Pen & Prosperity
Website: https://penandprosperity.vgcet.com
Volume 2 :: Issue 2 :: June 2025 :: e-ISSN No. 3048-9555

A Correlational Study on General Motor Ability and Physiological Variables in Adults: Reflections on Inter-Relationships

Mr. Kedar Kumar Barik

Research Scholar, Department of Physical Education, Utkal University, Email: Email:kedarkumarbarik1980@gmail.com,

Professor Devendra Nath Behera

Retd. Principal, Govt. College of Physical Education, Bhubaneswar, Odisha, Utkal University

Email: drdnbehera1963@gmail.com

Abstract:

This study aims to investigate the interrelationships among selected general motor ability and physiological variables using Pearson's correlation coefficient. A sample of 60 individuals was assessed for variables including speed, muscular strength, agility, explosive power, and cardiovascular endurance, as well as anaerobic power, vital capacity, resting heart rate, and breath-holding capacity. The findings highlight significant associations between several pairs of variables, indicating complex interdependence. The results contribute to understanding how physical capacities are functionally related, which has important implications for athletic training, health diagnostics, and physical education.

ARTICLE INFO

Article history:
Received: 10 May 2025
Received in revised form
20 May 2025
Accepted 29 May 2025

Citation: Barik. Mr. K. K. & Behera. Prof. D. N., (2025) "A Correlational Study on General Motor Ability and Physiological Variables in Adults: Reflections on Inter-Relationships", *Pen and Prosperity*, Vol. 2, Issue. 2, June 2025.

Keywords: *General Motor Ability, Physiological Variables, Adults, Inter-Relationships.*

Introduction:

General motor ability (GMA) refers to an individual's foundational capacity to perform a wide array of motor tasks efficiently. It encompasses key components such as coordination, strength, agility, balance, and endurance, which collectively support the execution of both simple and complex movements (Schmidt & Lee, 2019). In adulthood, particularly during middle and older age, GMA becomes increasingly relevant as it is closely linked to functional independence, physical performance, and quality of life. Physiological variables—including muscle strength, cardiovascular endurance, body composition, flexibility, and neuromuscular coordination—play a vital role in shaping and maintaining motor abilities. Understanding the inter-relationships among these variables is essential for health promotion and disease prevention in adult populations.

Motor ability is traditionally seen as either a general, underlying capability or a set of task-specific skills. The general motor ability hypothesis suggests that individuals possess a core motor function that influences

performance across a variety of tasks (Magill & Anderson, 2017). In adults, this general capability forms the foundation for daily activities such as walking, lifting, balancing, and responding to environmental stimuli. Studies have shown that higher levels of motor ability are associated with greater physical autonomy, reduced fall risk, and improved cognitive health in older adults (Laukkanen et al., 2020).

General motor ability and physiological fitness are key indicators of an individual's physical capacity. The efficiency of physical movements and endurance levels are influenced by multiple factors, such as speed, strength, and aerobic capacity. Understanding the relationships between these parameters helps in designing targeted fitness regimes, evaluating athlete potential, and improving sports performance. This study seeks to analyze how different components of general motor ability and physiological traits correlate with each other, thereby offering insights into the integrative nature of physical fitness.

Significance of the Study:

The study explores the relationship between general motor ability and key physiological variables in adults, emphasizing its importance in exercise science, adult health, and rehabilitation. As aging and sedentary lifestyles rise, understanding these interconnections is essential for developing effective, holistic health interventions. The findings can guide personalized fitness and rehabilitation programs, aid in early detection of physical decline, and support public health efforts aimed at maintaining motor function and independence. By linking physiological health with motor performance, the study fills a critical research gap and lays the groundwork for future studies and practical applications.

Objectives: The study has been carried out with the following objectives-

- To assess the general motor ability (GMA) levels among adult participants.
- To examine the relationships between general motor ability and each of the selected physiological variables.

Hypothesis:

H_1 : There exists a statistically significant positive correlation between components of general motor ability, notably between speed and cardiovascular endurance, as well as between muscular strength and explosive power. This suggests that enhancements in one component are likely to be associated with improvements in the other.

H_2 : A significant and positive relationship is observed between physiological variables such as anaerobic power and vital capacity, indicating that an increase in one variable may correspond to a proportional improvement in the other.

