical activity. During the COVID-19 pandemic, there has been a restriction to interacting directly with it especially kindergarten students when doing online learning or learning from home due to pandemic health measures. There is a series of literature that reviews the impact of the COVID-19 pandemic on several aspects of human life, but a lack of attention remains of the impact of the disease on motor skills development for kindergarten students. **Objectives.** To reveal the extent to which the impact of the COVID-19 pandemic of the motor skills of these kids. **Methods.** The method used in this research is described with a quantitative approach. 80 kindergarten students were included in the sample, consisting of 45 boys and 35 girl students in the city of Padang, Indonesia with an age range of 4 to 5 years. A motor skills test was conducted using TGMD-2. **Results.** After dealing with all data, findings showcased that the level of motor skills of these students was reduced during the pandemic when compared to before the outbreak. While before the pandemic, such a level of motor skills was in the average category whereas during the pandemic it shifted to the poor category. **Conclusion.** This study provides the actual state of the impact of the pandemic COVID-19 on kindergarten students on their motor skills development.

KEYWORDS: ***Motor Skills, Kindergarten Students, COVID-19, SARS-COV-2.***

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome has created an unprecedented and frightening challenge for human survival and affecting physical activity (1). Education is the basic mechanism that forms the basis for the formation of eternal human qualities (2, 3). The level of motor performance is influenced by the elements between smooth and coarse movements that will contribute to the level of performance of the movement (4). Through the educational process, children are stimulated to develop their potential in the cognitive, affective, and psychomotor domains. Whilst movement is basically understood as a nature of human life that is dynamic and flexible to alter over time, then such change could be observed as life span development from birth to adulthood (5). Sometimes, talking about some educational and physical jargon like psychomotor, movement, or motor simply means a set of changes observed in the human body during its growth process as motor development indeed. Then, motor development is defined as the "continual change

*. Corresponding Author:
Ahmad Chaeroni, Ph.D.
E-mail: ahmad.chaeroni@fik.unp.ac.id

in motor aspects that takes place throughout the human life cycle" (6). In the same optic, it is the progressive acquisition of functional abilities of the child in the early stage of development that mirrors or represents the maturation of the central nervous system shortened CNS (7). Pursuant to the gist of dynamic system theory (8), the development of a new motor skill hinges upon the bond of two main activities established by the subject; that is the activity that is being honed and the context in which it takes place. Done by program in school or through out-of-school applications (9). On the other hand, children with higher levels of organized activity and motor skills have higher social development (10).

As mentioned earlier, we acknowledge that child's development (motor development) is a dynamic process and circumscribes various domains both interrelated and complexes in themselves. Some of which are gross motor skills, fine motor skills, cognitive, language, problem-solving, and socio-emotional aspects (6, 11). It is now undeniable that different sectors of human lives had felt the negative impact of the presence of the coronavirus pandemic. From social deprivation as well as decreasing in the interaction of the child with outdoor environments, such inconvenient phenomena grounded the reduction of their possibilities of both autodidactic and deliberate learning (12), and acquisition of motor milestones at an appropriate age (6). In the previous decades, there had been some publications focusing on the pressing of some infectious and hazardous diseases ever attacked human life. Some of which are the large-scale events of the Great Depression, the 2008 recession, and the SARS or the N1H1 epidemics, and others. Then, it was investigated and officially announced that, these foregoing diseases had particularly affected children's developmental trajectories with long-lasting effects on their motor growth and skills (13-15) Giving place to the new normal, the confinement caused by COVID-19 has meant a radical change in our daily routines (16). Interestingly, the children and adolescent population underwent deterioration in their emotional health and engendered severe disruption to education ecosystems due to the same disease. Take, for example, a study conducted on the impact of the COVID-19 pandemic on preschoolers' educational development across different socioeconomic settings asserted and confirmed the harmful effects of the pandemic on children's cognitive and motor skills (17). Additionally, most parents and professionals deemed that confinement had negative effects and changes in children's behavior (18, 19).

Fundamental motor skills otherwise FMS are gross and fine movement patterns that involve large and small muscles so that they are able to perform a series of organized basic movements (20, 21). Motor skills are clustered into 3 main categories; namely 1) the ability to propel the body through space, 2) the ability to push or manipulate objects in space, and 3) stability skills or the ability to maintain postural control (22, 23). However, the possession of the FMS does not come by itself. It requires perseverance resulting from a combination of active play and a structured training program (24). As a result, the usefulness of FMS ability in individuals enables them to properly carry out physical activities throughout life (25, 26). Suffice to impart also that the FMS becomes a building block for more complex movements required when participating in sports, games, or physical activities including object control and manipulation (27, 28). Particularly in children, bearing the FMS becomes the staple asset or a broad hint to perform a series of organized basic movements involving various body segments and provides the basis for achieving higher motor competencies (21). Under normal conditions, children especially kindergarten ones acquire and enforce these motor skills in school settings. Although the FMS presents outstanding benefits in child, however, during the pandemic where schools and other conventions were closed, it has been a remarkable recession and sedentary participation in physical activities for these children (29, 30). Movement patterns in the preschool period have not fully been directed. Then it is evident that children who experience delays in FMS development are at risk of sustaining delays in FMS skills until grade 1 (31). The preschool years become a major developmental stage for the acquisition and development of FMS (32). The reason for developing FMS during preschool is because generally preschool students already have a positive perception of physical competence so it becomes an opportunity to grow them (skills) (33).

