Jurnal Sport Science
Vol. 13, No. 2, 2023, 45–56
DOI: 10.17977/um057v13i2p45-56
ISSN: 2620-4681 (online), ISSN: 1907-5111 (print)

The influence of gross motor habits on the physical activity abilities of preschool students at Hudan Cendia kindergarten

Laras Putri Gamagitta*
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia
* Corresponding author, E-mail: Laras.putri.fik@um.ac.id, +6281907208257

Dona Sandy Yudasmara
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Anditri Weningtyas
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Dessy Amelia
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Sri Soenarti
Faculty of Medicine, Brawijaya University, Veteran Street No. 10-11, Malang, East Java, Indonesia

Sukma Nur Hanifah
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Rizal Dwi Prasetyo
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Wahyu Surya Prayoga
Faculty of Sport Science State University of Malang, Semarang Street No. 5, Malang, East Java, Indonesia

Abstract

Physical activity habits in children aged 3-5 are built based on motor skills intervention. Gross motor activity can increase the ability to move and involve children in physical activities outside the room. This needs to be known about surveillance of physical and gross motor activities of children aged 3-5 years. This study correlated physical activity and gross motor skills in students at Kindergarten Hudan Cendikia with 20 subjects in Kindergarten A. Data were obtained from filling out physical activity questionnaires using the Global Physical Activity Questionnaire (GPAQ) and gross motor skills tests using the Gross Motor Development Test-2 (TGMD-2) with the data analysis technique used is correlation analysis using SPSS and quantitative descriptive analysis. The results of this study were that there was no relationship between physical activity and gross motor skills in children aged 3-5 years with a significance value of 0.330 > 0.05, students at Kindergarten Hudan Cendikia had an average gross motor skill which was very good with moderate physical conditions, on student involvement in sedentary activities students have high average results.

Keywords: TGMD-2; physical activity; gross motor; preschool children; GPAQ.

Abstrak

Kebiasaan aktivitas fisik pada anak usia 3-5 tahun dibangun berdasarkan intervensi keterampilan motoriknya. Kegiatan motorik kasar dapat meningkat kemampuan gerak serta keterlibatan anak dalam melakukan aktivitas fisik diluar ruangan, hal tersebut perlu ditehui untuk mengetahui surveillance aktivitas fisik dan motorik kasar anak usia 3-5 tahun. Penelitian ini mengkorelasikan aktivitas fisik dan kemampuan motorik kasar pada siswa di TK Hudan Cendikia dengan 20 subjek kelas TK A. Data diperoleh dari pengisian kuesioner aktivitas fisik menggunakan Global Physical Activity Questionnaire (GPAQ) dan tes kemampuan motorik kasar menggunakan Test Gross Motor Development- 2 (TGMD-2) dengan teknik analisis data yang digunakan adalah analisis korelasi menggunakan SPSS dan analisis deskriptif kuantitatif. Hasil dari penelitian ini adalah tidak ada hubungan antara aktivitas fisik dengan kemampuan motorik kasar pada anak usia 3-5 tahun dengan nilai signifikasi 0.330 >0.05, siswa di TK Hudan Cendikia miliki rata-rata kemampuan motorik kasar yang sangat baik dengan kondisi fisik yang sedang, pada keterlibatan siswa dalam aktivitas sedentary siswa memiliki hasil rata-rata yang tinggi.

***Kata kunci**: TGMD-2; aktifitas fisik, motorik kasar; anak prasekolah; GPAQ.*

Development in the first 4 years of children is the same as the development that occurs in the next 14 years (Uce, 2017). Apart from that, this age is a sensitive period for children, where certain functions need to be stimulated and directed so that their development is not hampered (Indraswari, n.d.). However, field data recorded by WHO in 2016 recorded that 52.9 million children under 5 years old experienced developmental disorders, 95 percent of which occurred in low and middle-income countries (Inggriani et al., 2019), while in Indonesia it was recorded 7,512.6 per 100,000 population (7.51%) (WHO, 2018). In addition, obesity and overweight in children have become a problem that requires special attention from the public health community in recent years (Hamilton et al., 2018). In 2019, it was estimated that there were around 38.2 million children under the age of 5 who were overweight or obese in high-income countries, but now an increase in overweight and obesity is also occurring in low-income countries and the middle class, especially in urban areas (WHO, 2021). In Africa, the number of children under 5 years of age who are overweight has increased by almost 24% since 2000, and in 2019 in the Asian region, nearly half of children under 5 years of age are overweight and obese (WHO, 2021). The cause of obesity and overweight due to an increase in sedentary lifestyle and as a result of low physical activity in early childhood to adolescence (Brown et al., 2016; Lahuerta-Contell et al., 2021; Verloigne et al., 2012). Physical inactivity and sedentary behavior are risk factors for poorer mental health and a higher likelihood of physical inactivity in adulthood (De Craemer et al., 2012; De Decker et al., 2014).