H_3 : Resting heart rate exhibits a significant negative correlation with key physiological performance indicators, specifically anaerobic power and vital capacity. This implies that a lower resting heart rate is indicative of enhanced physiological efficiency and overall cardiorespiratory function.

Methodology:

Sample: A total of 60 participants (N = 60) were selected for the study using random sampling. All subjects were screened for health conditions to ensure they were physically fit to undergo physical assessments.

Variables Assessed:

General Motor Ability Variables:

- Speed
- Muscular Strength
- Agility
- Explosive Power
- Cardiovascular Endurance

Physiological Variables:

- Anaerobic Power
- Vital Capacity
- Resting Heart Rate
- Breath Holding Capacity

Data Collection: Data collection was carried out in a controlled setting under the supervision of trained professionals and followed standardized testing procedures for all variables. The assessments were conducted over multiple sessions to minimize fatigue and ensure the accuracy of results.

Statistical Analysis

Pearson's correlation coefficient (r) was calculated to determine the strength and direction of the relationship between each pair of variables. A significance level of $\mathbf{p < 0.05}$ and $\mathbf{p < 0.01}$ was used.

Results and Interpretation

Table 1. Pearson correlation coefficients among general motor ability variables (N=60)

		Speed	Muscular Strength	Agility	Explosive Power	Cardio Vascular Endurance
Speed	Correlation coefficient (r) p value	1	.274*	.220	.104	.608**
Muscular Strength	Correlation coefficient (r) p value		1.	325* 0.011	.392** 0.002	.126 0.338
Agility	Correlation coefficient (r) p value			1	.320* 0.013	.234 0.073
Explosive	Correlation coefficient (r) p value				1	.287* 0.026

Cardio Vascular Endurance	Correlation coefficient (r) p value					1

*p<0.01

*p<0.05

The degree of association among general motor ability variable are shown in the table 1. Speed of subjects were found to be significantly and positively correlated with muscular strength with estimate of 0.274. Corresponding coefficients with agility and explosive power were recorded as 0.220 and 0.104 and revealed very weak, non-significant but positive. The degree of association between speed and cardio vascular endurance was strong, positive and highly significant with estimate of 0.608. The coefficient of determination between speed and cardio vascular endurance was calculated as 0.37, depicting 37% of variation in cardio vascular endurance that is explained by speed and indicated that, the model provided a good fit to the available data.

The Pearson correlation coefficients between muscular strength and agility (0.325) and explosive power (0.392) were found to be positive and significant having moderate strength of relation with less than 15% of variation in both the variables explained by muscular strength. Weak non-significant but positive association of 0.126 was observed between muscular strength and cardio vascular endurance.

Moderate positive significant coefficient of correlation of 0.320 was recorded between agility and explosive power. Corresponding coefficient of 0.234 was observed between agility and cardio vascular endurance, which was not significant. However, moderate, significant and positive correlation coefficient of 0.287 was realized between explosive power and cardio vascular endurance in the present study.

Highly significant strong positive relationship was recorded between muscular strength and explosive power besides speed and cardio vascular endurance in the present study having considerable portion of explanation to the variation in one variable taking the other variable into consideration.

Table 2. Pearson correlation coefficients among physiological variables (N=60)

		Anaerobic Power	Vital Capacity	Resting Heart Rate	Breath Holding Capacity
Anaerobic Power	Correlation coefficient (r) p value	1	0676** <0.001	-.288* 0.026	.856** <0.001
Vital Capacity	Correlation coefficient (r) p value		1	-.289* 0.025	.562** <0.001
Resting Heart Rate	Correlation coefficient (r) p value			1	-.202 0.122
Breath Holding Capacity	Correlation coefficient (r) p value				1

. p<0.05

** p<0.01

The degree of association among physiological variables are shown in Table 2. Anaerobic poser of subjects was found to have highly significant and positive correlation with vital capacity having estimate of 0.676. Corresponding coefficients with breath holding capacity was recorded as 0.556 and revealed as positive and very highly significant. The coefficient of determination between aerobic power with vital capacity and breath holding capacity were calculated as 0.316, depicting around 32% of variation in breath holding capacity that is explained by vital capacity and indicated that, the model provided a good fit to the available data. Significant but weak negative association of -0.288 was recorded between anaerobic power and resting heart rate in the present study.

