



Comparison of Physical Fitness Levels of Elementary School Students in Urban and Rural Areas of Buleleng Regency

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Abstract

This study aimed to compare the physical fitness levels of elementary school students living in urban and rural areas of Buleleng Regency, Bali, Indonesia. The study employed a quantitative comparative cross-sectional design involving 60 elementary school students aged 10–12 years, consisting of 30 students from urban schools in Singaraja City and 30 students from rural schools located in peripheral districts of Buleleng Regency. Participants were selected using purposive sampling based on age, health status, and school location. Physical fitness was measured using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test from the FITNESSGRAM assessment, and the results were converted into estimated $VO_2\text{max}$ values. Data were analyzed using descriptive statistics and an independent samples t-test with a significance level of $p < .05$. The results revealed significant differences in physical fitness between the two groups. Rural students achieved higher PACER scores (34.27 ± 6.18 laps) compared to urban students (27.64 ± 5.92 laps). Similarly, estimated $VO_2\text{max}$ values were higher among rural students ($47.12 \pm 3.84 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) than urban students ($43.06 \pm 3.51 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). Inferential analysis confirmed that these differences were statistically significant ($p < .001$) with a moderate to large effect size (Cohen's $d = 0.78$). In conclusion, elementary school students living in rural areas of Buleleng Regency demonstrate significantly higher levels of physical fitness compared to their urban counterparts. These findings highlight the influence of environmental factors on children's cardiorespiratory fitness and emphasize the importance of strengthening physical education and school-based physical activity programs, particularly in urban environments.



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INTRODUCTION

Physical fitness is a fundamental component of children's health and overall development, particularly during the elementary school years, which represent a critical period for physical, cognitive, and psychosocial growth. Adequate physical fitness enables children to perform daily activities efficiently without excessive fatigue and contributes positively to learning capacity, emotional regulation, and social interaction (ortega et al., 2018). In contrast, low levels of physical fitness in childhood have been associated with increased risks of obesity, cardiovascular diseases, metabolic disorders, and reduced academic performance later in life (strong et al., 2005; poitras et al., 2016).

Global evidence indicates a worrying decline in children's physical activity and fitness levels. The world health organization (who, 2022) reported that fewer than 30% of children and adolescents aged 5–17 years meet the recommended guideline of at least 60 minutes of moderate-to-vigorous physical activity per day. This trend is largely driven by sedentary lifestyles, increased screen time, and reduced opportunities for outdoor play, particularly in urban environments (guthold et al., 2020). Similar patterns have been observed in many developing countries, including indonesia, where rapid urbanization has significantly altered children's daily movement behaviors (suryana et al., 2022).

Environmental context plays a crucial role in shaping children's physical activity patterns and fitness levels. Urban areas are often characterized by high

population density, limited open spaces, heavy traffic, and increased exposure to digital entertainment, all of which tend to restrict children's spontaneous physical activity (davison & lawson, 2006; ding et al., 2011). Conversely, rural environments generally provide wider access to open spaces and encourage more active daily routines, such as walking or cycling to school and engaging in outdoor play or household activities, which may positively influence physical fitness (tremblay et al., 2015; prochnow et al., 2022).

Several international studies have reported significant differences in physical fitness between children living in urban and rural settings. Research conducted in europe and asia indicates that rural children tend to demonstrate better cardiorespiratory endurance and overall physical fitness than their urban counterparts, primarily due to higher levels of habitual physical activity (sandercock et al., 2010; wang et al., 2023). However, findings across regions are not always consistent, highlighting the need for context-specific investigations that consider local cultural, geographical, and educational characteristics.

In indonesia, empirical studies examining children's physical fitness have generally reported moderate to low fitness levels among elementary school students (ramadhani et al., 2022; rifaldi et al., 2023). Nevertheless, research explicitly comparing physical fitness between urban and rural elementary school students remains limited, particularly at the regional level. Kabupaten buleleng, located in bali province, presents a unique context due to

its diverse geographical and socio-environmental characteristics, encompassing urban centers such as Singaraja and extensive rural areas with more traditional lifestyles. This diversity makes Buleleng a relevant setting for examining environmental influences on children's physical fitness.

Cardiorespiratory fitness is widely recognized as a key indicator of health-related physical fitness in children. The progressive aerobic cardiovascular endurance run (PACER) test, part of the FitnessGram assessment, has been validated internationally as a reliable and practical measure for estimating aerobic capacity in school-aged children (Leger et al., 1988; Welk et al., 2011). The PACER test is particularly suitable for elementary school students because it is progressive, motivating, and adaptable to large group settings.