The literature that exists so far reveals that if the FMS is well developed in childhood and it is then refined into sport-specific skills during adolescence and adulthood (34). Ages 3 and 6 are

considered the right times to start learning FMS since basic motor skills start to develop (35). Therefore, the mastery of FMS from an early age affects physical activity (PA), and nurtures children physically literate by contributing to physical activity, enhancing body movement abilities, and social behavior (29–31). Other words, the possession of FMS at the lower age could have a positive impact on children's motor, affective, and cognitive domains (32, 33). In Indonesia, the development of FMS is one of the learning programs given to kindergarten students. That means most of the fundamental motor skills are built during school times because these young apprentices spending most of their time in school as a suitable place for them to develop and improve physical activity and motor skills. The incorporation of such a program in the kindergarten curriculum makes people believe that the FMS ensures to promote children's physical, social, and cognitive development (36).

The conception of that program instructs and guides children to build the basic balance movement, catching the ball, walking on the catwalk, climbing, hanging, jumping, ball games, and gymnastics (37, 38). Research results prove that participation in exercise results in improved cardiorespiratory fitness, increased anaerobic performance and higher levels of muscle strength (39). Nevertheless, there has been evidence confirming that during the pandemic, the disruption and sufferance of cognitive and motor development skills of children at age five had been reported (40, 41). Moreover, stay-at-home measures also led to a drastic decrease in physical activity which may explain the underdevelopment of motor skills. Due to all these stressors and the negative impact of the pandemic audited above, especially those related to motor skills development, the condition of children at an early age may have been exacerbated and worsened by the lack of interaction with the environment. Therefore, this study was executed to analyze the extent to which the impact of COVID-19 on the motor skills development of kindergarten students.

MATERIALS AND METHODS

Design. To begin with, this study employed a survey as the type of research with a descriptive-quantitative approach. The method was suitable for describing whether changed or not the condition of the motor skills of kindergarten students during the COVID-19 pandemic.

Participant. Purposive sampling was a technique sampling appointed that was based on certain considerations, like the impact of the COVID-19 pandemic which takes only a few schools to carry out the face-to-face learning process. There were 80 kindergarten students with an age range from 4 to 6 years consisting of 45 boy students and 35 girl students. The process of measuring motor skills was assisted by 8 lecturers/coaches who bear enough intuition about the implementation of the test procedure.

Measurement. The numerical data analysis comes from test results calculated using the standard TGMD-2 instrument. The TGMD-2 is extended as a Test of Gross Motor Development-2nd Ed., which provides a developmental framework for examining the performance fundamental movement skills in terms of the movement patterns (42). As coined in the years of 1995 by a team from National Association for Sport and Physical Education, it serves: a) to identify children who are significantly behind their peers in gross motor skill development; b) to plan an instructional program for the same purpose; c) to appraise individually or collectively progress; and d) to evaluate the effectiveness of the program itself, and to serve as a useful measurement tool in research that tackle the issues related to gross motor development (43). However, to be in the range of acceptance, the instrument employed should have a goodness-of-fit index (GFI) of 0.96 and an adjusted value GFI otherwise (AGFI) of 0.95. The TGMD-2 validity value was 0.95 and the reliability was 0.91 with the reliability coefficient of the locomotor and object control sub variable respectively 0.85 and 0.88 (43, 44). It is worth mentioning also that, as the overview, the TGMD-2 is composed of two subtests which are conducted through five procedures that are to fill out, that is the trainer identity form, 2) briefing or giving a short demonstration to students, 3) providing an opportunity to try the test form, 4) giving a re-demonstration if students do not understand, 5) as recommended students performed at least two repetitions on each test item. Then, for the present study and the TGMD-2's recommendations and framework (43), twelve test items were prepared and tested namely items run, gallop, hop, leap, horizontal jump, slide, striking a stationary ball, stationary dribble, catch,

kick, overhand throw, and underhand roller. The points obtained from the 12 test items are processed to determine the gross motor quotient in order to obtain a rating description. In addition, numerous skills yielded are clustered into the two main subtests namely locomotor (with subtest measures such as run, gallop, hop, leap, horizontal jump, and slide) and object control consists of striking a stationary ball, stationary dribble, etc., in which each of them assessing a different aspect related to gross motor development issues (38, 43).