WHO has recommended that children aged 3-5 years do at least 180 minutes of physical activity every day with 60 minutes of moderate to vigorous activity (*Physical Activity*, n.d.). However, data in China and Canada show that the physical activity level of preschool children is still relatively low (Chaput et al., 2017; Kippe & Lagestad, 2018; Lu et al., 2019). Ideally, physical activity should be promoted in preschool children because at that age it is much easier to establish healthy lifestyle intervention habits at an early age (Hodges et al., 2013). In preschool children, researchers have also seen many benefits from engaging in physical activity (Vazou et al., 2017). Physical maturation in children can be combined to expand cognitive development, expand brain function in the motor and premotor cortex and frontoparietal network to produce good working

memory (Ludyga et al., 2018, 2019). Recent research indicates that physical activity levels among preschool-aged children remain low. A longitudinal study conducted over five years found that physical activity (PA) in children aged two to six years increased by an average of 11% per year (Nyström et al., 2022).[review1][KH2] In 2021, a report from the Australian Institute of Health and Welfare revealed that over 8 in 10 (83%) of children aged 2–5 did not meet both the physical activity component and the screen-based activity component. Another study observed that preschoolers with higher basic motor skills competency were more likely to engage in higher amounts of vigorous-intensity physical activity and, to a lesser extent, moderate to vigorous-intensity activity (Webster et al., 2019).

The habit of physical activity is built based on the intervention of motor skills of preschoolers. One of the ways children's motor skills can be improved is by spending a lot of time outdoors (Barnett et al., 2019; Niemistö et al., 2019), however, over the years, children's outdoor activities have become less and less (Tremblay et al., 2015). In addition, there are 3 million toddlers experiencing motor development disorders, while in Indonesia as many as 16% of toddlers experience intelligence disorders due to brain, hearing, and motor development disorders (Maharani et al., 2018). Previous studies have proven that 88.23% of children aged 3-5 years experience gross motor delays (Hasanah & Ansori, 2014). The interconnectedness of motor skills and physical activity in preschool children means that it needs to be researched further regarding the absence of recommended physical activity guidelines in Indonesia. This investigation needs to focus on the potential for gross motor skills to strengthen the physical activity of preschool children in Indonesia. Focusing on this, this research aims to determine the relationship between children's gross motor skills and children's physical activity in the urban area of East Java, Indonesia[review3][KH4]. This research focuses on determining the relationship between children's gross motor skills and their physical activity in urban areas of East Java, Indonesia. The reason for conducting this research in East Java is due to previous studies indicating that the design of green spaces and playgrounds in urban areas can influence children's physical activity levels (El-Kholy, et al., 2022). Additionally, research has shown that children's physical activity can vary depending on where they live, learn, and play (Crouch, et al., 2023). The results of related data can be used as a reference to identify and increase children's movement activities in the home and school environment.

METHOD

The design of this study uses a correlational type with a quantitative descriptive approach. This research was carried out by identifying children's gross motor skills using the Gross Motor Development Test Second Edition (TGMD-2) which has two subtests, namely the locomotor subtest and the object control subtest (Ulrich & Sanford, 2000). The locomotor subtest includes run, gallop, hop, leap, horizontal jump, and slide movements. Object control subtests include two-hand strike, stationary bounce, catch, kick, overhand throw, and underhand roll (Palmer et al., 2021; Ulrich & Sanford, 2000). Meanwhile, children's daily physical activity was identified using the International Physical Activity Questionnaire (IPAQ) which was given to the child's parents and included high, moderate, low, and sedentary physical activity (Harikedua & Tando, 2012; Lee et al., 2011; Measures, 2002). The population in this study were preschool children aged 3-5 years living in Malang, East Java, Indonesia. The sampling technique used was purposive random sampling with the sample to be studied being 27 preschool children aged 3-5 years who were

located at Husan Cendikia Kindergarten. This research passed the ethical test Reg.No.:273/KEPK-POLKESMA/2021.

The first stage of data collection carried out in sampling was obtaining approval from the Hudan Cendikia Kindergarten which included permission from the child's parents to be willing to be included in research activities. Licensing from the Hudan Cendikia Kindergarten institution will later go through the management or personnel responsible for the Kindergarten. The next step after obtaining permission from the Hudan Cendikia Kindergarten is to conduct outreach to the children's parents regarding this research program which will be followed by filling out a consent form as a proof document for carrying out sampling. Meanwhile, the data analysis technique used is correlation analysis using SPSS and quantitative descriptive analysis.