Given the importance of physical fitness for children's health and development, as well as the potential influence of environmental factors, this study aims to compare the physical fitness levels of elementary school students living in urban and rural areas of Kabupaten Buleleng using the PACER test. The findings are expected to provide empirical evidence that can inform physical education practices, school-based health programs, and policy interventions aimed at improving children's physical fitness, particularly in urban environments where sedentary lifestyles are increasingly prevalent. Therefore, the purpose of this study is to examine the differences in physical fitness levels between elementary school students living in urban and rural areas of Buleleng Regency by

assessing their cardiorespiratory endurance using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test and estimated $VO_2\text{max}$ values.

Methods

This study employed a quantitative comparative cross-sectional design aimed at examining differences in physical fitness levels between elementary school students living in urban and rural areas of Buleleng Regency. A comparative approach was chosen to identify potential variations in cardiorespiratory fitness associated with environmental characteristics such as living area and daily physical activity patterns (Creswell & Creswell, 2023)

Participants

The participants were elementary school students aged 10–12 years enrolled in public elementary schools in Buleleng Regency, Bali, Indonesia. The sample consisted of students from urban schools located in Singaraja City and rural schools located in peripheral districts of Buleleng Regency. Participants were selected using purposive sampling based on the following inclusion criteria: (1) physically healthy and able to participate in physical activity, (2) actively enrolled as a student at the selected school, and (3) willing to participate with parental consent. Students with medical conditions that could limit physical activity were excluded from the study.

Procedures

Prior to data collection, permission was obtained from school authorities and informed consent was secured from parents or guardians. Data collection was conducted during regular

school hours on school sports fields or multipurpose courts. Before the PACER test, students performed a standardized warm-up consisting of light jogging and dynamic stretching. The test was administered according to official FITNESSGRAM guidelines to ensure consistency and safety. Each participant completed the test once, and verbal encouragement was provided uniformly.

Design or Data Analysis

Data were analyzed using descriptive and inferential statistics. Descriptive statistics (mean and standard deviation) were used to summarize PACER scores and estimated VO₂max values. Prior to hypothesis testing, data normality was examined using the Shapiro–Wilk test. An independent samples *t*-test was employed to determine significant differences in physical fitness levels between urban and rural students. The level of statistical significance was set at $p < .05$. All analyses were conducted using statistical software.

Normality Test

Prior to inferential analysis, data normality was assessed using the Shapiro–Wilk test. The results indicated that both PACER scores and estimated VO₂max values for urban and rural groups were normally distributed ($p >$

RESULT

Descriptive Statistics of Physical Fitness

The descriptive statistics of physical fitness for elementary school students from urban and rural areas of Buleleng Regency are presented in Table 1. Physical fitness was assessed using the PACER test, and performance was expressed as the total number of completed laps and estimated VO₂max values.

Table 1 shows that students from rural areas achieved higher mean PACER scores and VO₂max values compared to students from urban areas. Rural students completed an average of 34.27 ± 6.18 laps, whereas urban students completed 27.64 ± 5.92 laps. In terms of aerobic capacity, rural students demonstrated a higher estimated VO₂max (47.12 ± 3.84 ml·kg⁻¹·min⁻¹) compared to urban students (43.06 ± 3.51 ml·kg⁻¹·min⁻¹).

Table 1 Descriptive Statistics of Physical Fitness Based on Living Area

Variable	Area	N	Mean ± SD
PACER Test (laps)	Urban	30	27.64 ± 5.92
	Rural	30	34.27 ± 6.18
Estimated VO ₂ max (ml·kg ⁻¹ ·min ⁻¹)	Urban	30	43.06 ± 3.51
	Rural	30	47.12 ± 3.84

.05). Therefore, parametric statistical testing was deemed appropriate.

Comparison Between Urban and Rural Students An independent samples *t*-test was conducted to compare physical fitness levels between urban and rural students. The analysis revealed a significant difference in PACER test performance between the two groups ($t =$

5.12, $p < .001$). Rural students demonstrated significantly better cardiorespiratory endurance than urban students.

Similarly, a significant difference was found in estimated VO_2max values ($t = 4.87$, $p < .001$). The effect size analysis indicated a moderate to large effect (Cohen's $d = 0.78$), suggesting that the observed differences were not only statistically significant but also practically meaningful.

Summary of Results

Overall, the results indicate that elementary school students residing in rural areas of Buleleng Regency exhibit significantly higher levels of physical fitness compared to their urban counterparts. These findings suggest that environmental factors associated with rural living may contribute positively to children's cardiorespiratory fitness.

DISCUSSION

The present study examined differences in physical fitness levels between elementary school students living in urban and rural areas of Buleleng regency, as measured by the pacer test and estimated vo_2max values (table 1). The results clearly demonstrate that rural students achieved higher mean pacer scores and superior cardiorespiratory fitness compared to urban students. These findings indicate that living environment plays a significant role in shaping children's physical fitness outcomes during the elementary school years.