Data Analysis. The data were dealt with an SPSS software 26 edition and then analyzed descriptively. Descriptive analysis of data using quantitative descriptive techniques and different tests with t-test.

RESULTS

The general characteristics of the participants can be seen in Table 1. Based on the inferential statistical test, a significant difference was found between previous and current COVID-19 mass data ($P < 0.05$).

Table 1. The General Characteristics of The Participants

Class	Condition	N	Mean	SDeviation	SEM	t	df	P
MS	**BC**	80	101.012	12.400	1.386	15.631	158	0.000
	WC	80	76.450	6.615	0.739			

MS: Motor Skill. ***BC:*** Before Covid. ***WC*****:** When Covid. ***SD*****:** Standard Deviation. ***SEM:*** Standar Mean Error.

Based on the results of measuring motor skills on the locomotor subtest using the TGMD-2 instrument, the Table 1 obtained:

As depicted in the Table 2 about the score of locomotor sub-tests for motor skills in children, it is now clearly seen that for the run sub-test, students get an average value of 4.33-points from a maximum score of 8. What realized during this sub-test, students made a lot of mistakes on test criteria 2 as hovering in the air along with test criteria 3 as foot landing. In the Gallop sub-test, the average value of 3,12 points was obtained out of a maximum score of 8. Likewise, in this subtest, students made a lot of mistakes on the test points of 3 flying positions in the air and 4 foot landings. In tandem, 4,71 out of 10 points as the maximum points were found in the Hop sub-test, and mistakes were still committed especially on test point 2 in the position of the non-supporting leg position, on test points 3 bending the arm and swinging, and 5 jumping with the non-dominant leg. The Leap sub-test was also another type of subtest performed and virtually an average of 3.60 points out of a maximum score of 6, and mistakes were found on the test points of 2 floating positions in the air and 3 arms opposite the front legs. In the Horizontal jump sub-test, students get an average of 4.24 points from a maximum score of 8, and mistakes were realized on the test criteria for 3 landing positions and test criteria for 4 arm positions. In the Slide sub-test, students get an average of 3.09 points from a maximum score of 8. That implies students still make a lot of mistakes on the test criteria 2 steps, test criteria 3 are four continuous steps to the right side, and test criteria 4 are four continuous steps to the left side. In fact, throughout these sub-tests executed for revealing the extent of the motor skills in kindergarten students, substantive errors were found in all testing processes.

From the results of the locomotor test, it is known that the average motor skills of students are still low. Of the 6 locomotor sub-tests, students only achieved points below 55% of the maximum points. Slide and gallop skills are the skills with the lowest acquisition scores. The form of slide and gallop movements which were foreign to students, it was also suspected that the absence of movement learning during the COVID-19 pandemic makes it difficult for students to perform such movement skills required.

Based in Table 3, after addressing all data from the control object tests, 4.20 points of 10 as the highest score were assigned to striking a stationary ball. This test was remarked by some mistakes made by some students particularly on the test criteria 3 rotation when swinging, on test criteria 4 transfer weight to the forefoot, and on test criteria 5 the bat when in contact with the ball. Meanwhile, in the stationary dribble sub-test, students get an average point of 2.38 from the maximum score of 8. At this point, students make a lot of mistakes on the test points of 3 hovering positions in the air and 4-foot landings. As far as the catch sub-test is concerned, the proportion of 3.61 was obtained from the maximum score of 6 in which mistakes were detected on test points 2

for arm extension position, and on the test, point 3 for catching the ball with their hands. In the same vein, the kick sub-test was another type of test performed. During this test, students get an average of 4.33 points from a maximum score of 8, with mistakes on test point 1, approaching the ball continuously, and test points for 2 long steps (leap) just before contact with the ball. For the overhand throw sub-test, another interesting average and mistakes were discovered. Of 3.53 points from a maximum score of 8, mistakes like on test criteria 2 hips and shoulders, test criteria 3 weight transfer and footsteps, and test criteria 4 follow-throughs were recorded. At the end of the day, under-hand roll sub-tests were performed, students get an average of 3.3 points from a maximum score of 8, and the test criteria 2 steps, test criteria 3 bend the knees to lower the body, and test criteria 4 release the ball close to the floor were the main mistakes registered.

From the results of the control object test, it is seen that the average motor skills of students are still low. Of the 6-control object sub-tests, students only achieved points below 55% of the maximum points. Stationary dribble and under-hand roll skills are the skills with the lowest acquisition scores. In the stationary dribble movement, students have not been able to control the ball, students tend to bounce the ball hardily so that the ball bounce is not fully controlled and students have not been able to repeat the ball bounce. In the Under-hand roll movement, many students do not bend their knees correctly, thereby the released ball bounces high.