RESULTS

Physical activity for students aged 3-5 years at Hudan Cendikia Kindergarten has results with an average of 2747 (medium). Physical activity for students is carried out using instruments from global physical activity which are filled in by the child's parents or guardians. In this case, the following data can be seen:

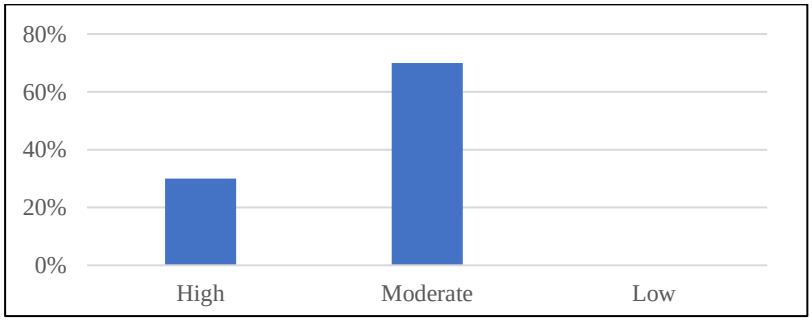

Figure 3.1 Physical Activity Results of Hudan Cendikia Kindergarten Students

Based on the results in Figure 3.1, 30% of students have a high level of physical activity and 70% of students are in the moderate category. The results of the physical activity of the students of Kindergarten Hudan Cendikia are included in the good category, but in this case, the results of sedentary activities have quite high results with an average student spending more than 3 hours doing sedentary activities, can be seen in the following table:

Table 3.1 Results of Physical Activity with Sedentary Activities of Hudan Cendikia Kindergarten Students

Physical Activity	Sedentary Activity	Total students (%)
Moderate	Low	20%
High	Low	5%
High	High	25%
Moderate	High	50%

The results of the questionnaire on physical activity and sedentary activity of students on average were at moderate levels of physical activity with high sedentary activities being carried out. On average, students do sedentary activities for more than 1 hour with average physical

activity in the moderate category. The results of students' gross motor skills had an average score of 69.7 (Very Superior). 90% of students are in the very superior category, 5% are in the below-average category, and 5% are in the poor category. These results can be seen in Figure 3.2

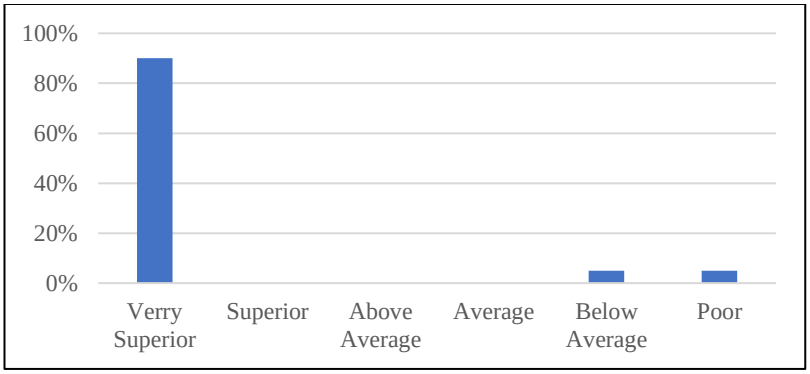

Figure 3.2 Results of Gross Motor Ability of Hudan Cendikia Kindergarten Students

Table 3.2 Physical Activity Results with Gross Motor Ability of Hudan Cendikia Kindergarten Students

Physical Activity	Gross Motor	Total students (%)
High	Very Superior	75%
Moderate	Very Superior	15%
High	Below Average	5%
Moderate	Poor	5%

On average, students have a moderate activity level with very good motor skills. In this case, the gross motor skills test results for students aged 3-5 years using the gross motor development-2 test instrument have a reliability value of 0.927 (reliable). For the validity results, the instrument used has valid results with a locomotor value of 0.999 and a control object of 0.970. These results can be concluded that the instruments used can be implemented in schools. On the results of gross motor skills and physical activity of children aged 3-5 years in Kindergarten Hudan Cendikia has good results, In this case, the relationship between physical activity and gross motor skills in students can be concluded as follows:

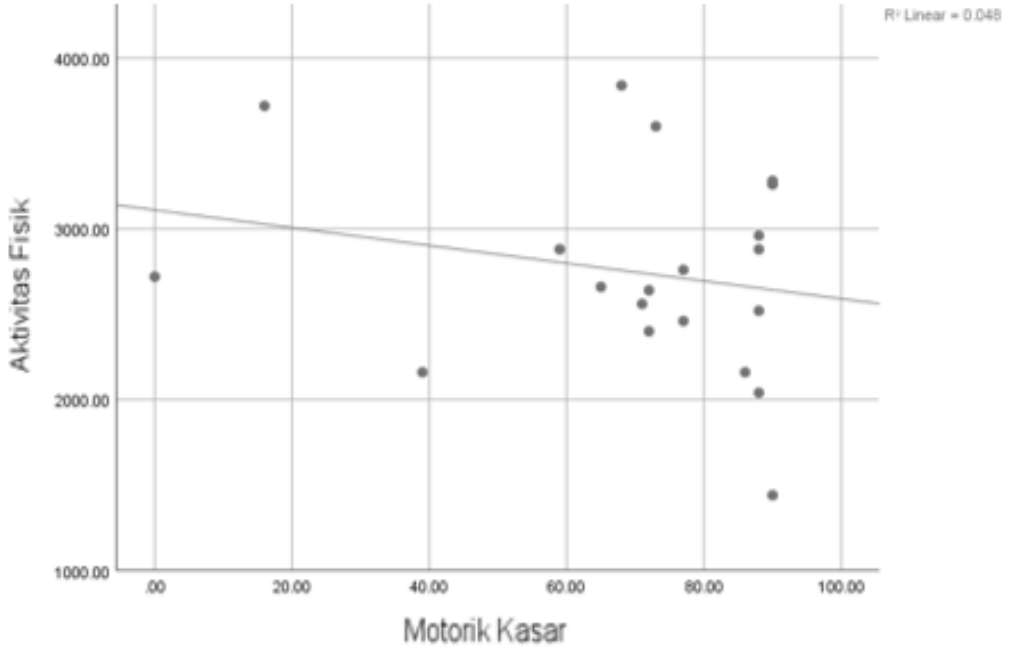

Figure 3.3 Graphic results of the correlation between physical activity and gross motor skills

Based on Figure 3.3, the results of the correlation graph between physical activity and gross motor skills above, it can be concluded that there is no relationship between gross motor skills and students' physical activity. If the line on the graph becomes more diagonal and sharper, then there is a correlation between physical activity and gross motor skills. Results with a significance value of 0.330 > 0.05, it can be concluded that students' physical activity and motor skills do not have a significant correlation so there is no relationship between the two variables.

Table 3.3 Correlation Results of Physical Activity with Gross Motor of Hudan Cendikia Kindergarten Students

SPSS Correlation Results		TGMD	GPAQ
TGMD	Pearson Correlation	1	-.230
	Sig. (2-tailed)		.330
	N	20	20
GPAQ	Pearson Correlation	-.230	1
	Sig. (2-tailed)	.330	
	N	20	20

DISCUSSION

Gross motor skills in students aged 3-5 years have very good results with moderate physical activity so the physical and motor conditions of Hudan Cendikia Kindergarten students have results that are by the recommendations for physical activity with medium-high intensity from the World Health Organization (WHO) (WHO, 2020). The low gross motor results in preschool

children using the TGMD-2 instrument which obtained locomotor movement results and control objects in preschool children (3-5 years) are included in the medium average category (Kit et al., 2017). Similar studies have also been conducted using the TGMD-2 instrument, the results show that most children fall into the average category (Malika et al., 2022). This research is consistent with previous research which found that the gross motor development of preschool children in most subjects was average in overall skill ratings (Aye et al., 2017). Children's gross motor skills are categorized as very good with a percentage of 71.44%, good category with a percentage of 9.52%, sufficient with a percentage of 4.76%, lacking with a percentage of age 4.76%, and very poor with a percentage of 9.52%. based on data analysis it can be interpreted that the gross motoric development of children is categorized as very good (Ricky Kurniawan et al., 2020). In this study, the results of students' motor skills were in good categories, but for some movement instruments, they were still lacking. In the observations and results of the TGMD-2 test on the hop or jump test instrument, horizontal jump or two-foot jump, two-hand strike or hit with a stick, stationary bounce or dribbling, overhand throw or throwing and underhand roll or rolling the ball have a level of difficulty. higher compared to other instruments. This happens in children aged 3-5 years because some TGMD-2 instruments are difficult to use for very young children (Kezić et al., 2020). Locomotor movements, which tend to be basic have their difficulties related to the movement process carried out by children. In the process of developing their movements, it is necessary to implement learning by doing movements that are carried out in a fun way (Calero-morales et al., 2023). Early childhood has neurobiological mechanisms based on different sexes, and the process of mental development has the same influence on cognitive processes (Fernández-Sánchez et al., 2022). In this case, gross motor development in early childhood is very important as a process of supporting child development.