The degree of association between vital capacity and resting heart rate was weak, negative but significant with estimate of -0.289. In contrary very highly significant positive strong correlation of coefficient of 0.562 was recorded between vital capacity and breath holding capacity. The coefficient of determination between vital capacity and breath holding capacity was calculated as 0.316, depicting around 32% of variation in breath holding capacity that is explained by vital capacity and indicated that, the model provided a good fit to the available data.

The Pearson correlation coefficient of -0.202 between resting heart rate and breath holding capacity was found to be negative and non-significant having weak strength of relation with less than 5% of variation in breath holding capacity explained by resting heart rate.

Findings:

- The findings demonstrate meaningful positive inter-relationships among key general motor ability variables, particularly between speed and cardiovascular endurance, and between muscular strength and explosive power.
- Similarly, significant associations among physiological variables highlight the close link between anaerobic power, lung capacity, and breath control.
- The inverse correlations between resting heart rate and performance variables further underscore the importance of cardiovascular efficiency in overall physical fitness.

Conclusion:

The inter-relationships between general motor ability and physiological variables in adults underscore the importance of holistic fitness approaches. Rather than targeting isolated components, interventions should simultaneously address strength, endurance, flexibility, and coordination to preserve or enhance GMA. Recognizing these connections can inform preventive strategies, rehabilitation programs, and public health initiatives aimed at promoting functional longevity. Ultimately, maintaining both physiological health and motor ability is essential for sustaining autonomy, reducing disability, and improving life satisfaction in adulthood.

Reference:

- American College of Sports Medicine (ACSM). (2021). *ACSM's Guidelines for Exercise Testing and Prescription* (11th ed.). Wolters Kluwer.
- Cruz-Jentoft, A. J., Bahat, G., Bauer, J., Boirie, Y., Bruyère, O., Cederholm, T., ... & Cooper, C. (2019). Sarcopenia: revised European consensus on definition and diagnosis. *Age and Ageing, 48*(1), 16–31.

- Fielding, R. A., Rejeski, W. J., Blair, S., Church, T., Espeland, M. A., Gill, T. M., ... & Kritchevsky, S. B. (2011). The lifestyle interventions and independence for elders study: design and methods. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 66*(11), 1226–1237.
- Hunter, S. K. (2014). Sex differences in human fatigability: mechanisms and insight to physiological responses. *Acta Physiologica, 210*(4), 768–789.
- Janssen, I., Heymsfield, S. B., & Ross, R. (2002). Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. *Journal of the American Geriatrics Society, 50*(5), 889–896.
- Kodama, S., Saito, K., Tanaka, S., Maki, M., Yachi, Y., Asumi, M., ... & Sone, H. (2009). Cardiorespiratory fitness as a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women: a meta-analysis. *JAMA, 301*(19), 2024–2035.
- Laukkanen, P., Finni, T., Pesola, A., & Heinonen, A. (2020). Physical function and motor performance in aging. *Gerontology, 66*(2), 132–141.
- Liu, C. J., & Latham, N. K. (2009). Progressive resistance strength training for improving physical function in older adults. *The Cochrane Database of Systematic Reviews, 2009*(3), CD002759.
- Lord, S. R., Sherrington, C., Menz, H. B., & Close, J. C. (2003). *Falls in older people: Risk factors and strategies for prevention.* Cambridge University Press.
- Magill, R. A., & Anderson, D. I. (2017). *Motor learning and control: Concepts and applications* (11th ed.). McGraw-Hill Education.
- Manini, T. M., & Clark, B. C. (2012). Dynapenia and aging: An update. *The Journals of Gerontology: Series A, 67*(1), 28–40.
- Peterson, M. D., Rhea, M. R., Sen, A., & Gordon, P. M. (2010). Resistance exercise for muscular strength in older adults: A meta-analysis. *Ageing Research Reviews, 9*(3), 226–237.
- Schmidt, R. A., & Lee, T. D. (2019). *Motor control and learning: A behavioral emphasis* (6th ed.). Human Kinetics.
- Villareal, D. T., Apovian, C. M., Kushner, R. F., & Klein, S. (2005). Obesity in older adults: Technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *The American Journal of Clinical Nutrition, 82*(5), 923–934.