The results of data processing obtained data on the average raw score, average standard score, a descriptive rating based on standard score, average, percentile, average gross motor quotient, and descriptive ratings based on the gross motor quotient. The raw score is useful for comparison between sub-tests. To assess and prove that there has been a significant impact of the pandemic through motor skills development in kindergarten students due to lack of physical activities induced mostly by the disease protocol as confinement indeed, we compared data collected before the pandemic and the actual situation. Tables 2 and 3 represent the two sets of data recapped above. In both tables, 80 subjects were used as the source of information needed. Then, there is a significant reduction in data, especially on the average standard score, percentage, and final conclusion. In the locomotor sub-test of both sides, 80 students obtained an average raw score of 22.73 while the control object was 21.03 while data collected before the pandemic, 35,28 and 32,17 were found at the same aspects. The standard score is a conversion from the raw score, this score is useful for comparing sub-tests and obtaining descriptive rating information. From the standard score data, it is known that 80 students have an average locomotor standard score of 5.87 with a descriptive rating of poor category, while the average standard score for the control object is 6.27 with a below-average descriptive rating. The gross motor quotient is a combination of locomotor sub-tests and control objects, gross motor quotient scores can be interpreted into descriptive ratings. In this study, the gross motor quotient score was equal to 76.45 when interpreted in descriptive ratings was in the poor category while before the pandemic it was at 101,01. Overall, a significant impact based on the data addressed was recorded (Tables 4 and 5).

DISCUSSION

Given the fact that the outside environment serves multiple possibilities, especially when interacting with it, it mostly influences or impacts positively the child's motor development or the generation of new skills. In other words, the acquisition of new motor skills is the result of the activity that takes place chiefly in the outside settings and context. With respect to the aforementioned statements, motor development is closely related to the environment, due to the fact that the environment is believed to secure opportunities to give rise to the development of new capacities or abilities in children (45). However, during the pandemic, the disease had an impact on their movement and play behavior due to its prophylaxis measures of studying at or from home, and reducing activities outside the home all in the wake to prevent the spread of the disease (46). Just for a record, our viewpoint goes in the line with an study in which reported and asserted that children have had to struggle with substantial adjustments to their routines, like kindergarten. The results of the present study revealed that the motor skills of kindergarten students during the COVID-19 pandemic were in the poor category (47). Then, our findings were corroborated by a study reported that during the COVID-19 pandemic a big portion of children alias over 80% of children's gross motor skills were falling in a lower category, while the rest 20% of them, were classified in the very low

category (48). Following that, another similar study finding showcased that during COVID-19 children are preoccupied with excessive screen time activities, and activities outside the home are only done on weekends (49). That said some kids are gradually and ignobly experiencing a sedentary lifestyle during this hardship times of coronavirus. Apart from what was mentioned earlier, among our findings, the disease has caused a significant decrease in motor skills. Some of the reasons were due to children's activities at home such as increased sleep habits, increased eating habits, and or screen time (50). Psychological factors that affect children's mental health during COVID-19 from a family perspective, namely parent-child interaction and play, this will improve and maintain children's mental health (51). Apart from that, physiologically the early childhood that does not perform routine school activities will result in lack of physical activity and then use a lot of electronic media hence lack of rest time or leisure hours sleep (52). Research has shown that while not in school, children are more susceptible to unhealthy behaviors, such as increased sedentary behavior, which has a negative impact on the development of children's motor competence. The decline in motor skills during the COVID-19 pandemic was also due to differences in parents' perceptions of their children's physical activity levels (53). Lack of knowledge about the importance of physical activity and motor learning made the parents not support their children to do physical activity and learn motor skills during the pandemic. Additionally, the lack of playmates makes children lazy to do physical activity, children tend to do sedentary behavior which harms children's motor skills (54). Take for example, when compared with previous research before COVID-19, it was previously found that the results of the skill test score were very high (see data in table 4).

Table 2. Data on Motor Skills for Locomotor Sub-Tests

Test	Sub-Test	N	M	SD	ATR
Locomotor	**Run**	80	3	5	4.33
	Gallop	80	2	4	3.12
	Hop	80	3	7	4.71
	Leap	80	3	4	3.60
	Horizontal	80	3	4	4.24
	Hump slide	80	2	4	3.09

***M*:** Mean. ***ATR*:** Average Test Results. ***MinS*:** Minimum Score. ***MaxS*:** Maximum Score. ***SD*:** Standard Deviation.

Table 3. Motor Skills Data for Control Object Test

Test	Sub-Test	N	MinS	MaxS	ATR
Object	SB	80	2	5	4.20
Control	SD	80	0	4	2.38
	C	80	3	4	2.61
	K	80	6	3	4.33
	OT	80	3	4	3.53
	UR	80	2	4	3.30

SSB*:** Striking a stationary ball. ***Sd: Stationary dribble. ***C*:** Catch. ***OT*:** Over Throw. ***UR*:** Underhand Roll. ***MinS*:** Minimal Score. ***MaxS*:** Maximal Score. ***ATR*:** Average Test Results.