The importance of gross motor skills for children aged 3-5 years needs to be a concern for PAUD educators to provide positive coaching from an early age so that children can develop gross motor skills. This can be achieved using traditional gaming strategies. In addition, improving gross motor skills can also be done by modifying those used, such as playing media, dividing groups of children, and playing so that playing time can be used as a means to develop gross motor skills in children (Titi Sutiarti S, 2020). A 24-week structured physical education program was used in the intervention group. An experiential program based on free play was used in a comparison group during the same period. Preschoolers in both groups experienced significant improvements in limb coordination compared to pre-and post-intervention. A statistically significant difference in postintervention measurements between the comparison and intervention groups in arm and leg coordination was observed, with the intervention group showing higher arm coordination scores ($F_{1,134} = 14{,}389$, $p = 0{,}000$, $\eta^2 = 0{,}097$) and higher limb coordination scores ($F_{1,134} = 19{,}281$, $p = 0{,}000$, $\eta^2 = 0{,}126$) compared to the comparison group (Ruiz-Esteban et al., 2020). So, in this case, the programs provided at children's educational institutions will greatly influence their habituation to physical activity and motor skills.

The level of physical activity of preschool children tends to be low (Tucker, 2008), only 23% of preschool children in the United States between the ages of 2 and 5 engage in 120 minutes of daily physical activity. Several studies show that preschool children spend at least 80%-85% of their time on sedentary activities (Sugiyama et al., 2012). In general, preschool children engage in high levels of sedentary activities and physical activity (Hnatiuk et al., 2014) in low quantities (Hnatiuk et al., 2014). Researchers have demonstrated the health benefits of physical activity

engagement among preschool children (Vazou et al., 2017). *The American Academy of Pediatrics recommends that young children spend no more than 1 hour each day engaged in screen time* (Hill et al., 2016) However, preschoolers accumulate about 4 hours of screen time every day (Tandon et al., 2011). Almost all preschoolers (99.4%) watch television; In addition, a third of young children play games on computers or electronic devices, and more than a quarter use the internet for activities other than playing games (Reilly et al., 2022). Many preschoolers have decreased physical activity behavior and screen activity increases as the child gets older. In terms of sedentary activity, this study has quite high results with an average of 3.5 hours per day. The results of this study showed that there was a gap between physical activity and students' sedentary activities, physical activity with moderate results had a high level of sedentary activity, so in this case, students' activities were still heavily involved in sedentary activities. But on gross motor skills, students have very good results. The habit of physical activity can be emphasized more in students by reducing sedentary activities, especially activities in front of the screen. In addition, a sedentary lifestyle can also pose risks to the body that can be observed from changes in body composition (Bernardi, et al., 2023). Body composition consists of fat tissue and non-fat tissue components (Budi, et al., 2023). A sedentary lifestyle can pose a risk of obesity (Raya-Cano, et al., 2023). Future research can examine more deeply related to physical activity with sedentary activities in children which are carried out on a larger number of subjects in different areas.

CONCLUSIONS

The results of gross motor skills for students aged 3-5 years at Hudan Cendikia Kindergarten have an average category of very good with moderate physical activity. The physical activity of students who are classified as good has high involvement in sedentary activities, so in this case, the student's physical condition has no relationship with their sedentary activities. In these conditions, students' motor skills also had very good results with a score of 90%. The results of the relationship between physical activity and students' motor skills in this study did not have significant results with the result being that there was no relationship between these two variables. The level of physical activity with sedentary activities also does not have a significant relationship with a significance value of 0.801>0.05 so in this case there is no relationship between students' daily physical activities and students' gross motor skills, as well as with sedentary activities[review5][KH6]. These findings provide new insights that the level of physical or sedentary activities does not necessarily directly impact students' gross motor skills. The implication is that alternative approaches may be needed to enhance students' gross motor skills, and further research is required to explore other potential contributing factors. This research requires deeper justification related to physical activity which can be seen using tools so that valid results can be obtained.

REFERENCES[review7][KH8]

Aye, T., Oo, K. S., Khin, M. T., Kuramoto-Ahuja, T., & Maruyama, H. (2017). Gross motor skill development of 5-year-old Kindergarten children in Myanmar. *Journal of Physical Therapy Science*, 29(10), 1772–1778. https://doi.org/10.1589/jpts.29.1772

Barnett, L. M., Hnatiuk, J. A., Salmon, J., & Hesketh, K. D. (2019). Modifiable factors which predict children's gross motor competence: a prospective cohort study. *International*

Journal of Behavioral Nutrition and Physical Activity, 16(1). https://doi.org/10.1186/s12966-019-0888-0

Bernardi, F. A., Alves, D., Crepaldi, N., Yamada, D. B., Lima, V. C., & Rijo, R. (2023). Data Quality in Health Research: Integrative Literature Review. Journal of Medical Internet Research, 25. http://doi.org/10.2196/41446

Budi, R., Hamisah, H., & Irianto, I. (2023). Gambaran indeks massa tubuh (IMT), persentase lemak tubuh dan massa otot menggunakan karada scan pada pemain sepak bola di Kota Makassar. Jurnal Sport Science, 13(1), 30-44. http://doi.org/10.17977/um057v13i1p30-44