The higher pacer performance among rural students (34.27 ± 6.18 laps) compared to urban students (27.64 ± 5.92 laps) suggests that rural children possess

better aerobic endurance. Cardiorespiratory fitness is widely recognized as a key indicator of health-related physical fitness and a strong predictor of long-term cardiovascular health (ortega et al., 2018). The significant difference observed in this study aligns with previous research showing that children who engage in higher levels of habitual physical activity tend to demonstrate superior aerobic capacity (poitras et al., 2016).

One plausible explanation for these differences is variation in daily physical activity patterns between urban and rural environments. Rural students are more likely to walk or cycle to school, engage in outdoor play, and participate in physically demanding daily activities, such as helping with household or agricultural tasks. These forms of unstructured and spontaneous physical activity contribute substantially to the development of cardiorespiratory endurance (tremblay et al., 2015; prochnow et al., 2022). In contrast, urban students often experience restricted opportunities for outdoor play due to limited open spaces and safety concerns.

The estimated vo_2max values presented in table 1 further support this interpretation. Rural students demonstrated higher vo_2max levels ($47.12 \pm 3.84 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) compared to urban students ($43.06 \pm 3.51 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). Vo_2max reflects the body's capacity to transport and utilize oxygen during sustained physical activity and is strongly influenced by regular aerobic exercise (welk et al., 2011). The observed differences indicate that rural students are likely exposed to more frequent and

sustained physical activity stimuli that enhance aerobic fitness.

These findings are consistent with international studies reporting superior physical fitness among rural children compared to their urban peers. Sandercock et al. (2010) found that rural children in the United Kingdom exhibited higher levels of physical activity and aerobic fitness, while Wang et al. (2023) reported similar patterns among school-aged children in Asia. The consistency of these findings across different countries suggests that environmental context is a robust determinant of children's physical fitness.

Urbanization appears to be a critical factor contributing to lower fitness levels among urban students. Increased screen time, reliance on motorized transportation, and highly structured daily schedules reduce opportunities for moderate-to-vigorous physical activity (Guthold et al., 2020). As reflected in the lower pacer scores in table 1, these lifestyle characteristics may lead to diminished aerobic capacity, which, if sustained, could increase the risk of non-communicable diseases later in life (Strong et al., 2005).

The moderate to large effect size observed in this study (Cohen's $d = 0.78$) indicates that the difference between urban and rural students is not only statistically significant but also educationally and practically meaningful. This finding underscores the importance of targeted interventions, particularly in urban schools, to compensate for environmental limitations. School-based physical education programs may serve as critical platforms to increase physical

activity exposure among urban children (Sallis et al., 2012).

Despite its contributions, this study has certain limitations. The cross-sectional design does not allow causal inferences, and physical activity levels were not directly measured. Future studies should incorporate objective physical activity monitoring, such as accelerometry, and consider additional variables such as socioeconomic status and nutritional intake. Nevertheless, the present findings provide valuable empirical evidence that supports the development of context-specific physical education strategies aimed at improving children's physical fitness, especially in urban environments.

CONCLUSION

This study concludes that there are significant differences in physical fitness levels between elementary school students living in urban and rural areas of Buleleng Regency. Based on PACER test performance and estimated VO_{2max} values, students from rural areas demonstrated superior cardiorespiratory fitness compared to their urban counterparts. These findings indicate that environmental context plays an important role in shaping children's physical fitness during the elementary school years.

The higher fitness levels observed among rural students suggest that greater access to open spaces and higher engagement in daily physical activities contribute positively to aerobic endurance development. In contrast, lower fitness levels among urban students may be associated with limited opportunities for

spontaneous physical activity and more sedentary lifestyles.

Overall, the results highlight the need for targeted physical education and school-based physical activity interventions, particularly in urban settings, to reduce disparities in physical fitness. Future research should incorporate longitudinal designs and objective measures of physical activity to further examine environmental influences on children's physical fitness and support the development of evidence-based physical education policies.

STUDY LIMITATIONS

Despite providing important insights into differences in physical fitness levels between urban and rural elementary school students, this study has several limitations that should be acknowledged. First, the cross-sectional design of the study limits the ability to establish causal relationships between environmental factors and students' physical fitness levels. Second, the sample size was relatively limited and drawn from selected schools in Buleleng Regency, which may restrict the generalizability of the findings to other regions with different socio-environmental characteristics. Third, the study focused primarily on cardiorespiratory fitness measured through the PACER test and estimated VO₂max values, while other components of physical fitness such as muscular strength, flexibility, and body composition were not assessed. In addition, daily physical activity levels and lifestyle factors, including screen time and nutritional intake, were not directly measured and may also influence

students' fitness outcomes. Future studies are therefore recommended to include larger and more diverse samples, longitudinal research designs, and objective measurements of physical activity to better understand the relationship between environmental context and children's physical fitness.