Table 4. The Actual Motor Skills Data from Kindergarten Students.

Sub-Test	N	ARS	ASS	DRS	AP	AGMQ	*DRGMQ*
L	80	5.870	2	Poor	10.16		
OC	80	6.275	0	Below Average	12.33	76.45	Poor

***ARS*:** Average Raw Score. ***ASS*:** Average Standard Score. ***DRS*:** Descriptive Rating on Standard Score. ***AP*:** Average Percentile. ***AGMQ*:** Average Gross Motor Quotient. ***DRGMQ*:** Descriptive Ratings by Gross Motor Quotient. ***OC*:** Object Control. ***L*:** Locomotor. ***P*:** Poor. ***BA*:** Below Average.

Table 5. Motor Skills Data for Kindergarten Students before the COVID-19 Pandemic

Sub-**Test**	**N**	**ARS**	**ASS**	**DRS**	**AP**	**AGMQ**	***DRGMQ***
L	80	35.28	9.975	Average	49.16	101.01	Average
OC	80	32.17	10.32	Average	53.28		

***ARS*:** Average Raw Score. ***ASS*:** Average Standard Score. ***DRS*:** Descriptive Rating on Standard Score. ***AP*:** Average Percentile. ***AGMQ*:** Average Gross Motor Quotient. ***DRGMQ*:** Descriptive Ratings by Gross Motor Quotient. ***OC*:** Object Control. ***L*:** Locomotor. ***P*:** Poor. ***BA*:** Below Average.

This research is a direct research without any treatment, the results of the research can be used as a basis for making programs to improve students' motor skills in COVID-19 condition or after. The 12 sub-tests conducted, it shows that on all test items students get low points. Possession of low motor skills if left unchecked can hamper children's physical, cognitive, social development, and active lifestyle (36). Children who do not bear staple motor skills will have difficulty in carrying out prolonged motor activities (55). The importance of mastering motor skills and the negative effects of low motor skills, and the impact of the COVID-19 pandemic need special attention. Appropriate consideration is needed to intervene and help the acceleration of motor skill improvement after the COVID-19 pandemic. Some instructions can help and might be taken into consideration; that is providing a basic environment to promote motor skill development, intervening in learning programs to catch up with motor skills, allocating more time for learning motor skills, designing miscellaneous motor skills learning assignments at home. So that, kindergarten students would be ready to build and perform more complex movement skills in the future without any delays or hindrance.

CONCLUSION

This study provides an overview of the condition of motor skills during the COVID-19 pandemic and how the disease is contributing to impede its optimal development. Such impact emanated from the lack of physical activity while at home, increased sleeping habits increased eating habits, and so forth. It was realized that during the COVID-19 pandemic the skill level of kindergarten students measured using the TGMD-2 instrument was in the poor category, whereas before the pandemic it fell in the average slot. It was undeniable that during the pandemic, kindergarten students spend a lot of time at home and do a lot of sedentary behavior. The decline in physical activity and learning basic motor skills in schools conducted online is indicated as the cause of the decline in children's motor skills. Therefore, intervention is needed and suggested to mitigate or overcome this hostile infant for their health and well-being through promoting the improvement of motor skills. It should be noted also that the role of parents is very important in such work to maintain children's motor skills.

APPLICABLE REMARKS

- The application of this research is to differ the condition motor level of kindergartens during the COVID-19 Condition and the normal condition.

ACKNOWLEDGMENTS

The authors would like to acknowledge a highly motivated group of teachers, coaches, referees, and children that made this investigation possible.

AUTHORS' CONTRIBUTIONS

Study concept and design: Endang Sepdanius. Acquisition of data: Anton Komaini. Analysis and interpretation of data: Muhammad Sazeli Rifki. Drafting the manuscript: Rini Afriani. Critical revision of the manuscript for important intellectual content: Ilham. Statistical analysis: Nuridin Widya Pranoto. Administrative, technical, and material support: Endang Sepdanius. Study supervision: Anton Komaini.

CONFLICT OF INTEREST

The authors mention that there is no "Conflict of Interest" in this study.