Brown, E. C., Buchan, D. S., Cavana, J., Baker, J. S., Wyatt, F. B., & Kilgore, J. L. (2016). Fit for school: results of a 10-week school-based child healthy weight pilot intervention for primary school students. *International Journal of Health Promotion and Education*, 54(5), 229–244. https://doi.org/10.1080/14635240.2016.1157511

Calero-morales, S., Vinueza-burgos, G. C., Yance-carvajal, C. L., & Paguay-balladares, W. J. (2023). *Gross Motor Development in Preschoolers through Activities : Comparative Research*

Chaput, J.-P., Colley, R. C., Aubert, S., Carson, V., Janssen, I., Roberts, K. C., & Tremblay, M. S. (2017). Proportion of preschool-aged children meeting the Canadian 24-Hour Movement Guidelines and associations with adiposity: results from the Canadian Health Measures Survey. *BMC Public Health*, 17(S5). https://doi.org/10.1186/s12889-017-4854-y

Crouch, E., Abshire, D. A., Wirth, M. D., Hung, P., & Benavidez, G. A. (2023). Rural–Urban Differences in Overweight and Obesity, Physical Activity, and Food Security Among Children and Adolescents. Prev Chronic Dis 2023;20:230136. DOI: http://dx.doi.org/10.5888/pcd20.230136

De Craemer, M., De Decker, E., De Bourdeaudhuij, I., Vereecken, C., Deforche, B., Manios, Y., & Cardon, G. (2012). Correlates of energy balance-related behaviours in preschool children: a systematic review. *Obesity Reviews*, *13*, 13–28. https://doi.org/10.1111/j.1467-789X.2011.00941.x

De Decker, E., De Craemer, M., De Bourdeaudhuij, I., Verbestel, V., Duvinage, K., Iotova, V., Grammatikaki, E., Wildgruber, A., Mouratidou, T., Manios, Y., & Cardon, G. (2014). Using the intervention mapping protocol to reduce European preschoolers' sedentary behavior, an application to the ToyBox-Study. *International Journal of Behavioral Nutrition and Physical Activity*, *11*(1). https://doi.org/10.1186/1479-5868-11-19

El-Kholy, S. A., Moustafa, Y. M., & Abou El-Ela, M. A. S. (2022). Urban park design and children's physical activity levels: an investigation of design characteristics of green areas and playgrounds. Journal of Engineering and Applied Science, 69. https://doi.org/10.1186/s44147-022-00152-x

Fernández-Sánchez, A., Redondo-Tébar, A., Sánchez-López, M., Visier-Alfonso, M. E., Muñoz-Rodríguez, J. R., & Martínez-Vizcaíno, V. (2022). Sex differences on the relation among gross motor competence, cognition, and academic achievement in children. *Scandinavian Journal of Psychology*, *63*(5), 504–512. https://doi.org/10.1111/sjop.12827

Hamilton, D., Dee, A., & Perry, I. J. (2018). The lifetime costs of overweight and obesity in childhood and adolescence: a systematic review. *Obesity Reviews*, *19*(4), 452–463. https://doi.org/10.1111/obr.12649

Harikedua, V. T., & Tando, N. M. (2012). Aktivitas Fisik dan Pola Makan dengan Obesitas Sentral pada Tokoh Agama di kota Manado. *Gizido*, *4*(1), 289–298.

Hasanah, N., & Ansori, M. N. (2014). Hubungan Tingkat Pengetahuan Ibu Dengan Perkembangan Motorik Kasar Anak Usia (3-5 Tahun). *JURNAL KEBIDANAN*, *6*(2), 7. https://doi.org/10.30736/midpro.v6i2.42

Hill, D., Ameenuddin, N., Chassiakos, Y. R., Cross, C., Radesky, J., Hutchinson, J., Boyd, R., Mendelson, R., Moreno, M. A., Smith, J., & Swanson, W. S. (2016). Media and young minds. *Pediatrics*, *138*(5). https://doi.org/10.1542/peds.2016-2591

Hnatiuk, J. A., Salmon, J., Hinkley, T., Okely, A. D., & Trost, S. (2014). A review of preschool children's physical activity and sedentary time using objective measures. *American Journal of Preventive Medicine*, *47*(4), 487–497. https://doi.org/10.1016/j.amepre.2014.05.042

Hodges, E. A., Smith, C., Tidwell, S., & Berry, D. (2013). Promoting Physical Activity in Preschoolers to Prevent Obesity: A Review of the Literature. *Journal of Pediatric Nursing*, *28*(1), 3–19. https://doi.org/10.1016/j.pedn.2012.01.002

Indraswari, L. (n.d.). *Peningkatan Perkembangan Motorik Halus Anak Usia Dini Melalaui Kegiatan Mozaik Di Taman Kanak-Kanak Pembina Agam*. *2*.