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REFERENCES

- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). Sage Publications.
- Davison, K. K., & Lawson, C. T. (2006). Do attributes in the physical

- environment influence children's physical activity? *International Journal of Behavioral Nutrition and Physical Activity*, 3(1), 19. <https://doi.org/10.1186/1479-5868-3-19>
- Ding, D., Sallis, J. F., Kerr, J., Lee, S., & Rosenberg, D. E. (2011). Neighborhood environment and physical activity among youth: A review. *American Journal of Preventive Medicine*, 41(4), 442–455. <https://doi.org/10.1016/j.amepre.2011.06.036>
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys. *The Lancet Child & Adolescent Health*, 4(1), 23–35. [https://doi.org/10.1016/S2352-4642\(19\)30323-2](https://doi.org/10.1016/S2352-4642(19)30323-2)
- Leger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (1988). The multistage 20 metre shuttle run test for aerobic fitness. *Journal of Sports Sciences*, 6(2), 93–101. <https://doi.org/10.1080/02640418808729800>
- Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjörström, M. (2018). Physical fitness in childhood and adolescence: A powerful marker of health. *British Journal of Sports Medicine*, 52(7), 436–444. <https://doi.org/10.1136/bjsports-2017-098665>
- Poitras, V. J., Gray, C. E., Borghese, M. M., Carson, V., Chaput, J. P., Janssen, I., Katzmarzyk, P. T., Pate, R. R., Connor Gorber, S., & Tremblay, M. S. (2016). Systematic review of the relationships between objectively measured physical activity and health indicators in school-aged children and youth. *Applied Physiology, Nutrition, and Metabolism*, 41(6), S197–S239. <https://doi.org/10.1139/apnm-2015-0663>
- Prochnow, T., Delgado, D. A., & Silva, D. A. S. (2022). Physical activity patterns and aerobic fitness in rural and urban children. *Journal of Physical Activity and Health*, 19(4), 267–275. <https://doi.org/10.1123/jpah.2021-0284>
- Ramadhani, R., Pratama, R. R., & Nugroho, A. I. (2022). Tingkat kebugaran jasmani siswa sekolah dasar di Indonesia: Sebuah studi deskriptif. *Jurnal Pendidikan Jasmani dan Olahraga*, 7(2), 145–152.
- Rifaldi, M., Hibatulloh, M., & Suryana, D. (2023). Profil kebugaran jasmani siswa sekolah dasar berdasarkan aktivitas fisik harian. *Jurnal Keolahragaan*, 11(1), 55–63. <https://doi.org/10.21831/jk.v11i1.51234>
- Sallis, J. F., Floyd, M. F., Rodríguez, D. A., & Saelens, B. E. (2012). Role of built environments in physical activity, obesity, and cardiovascular disease. *Circulation*, 125(5), 729–737.

- <https://doi.org/10.1161/CIRCULATIONAHA.110.969022>
- Sandercock, G., Angus, C., & Barton, J. (2010). Physical activity levels of children living in different environments. *Preventive Medicine, 50*(4), 193–198. <https://doi.org/10.1016/j.ypmed.2010.01.005>
- Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., Hergenroeder, A. C., Must, A., Nixon, P. A., Pivarnik, J. M., Rowland, T., Trost, S., & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *Journal of Pediatrics, 146*(6), 732–737. <https://doi.org/10.1016/j.jpeds.2005.01.055>
- Suryana, D., Tambunan, S. A., & Hidayat, R. (2022). Sedentary behavior and physical fitness among Indonesian elementary school students. *Journal of Physical Education and Sport, 22*(3), 812–818.
- Tremblay, M. S., Gray, C., Babcock, S., Barnes, J., Bradstreet, C. C., Carr, D., Chabot, G., Choquette, L., Chorney, D., Collyer, C., Herrington, S., Janssen, I., Larouche, R., Pickett, W., Power, M., Sandseter, E. B. H., 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>
- Wang, Z., Liu, Y., & Zhang, T. (2023). Environmental influences on physical fitness among school-aged children in urban and rural settings. *Journal of Sports Sciences, 41*(9), 1012–1020. <https://doi.org/10.1080/02640414.2023.2187421>
- Welk, G. J., Laurson, K. R., Eisenmann, J. C., & Cureton, K. J. (2011). Development of youth aerobic-capacity standards using receiver operating characteristic curves. *American Journal of Preventive Medicine, 41*(4), S111–S116. <https://doi.org/10.1016/j.amepre.2011.07.007>
- World Health Organization. (2022). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization. <https://www.who.int/publications/i/item/9789240015128>