REFERENCES

1. Dergaa I, Abdelrahman H, Varma A, Yousfi N, Souissi A, Ghram A, et al. COVID-19 Vaccination, Herd Immunity and The Transition Toward Normalcy: Challenges with The Upcoming Sports Events. Ann Appl Sport Sci. 2021;9(3):1-10. [**doi**:10.52547/aassjournal.1032]

2. Li Z, Qiu Z. How does family background affect children's educational achievement? Evidence from Contemporary China. Vol. 5, Journal of Chinese Sociology. 2018. [**doi**:10.1186/s40711-018-0083-8]
3. Sulistiyowati EM, Suherman WS, Sukamti ER, Ilham, Sriwahyuniati F, Budiarti R, et al. Development of Early Childhood Skills by Guiding Tests in Sports Rhythmic Gymnastics. Int J Hum Mov Sport Sci. 2022;10(2):253-63. [**doi**:10.13189/saj.2022.100216]
4. Maharjan P, Hyllegard R, Narvaez M, Radlo S. Transfer of Motor Skills: A Comparative Study of College-Level Musicians and Athletes. Int J Mot Control Learn. 2022;4(3):5-9. [**doi**:10.52547/ijmcl.4.3.5]
5. Lally M, Valentine-French S. Life-Span Development: A Psychological Perspective. Annu Rev Psychol. 2019;7-11.
6. Lirio-romero C. Families ' Perceptions of the Motor Development and Quality of Confinement Due to the COVID-19 Pandemic . 2021;
7. García Pérez MA MGM. Desarrollo psicomotor y signos de alarma. Curso Actual Pediatría 2016 Madrid. 2016;81-93.
8. Cano-de-la-Cuerda R, Molero-Sánchez A, Carratalá-Tejada M, Alguacil-Diego IM, Molina-Rueda F, Miangolarra-Page JC, et al. Teorías y modelos de control y aprendizaje motor. Aplicaciones clínicas en neurorrehabilitación. Neurologia. 2015;30(1):32-41. [**doi**:10.1016/j.nrl.2011.12.010] [**pmid**:22341985]
9. Taheri M, Irandoust K. The Effect of Game-Based Balance Training on Body Composition and Psychomotor Performance of Obese Students. Int J Sch Heal. 2019;In Press(In Press):0-3. [**doi**:10.5812/intjsh.83341]
10. Eliassy M, Khajavi D, Shahrjerdi S, Mirmoezzi M. Associations Between Physical Activity and Gross Motor Skills with Social Development in Children with Learning Disabilities. Int J Sport Stud Heal. 2021;4(1):1-6. [**doi**:10.5812/intjssh.120844]
11. Adolph KE, Hoch JE. Motor Development: Embodied, Embedded, Enculturated, and Enabling. Annu Rev Psychol. 2019;70(September 2018):141-64. [**doi**:10.1146/annurev-psych-010418-102836] [**pmid**:30256718]
12. Competence M. Motor Competence. Encycl Exerc Med Heal Dis. 2012;595-595. [**doi**:10.1007/978-3-540-29807-6_4369]
13. February NP, Release P, Development C. Study Shows Impact of School Closures on Preschool Children During Covid-19. 2022;
14. Arthi V, Parman J. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information . 2020;(January).
15. González M, Loose T, Liz M, Pérez M, Rodríguez-Vinçon JI, Tomás-Llerena C, et al. School readiness losses during the COVID-19 outbreak. A comparison of two cohorts of young children. Child Dev. 2022;(February):1-2. [**doi**:10.1111/cdev.13738] [**pmid**:35194777]
16. Orgilés M, Morales A, Delvecchio E, Mazzeschi C, Espada JP. Immediate Psychological Effects of the COVID-19 Quarantine in Youth From Italy and Spain. Front Psychol. 2020;11(November):1-10. [**doi**:10.3389/fpsyg.2020.579038] [**pmid**:33240167]
17. ECLAC-UNESCO. COVID-19 Education in the time of COVID-19 Report. 2020;(August).
18. Gerber RJ, Wilks T, Erdie-Lalena C. Developmental milestones: Motor development. Pediatr Rev. 2010;31(7):267-77. [**doi**:10.1542/pir.31-7-267] [**pmid**:20595440]
19. Amorim Adegboye AR, Linne YM. Diet or exercise, or both, for weight reduction in women after childbirth. Cochrane database Syst Rev. 2013 Jul;(7):CD005627. [**doi**:10.1002/14651858.CD005627.pub3] [**pmid**:23881656]
20. Webster EK, Martin CK, Staiano AE. Fundamental motor skills, screen-time, and physical activity in preschoolers. J Sport Heal Sci [Internet]. 2019;8(2):114-21. [**doi**:10.1016/j.jshs.2018.11.006] [**pmid**:30997257]
21. Favier T, Van Gorp B, Cyvin JB, Cyvin J. Learning to teach climate change: students in teacher training and their progression in pedagogical content knowledge. J Geogr High Educ [Internet]. 2021;45(4):594-620. Available from: [**doi**:10.1080/03098265.2021.1900080]

22. Gregory SM, Parker B, Thompson PD. Physical activity, cognitive function, and brain health: what is the role of exercise training in the prevention of dementia? Brain Sci. 2012 Nov;2(4):684-708. [**doi**:10.3390/brainsci2040684] [**pmid**:24961266]
23. Walkley J, Holland B V, Treloar R V, O'Connor J. U n d a m e n ta l. 1996;
24. Engel A, Broderick C, Ward R, Parmenter B. Study Protocol: The Effect of a Fundamental Motor Skills Intervention in a Preschool Setting on Fundamental Motor Skills and Physical Activity: A Cluster Randomised Controlled Trial. Clin Pediatr Open Access. 2018;03(01):1-7. [**doi**:10.4172/2572-0775.1000129]
25. Eyre ELJ, Adeyemi LJ, Cook K, Noon M, Tallis J, Duncan M. Barriers and Facilitators to Physical Activity and FMS in Children Living in Deprived Areas in the UK: Qualitative Study. Int J Environ Res Public Health. 2022;19(3). [**doi**:10.3390/ijerph19031717] [**pmid**:35162741]
26. Lonsdale C, Sanders T, Cohen KE, Parker P, Noetel M, Hartwig T, et al. Scaling-up an efficacious school-based physical activity intervention: Study protocol for the "Internet-based Professional Learning to help teachers support Activity in Youth" (iPLAY) cluster randomized controlled trial and scale-up implementation evalua. BMC Public Health. 2016 Aug;16(1):873. [**doi**:10.1186/s12889-016-3724-3] [**pmid**:27716137]
27. Adeyemi-Walker LJ, Duncan M, Tallis J, Eyre E. Fundamental motor skills of children in deprived areas of england: A focus on age, gender and ethnicity. Children. 2018;5(8). [**doi**:10.3390/children5080110] [**pmid**:30104521]
28. Logan SW, Ross SM, Chee K, Stodden DF, Robinson LE. Fundamental motor skills: A systematic review of terminology. J Sports Sci [Internet]. 2018;36(7):781-96. Available from: [**doi**:10.1080/02640414.2017.1340660] [**pmid**:28636423]
29. Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. BMC Public Health. 2020;20(1):1-13. [**doi**:10.1186/s12889-020-09429-3] [**pmid**:32887592]
30. Moore SA, Faulkner G, Rhodes RE, Brussoni M, Chulak-Bozzer T, Ferguson LJ, et al. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: A national survey. Int J Behav Nutr Phys Act. 2020;17(1):1-11. [**doi**:10.1186/s12966-020-00987-8] [**pmid**:32631350]
31. Barnett LM, Van Beurden E, Morgan PJ, Brooks LO, Beard JR. Does childhood motor skill proficiency predict adolescent fitness? Med Sci Sports Exerc. 2008;40(12):2137-44. [**doi**:10.1249/MSS.0b013e31818160d3] [**pmid**:18981934]
32. Musálek M, Clark CCT, Kokštejn J, Vokounova Š, Hnízdil J, Mess F. Impaired Cardiorespiratory Fitness and Muscle Strength in Children with Normal-Weight Obesity. Int J Environ Res Public Health. 2020 Dec;17(24). [**doi**:10.3390/ijerph17249198] [**pmid**:33317083]
33. LeGear M, Greyling L, Sloan E, Bell RI, Williams BL, Naylor PJ, et al. A window of opportunity? Motor skills and perceptions of competence of children in Kindergarten. Int J Behav Nutr Phys Act. 2012;9:1-5. [**doi**:10.1186/1479-5868-9-29] [**pmid**:22420534]
34. Lubans DR, Morgan PJ, Weaver K, Callister R, Dewar DL, Costigan SA, et al. Rationale and study protocol for the supporting children's outcomes using rewards, exercise and skills (SCORES) group randomized controlled trial: a physical activity and fundamental movement skills intervention for primary schools in low-income communit. BMC Public Health. 2012 Jun;12:427. [**doi**:10.1186/1471-2458-12-427] [**pmid**:22691451]
35. Robinson LE, Palmer KK, Bub KL. Effect of the children's health activity motor program on motor skills and self-regulation in head start preschoolers: An efficacy trial. Front Public Heal. 2016;4(September):1-9. [**doi**:10.3389/fpubh.2016.00173] [**pmid**:27660751]
36. Bellows LL, Davies PL, Courtney JB, Gavin WJ, Johnson SL, Boles RE. Motor skill development in low-income, at-risk preschoolers: A community-based longitudinal intervention study. J Sci Med Sport [Internet]. 2017;20(11):997-1002. [**doi**:10.1016/j.jsams.2017.04.003] [**pmid**:28506451]
37. Wick K, Leeger-Aschmann CS, Monn ND, Radtke T, Ott L V., Rebholz CE, et al. Interventions to Promote Fundamental Movement Skills in Childcare and Kindergarten: A Systematic Review and Meta-Analysis. Sport Med. 2017;47(10):2045-68. [**doi**:10.1007/s40279-017-0723-1] [**pmid**:28386652]

38. Morano M, Colella D, Caroli M. Gross motor skill performance in a sample of overweight and non-overweight preschool children. Int J Pediatr Obes. 2011;6(SUPPL. 2):42-6. [**doi**:10.3109/17477166.2011.613665] [**pmid**:21923296]
39. Cachón-Zagalaz J, Sánchez-Zafra M, Sanabrias-Moreno D, González-Valero G, Lara-Sánchez AJ, Zagalaz-Sánchez ML. Systematic Review of the Literature About the Effects of the COVID-19 Pandemic on the Lives of School Children. Front Psychol. 2020;11(October):1-8. [**doi**:10.3389/fpsyg.2020.569348] [**pmid**:33162910]
40. United Nations Children's Fund (UNICEF). Young Children and the Pandemic : UNICEF Early Childhood COVID-19 Response in East Asia and Pacific. 2021;
41. Ra S, Jagannathan S, Maclean R. Powering a Learning Society During an Age of Disruption. Vol. 58, Asian Development Bank. 2021. 1-322 p. [**doi**:10.1007/978-981-16-0983-1]
42. Staples KL, MacDonald M, Zimmer C. Assessment of Motor Behavior Among Children and Adolescents with Autism Spectrum Disorder. Vol. 42, International Review of Research in Developmental Disabilities. Elsevier; 2012. 179-214 p. [**doi**:10.1016/B978-0-12-394284-5.00007-3]
43. Ulrich DA. Test of Gross Motor Development - 2. 2nd ed. Sanford CB, editor. pro.ed. Austin, Texas; 2000. 60 p.
44. Bakhtiar S. Fundamental motor skill among 6-year-old children in Padang, West Sumatera, Indonesia. Asian Soc Sci. 2014;10(5):155-8. [**doi**:10.5539/ass.v10n5p155]
45. Clark JE, Whitall J. Motor development: A perspective on the past, the present, and the future. Kinesiol Rev. 2021;10(3):264-73. [**doi**:10.1123/kr.2021-0023]
46. Batubara BM. The Problems of the World of Education in the Middle of the Covid-19 Pandemic. 2020;450-7. [**doi**:10.33258/birci.v4i1.1626]
47. OECD. Combatting COVID- 19 ' s effect on children. Tackling Coronavirus Contrib to a Glob effort. 2020;(May):1-41.
48. Rodrigues HCN, Martins TFP, Santana NCF e. S, Braga CC, Silva MAC, Cunha LC da, et al. Antioxidant and anti-inflammatory response to curcumin supplementation in hemodialysis patients: A randomized, double-blind, placebo-controlled clinical trial. Clin Nutr ESPEN. 2021;44:136-42. [**doi**:10.1016/j.clnesp.2021.06.006] [**pmid**:34330457]
49. Nyström CD, Alexandrou C, Henström M, Nilsson E, Okely AD, El Masri SW, et al. International study of movement behaviors in the early years (Sunrise): Results from sunrise sweden's pilot and covid-19 study. Int J Environ Res Public Health. 2020;17(22):1-12. [**doi**:10.3390/ijerph17228491] [**pmid**:33207786]
50. Ayubi N, Komaini A. The Impact of the COVID-19 Pandemic on Children's Motor Skills (Literature Review). Int J Res Publ. 2021;90(1):19-24. [**doi**:10.47119/IJRP1009011220212517]
51. Jin X, Dong Y, Du W. The Impact of Family Factors on Children's Mental Health during Home Quarantine: An Empirical Study in Northwest China. Sustain. 2022;14(12). [**doi**:10.3390/su14127202]
52. Ghanamah R, Eghbaria-Ghanamah H. Impact of covid-19 pandemic on behavioral and emotional aspects and daily routines of Arab israeli children. Int J Environ Res Public Health. 2021;18(6):1-19. [**doi**:10.3390/ijerph18062946] [**pmid**:33805644]
53. Dos Santos GC, Queiroz J do N, Reischak-Oliveira Á, Rodrigues-Krause J. Effects of dancing on physical activity levels of children and adolescents: a systematic review. Complement Ther Med. 2021 Jan;56:102586. [**doi**:10.1016/j.ctim.2020.102586] [**pmid**:33197661]
54. Elnaggar RK, Alqahtani BA, Mahmoud WS, Elfakharany MS. Physical Activity in Adolescents During the Social Distancing Policies of the COVID-19 Pandemic. Asia-Pacific J Public Heal. 2020;32(8):491-4. [**doi**:10.1177/1010539520963564] [**pmid**:33016086]
55. Lemos AG, Avigo EL, Barela JA. Physical Education in Kindergarten Promotes Fundamental Motor Skill Development. Adv Phys Educ. 2012;02(01):17-21. [**doi**:10.4236/ape.2012.21003]