Inggriani, D. M., Rinjani, M., & Susanti, R. (2019). Deteksi Dini Tumbuh Kembang Anak Usia 0-6 Tahun Berbasis Aplikasi Android. *Wellness And Healthy Magazine*, *1*(1), 115–124.

Kezić, A. N. A., Šimunović, I., & Kalinski, S. D. (2020). Application of the TGMD-2 test in early school-age children for determining the level of fundamental movement skills in different sports. *Journal of Physical Education and Sport*, *20*(2), 635–639. https://doi.org/10.7752/jpes.2020.02093

Kippe, K. O., & Lagestad, P. A. (2018). Kindergarten: Producer or Reducer of Inequality Regarding Physical Activity Levels of Preschool Children. *Frontiers in Public Health*, *6*. https://doi.org/10.3389/fpubh.2018.00361

Kit, B. K., Akinbami, L. J., Isfahani, N. S., & Ulrich, D. A. (2017). Gross Motor Development in Children Aged 3–5 Years, United States 2012. *Maternal and Child Health Journal*, *21*(7), 1573–1580. https://doi.org/10.1007/s10995-017-2289-9

Lahuerta-Contell, S., Molina-García, J., Queralt, A., & Martínez-Bello, V. E. (2021). The Role of Preschool Hours in Achieving Physical Activity Recommendations for Preschoolers. *Children*, *8*(2), 82. https://doi.org/10.3390/children8020082

Lee, P. H., Macfarlane, D. J., Lam, T., & Stewart, S. M. (2011). Validity of the international physical activity questionnaire short form. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(115), 1–11.

Lu, C., Wiersma, R., Shen, T., Huang, G., & Corpeleijn, E. (2019). Physical activity patterns by objective measurements in preschoolers from China. *Child and Adolescent Obesity*, *2*(1), 1–17. https://doi.org/10.1080/2574254X.2019.1585178

Ludyga, S., Gerber, M., Brand, S., Pühse, U., & Colledge, F. (2018). Effects of Aerobic Exercise on Cognitive Performance Among Young Adults in a Higher Education Setting. *Research Quarterly for Exercise and Sport*, *89*(2), 164–172. https://doi.org/10.1080/02701367.2018.1438575

Ludyga, S., Koutsandréou, F., Reuter, E.-M., Voelcker-Rehage, C., & Budde, H. (2019). A Randomized Controlled Trial on the Effects of Aerobic and Coordinative Training on Neural Correlates of Inhibitory Control in Children. *Journal of Clinical Medicine*, *8*(2), 184. https://doi.org/10.3390/jcm8020184

Maharani, Ayu, S., & Setiawan, I. (2018). *Hubungan Pemberian Asi Eksklusif, Jenis Kelamin Dan Status Gizi Terhadap Perkembangan Motorik Kasar Pada Anak Usia 3-5 Tahun Di Kelurahan Makam Haji - UMS ETD-db*.

Malika, L. D., Hariadi, I., Fadhli, N. R., & Roesdiyanto, R. (2022). Keterampilan Motorik Kasar Anak Usia Prasekolah di TK Muslimat NU Dewi Masithoh 01 Kalipare Kabupaten Malang. *Sport Science and Health*, *4*(11), 964–979. https://doi.org/10.17977/um062v4i112022p964-979

Measures, E. (2002). Evaluation Measures International Physical Activity Questionnaire-Short Form. *Evaluation Measures*. https://doi.org/10.2165/11531930-000000000

Niemistö, D., Finni, T., Haapala, E., Cantell, M., Korhonen, E., & Sääkslahti, A. (2019). Environmental Correlates of Motor Competence in Children—The Skilled Kids Study. *International Journal of Environmental Research and Public Health*, *16*(11), 1989. https://doi.org/10.3390/ijerph16111989

Nyström, C. D., Alexandrou, C., Henström, M., Nilsson, E., Okely, A. D., Elinder, L. S., & Löf, M. (2022). Physical activity in early childhood: a five-year longitudinal analysis of patterns and correlates. International Journal of Behavioral Nutrition and Physical Activity, 19(1). https://doi.org/10.1186/s12966-022-01289-x

Palmer, K. K., Chinn, K. M., Scott-Andrews, K. Q., & Robinson, L. E. (2021). An Intervention-Related Comparison of Preschoolers' Scores on the TGMD-2 and TGMD-3. *Perceptual and Motor Skills*, *128*(4), 1354–1372. https://doi.org/10.1177/00315125211013217

Physical activity. (n.d.).

Raya-Cano, E., Molina-Luque, R., Vaquero-Abellán, M., Molina-Recio, G., Rocío Jiménez-Mérida, & Romero-Saldaña, M. (2023). Metabolic syndrome and transaminases: systematic review and meta-analysis. Diabetology & Metabolic Syndrome, 15(1). https://doi.org/10.1186/s13098-023-01200-z

Reilly, J. J., Barnes, J., Gonzalez, S., Huang, W. Y., Manyanga, T., Tanaka, C., & Tremblay, M. S. (2022). Recent Secular Trends in Child and Adolescent Physical Activity and Sedentary Behavior Internationally: Analyses of Active Healthy Kids Global Alliance Global Matrices 1.0 to 4.0. *Journal of Physical Activity and Health*, *19*(11), 729–736. https://doi.org/10.1123/jpah.2022-0312

Ricky Kurniawan, A. P., Junaidi, S., Setya Subiyono, H., & S, S. H. (2020). Health and Recreations Jour-nal of Physical Education, Sport, Health and Recreation. *Journal of Physical Education, Sport*, *9*(1), 58–62. http://journal.unnes.ac.id/sju/index.php/peshr

Ruiz-Esteban, C., Terry Andrés, J., Méndez, I., & Morales, Á. (2020). Analysis of Motor Intervention Program on the Development of Gross Motor Skills in Preschoolers. *International Journal of Environmental Research and Public Health*, *17*(13), 4891. https://doi.org/10.3390/ijerph17134891

Sugiyama, T., Okely, A. D., Masters, J. M., & Moore, G. T. (2012). Attributes of child care centers and outdoor play areas associated with preschoolers' physical activity and sedentary behavior. *Environment and Behavior*, *44*(3), 334–349. https://doi.org/10.1177/0013916510393276

Tandon, P. S., Zhou, C., Lozano, P., & Christakis, D. A. (2011). Preschoolers' total daily screen time at home and by type of child care. *Journal of Pediatrics*, *158*(2), 297–300. https://doi.org/10.1016/j.jpeds.2010.08.005

Titi Sutiarti S, M. N. (2020). Aplikasi Gerak Lokomotor Sebagai Media Untuk Meningkatkan Kemampuan Motorik Kasar Pada Kelompok B1. *Jurnal Ilmiah Potensia*, *5*(1), 1. https://ejournal.unib.ac.id/index.php/potensia/article/view/8188

Tremblay, M., Gray, C., Babcock, S., Barnes, J., Bradstreet, C., Carr, D., Chabot, G., Choquette, L., Chorney, D., Collyer, C., Herrington, S., Janson, K., Janssen, I., Larouche, R., Pickett,

W., Power, M., Sandseter, E., Simon, B., & Brussoni, M. (2015). Position Statement on Active Outdoor Play. *International Journal of Environmental Research and Public Health*, *12*(6), 6475–6505. https://doi.org/10.3390/ijerph120606475

Tucker, P. (2008). The physical activity levels of preschool-aged children: A systematic review. *Early Childhood Research Quarterly*, *23*(4), 547–558. https://doi.org/10.1016/j.ecresq.2008.08.005

Uce, L. (2017). The golden age: Masa efektif merancang kualitas anak. *Jurnal.Ar-Raniry.Ac.Id*.

Ulrich, D., & Sanford, C. (2000). Test of gross motor development: Examiner's manual. In *Research quarterly for exercise and sport* (Vol. 71, Issue 2 Suppl, pp. S59-73).

Vazou, S., Mantis, C., Luze, G., & Krogh, J. S. (2017). Self-perceptions and social–emotional classroom engagement following structured physical activity among preschoolers: A feasibility study. *Journal of Sport and Health Science*, *6*(2), 241–247. https://doi.org/10.1016/j.jshs.2016.01.006

Verloigne, M., Van Lippevelde, W., Maes, L., Yildirim, M., Chinapaw, M., Manios, Y., Androutsos, O., Kovacs, E., Bringolf-Isler, B., Brug, J., & De Bourdeaudhuij, I. (2012). Levels of physical activity and sedentary time among 10- to 12-year-old boys and girls across 5 European countries using accelerometers: an observational study within the ENERGY-project. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 34. https://doi.org/10.1186/1479-5868-9-34

Webster, E. K., Martin, C. K., & Staiano, A. E. (2019). Fundamental motor skills, screen-time, and physical activity in preschoolers. *Journal of Sport and Health Science*, *8*(2), 114–121. https://doi.org/10.1016/j.jshs.2018.11.006

WHO. (2018). *World Health Statistics 2018-Monitoring Health For The SDGs*.

WHO. (2020). WHO Guidelines on physical activity, sedentary behaviour. *World Health Organization*, 4.

WHO. (2021). *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight