2025 Volume: 01 Issue: 02 www.ijrpa.com Research Article

International Journal Research Publication Analysis

Page: 01-08

EFFECTS OF RESISTANCE TRAINING ON SELECTED PHYSICAL AND PHYSIOLOGICAL VARIABLES AMONG SCHOOL LEVEL HANDBALL PLAYERS

***[1]Manivannan T. A., [2]Dharani S., [3]S.T.N. Rajeswaran**

[1]Ph.D., Research Scholar, Department of Physical Education, Bharathiar University.

[2]Ph.D., Research Scholar, Department of Physical Education, Bharathiar University.

[3]Professor, Department of Physical Education, Bharathiar University.

Article Received: 04 June 2025

Article Revised: 24 June 2025

Published on: 14 July 2025

***Corresponding Author: Manivannan T. A.**

[1]Ph.D., Research Scholar, Department of Physical Education, Bharathiar University. Email Id: dobby1021@yahoo.com

ABSTRACT

The study aimed to explore the influence of effect of resistance training on selected physical and physiological variables among school level handball players. The hypothesis posited that eight weeks of resistance training would significantly impact selected physical and physiological variables among school level handball players. For this investigation 30 randomly selected school level handball players from Maruthamalai Devasathanam Higher Secondary School, Tamilnadu, India aged between 13 to 17 years were chosen as subjects. The research employed a pre-test and post-test random group design incorporating an experimental group and a control group each comprising fifteen participants. Experimental group underwent resistance training while control group underwent traditional training. The physical and physiological variables assessed included muscular endurance (measured by sit-ups), flexibility (assessed using the sit-and-reach test), resting heart rate (recorded via radial pulse count) and breath-holding time (measured using a digital stopwatch) respectively. Before the eight-week experimental period commenced, we conducted pre-tests to assess the selected physical fitness and physiological variables in all 30 subjects. Subsequently, post-tests were carried out at the conclusion of the experimental period, with scores meticulously recorded. Statistical analysis was conducted with a predetermined level of significance set at a confidence level of 0.05. The study results revealed a significant improvement in physical and physiological variables among participants in the resistance training group.

KEYWORDS: Resistance Training, Muscular Endurance, Flexibility, Resting Heart Rate and Breath Holding Time.

INTRODUCTION

Resistance training, also referred to as strength or weight training, is a form of physical exercise that involves working against a force to enhance muscular strength, power and endurance. The external resistance used can include free weights, machines, resistance bands, or body weight (American College of Sports Medicine [ACSM], 2009). Over the past few decades, resistance training has transitioned from being a niche activity for athletes and bodybuilders to a widely recommended practice for individuals of all ages and fitness levels. The physiological foundation of resistance training lies in the principle of overload applying a stress greater than what the body is accustomed to in order to stimulate muscle adaptation. According to Phillips and Winett (2010), this form of training promotes muscle hypertrophy, improved neuromuscular coordination and increased metabolic efficiency. As muscles adapt to the imposed demands, strength and endurance improve, supporting both athletic performance and daily functional tasks.

One of the most significant benefits of resistance training is the preservation and enhancement of muscle mass, especially important as people age. Sarcopenia the age-related loss of muscle tissue, contributes to decreased mobility, increased fall risk and reduced quality of life in older adults. Regular resistance training helps counteract this process by stimulating muscle protein synthesis and maintaining functional capacity (Roubenoff & Hughes, 2000). Fiatarone *et al*., (1994) demonstrated that even frail elderly individuals experienced substantial improvements in strength and physical function after participating in resistance training programs.

In addition to musculoskeletal benefits, resistance training positively affects metabolic health. It has been shown to improve insulin sensitivity, regulate blood glucose levels and reduce abdominal fat factors that play a role in preventing or managing type 2 diabetes and cardiovascular disease (Strasser *et al*., 2010). Furthermore, resistance training enhances bone density which is critical in reducing the risk of osteoporosis, particularly among postmenopausal women (Kerr *et al*., 2001). Mental health benefits are also associated with resistance training. Research by O'Connor, Herring and Caravalho (2010) highlights how strength training can alleviate symptoms of depression and anxiety while improving self-esteem and cognitive function. These psychological effects, coupled with the physical improvements make resistance training a holistic tool for enhancing overall well-being.

To be effective, resistance training should follow key principles such as specificity, overload, progression and recovery (Kraemer & Ratamess, 2004). Programs should be tailored to individual goals whether that be building strength, increasing endurance or improving body composition. With proper technique and supervision, resistance training is safe for nearly all populations, including children, seniors and individuals with chronic conditions (Faigenbaum *et al*., 2009). In resistance training is a foundational component of physical fitness that offers wide ranging benefits for muscular, metabolic and mental health. As research continues to evolve, it remains an essential strategy for promoting longevity and quality of life.

Methodology

To achieve the objectives formulated in the present study, the means and methods used are as follows: In the present study, the investigator aimed to study the effects of resistance training on selected physical and physiological variables of among school level handball players. It was hypothesized that eight weeks of resistance training would produce significant improvements in physical and physiological parameters when compared to traditional training. A total of thirty (N = 30) male school level handball players aged between 13 and 17 years, were randomly selected from Maruthamalai Devasthanam Higher Secondary School, Tamil Nadu, India. The subjects were randomly assigned into two equal groups of fifteen each, an experimental group and a control group. The experimental group underwent a structured resistance training program for eight weeks while the control group continued their regular traditional training. A pre-test and post-test randomized group design was employed to measure changes in the selected variables. The physical and physiological variables assessed included muscular endurance (measured by sit-ups), flexibility (assessed using the sit-and-reach test), resting heart rate (recorded via radial pulse count) and breath-holding time (measured using a digital stopwatch). All assessments were conducted before and after the training period under standardized conditions. The data collected from pre- and post-tests were analyzed using the dependent t-test to determine the significance of changes within groups. To test the significance of the results derived, the 0.05 level was chosen as the level of significance. The results of the study revealed that resistance training had a positive impact on the selected variables, supporting its effectiveness as a training method for improving physical and physiological fitness in adolescent handball players.

RESULTS

Table 1: Mean and Dependent 'T' – ratio for the Pre and Post Tests on Resistance Training Group and Control Group on Physical and Physiological Variables.

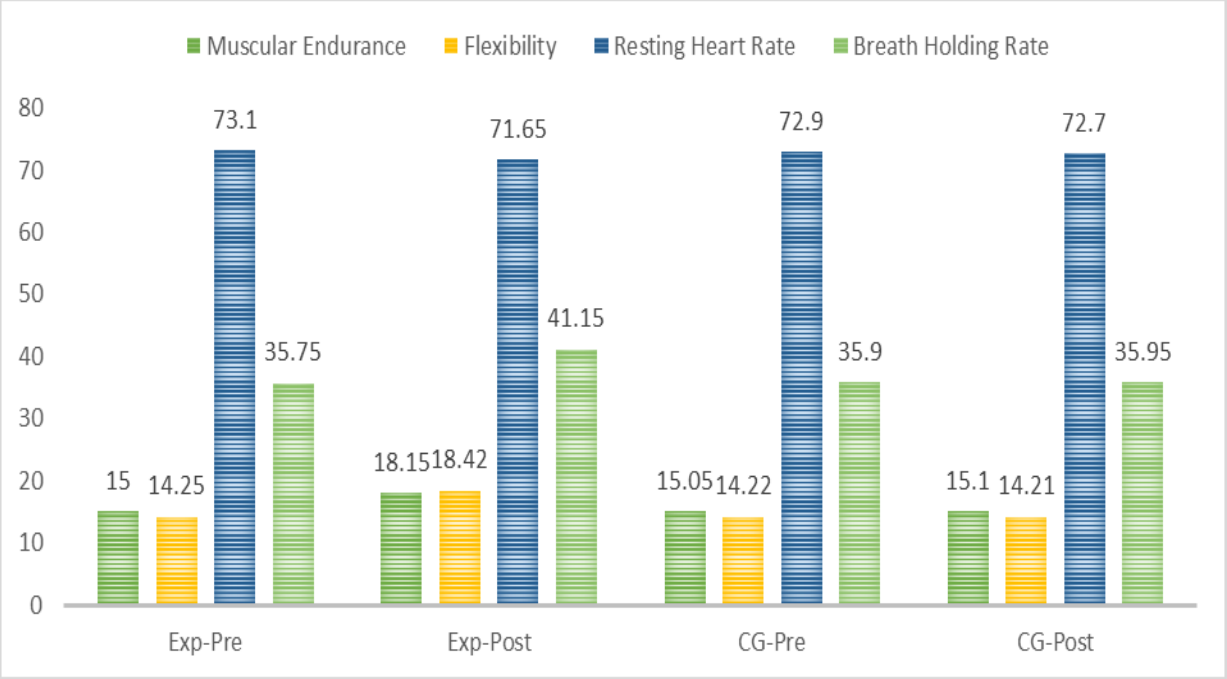
S. No	Group	Variables	Pre-Test Mean	Post-Test Mean	Mean Difference	Standard Error Mean	T- ratio
1	Resistance Training	Muscular Endurance	15.00	18.15	3.15	0.20	15.94*
2		Flexibility	14.25	18.42	4.17	0.10	41.11*
3		Resting Heart rate	73.10	71.65	1.45	0.21	6.86*
4		Breath Holding Time	35.75	41.15	5.4	0.36	14.76*
1	Control Group	Muscular Endurance	15.05	15.10	0.05	0.05	1.00
2		Flexibility	14.22	14.21	0.01	0.05	1.00
3		Resting Heart rate	72.90	72.70	0.2	0.11	1.1
4		Breath holding time	35.90	35.95	0.05	0.16	0.29

*Significant level 0.05 level degree of freedom (2.14, 1 and 14)

Table - 1 displays the computation of the t-ratio comparing the means of the pre-test and post-test scores among school level handball players. The mean values of the physical and physiological variables for the experimental group were 15.00 (pre-test) and 18.15 (post-test) for muscular endurance, 14.25 (pre-test) and 18.42 (post-test) for flexibility, 73.10 (pre-test) and 71.65 (post-test) for resting heart rate and 35.75 (pre-test) and 41.15 (post-test) for breath holding time. In contrast, the control group recorded means of 15.05 and 15.10 (muscular endurance), 14.22 and 14.21 (flexibility), 72.90 and 72.70 (resting heart rate) and 35.90 and 35.95 (breath-holding time) for the respective pre- and post-tests.

The calculated t-ratios for the experimental group were 15.94 (muscular endurance), 41.11 (flexibility), 6.86 (resting heart rate) and 14.76 (breath-holding time) all of which exceeded the critical t-value of 2.14 for 14 degrees of freedom at the 0.05 level of significance. This indicates that the physical and physiological variables in the experimental group improved significantly as a result of the resistance training program. Conversely the computed t-ratios for the control group 1.00, 1.00, 1.10 and 0.29 did not exceed the critical value indicating no statistically significant improvement in any of the variables. These findings clearly demonstrate

that resistance training had a substantial effect on the physical and physiological development of school level handball players whereas traditional training alone did not yield similar results.



The bar diagram shows the mean values of pre-test and post-test on physical and physiological variables of experimental group and control group.

Finding of Results

The study findings reveal a significant improvement in the selected variables muscular endurance, flexibility, resting heart rate and breath-holding time within the experimental group which underwent resistance training compared to the control group. Statistical analysis demonstrated that participants in the resistance training group showed marked enhancements in physical and physiological parameters following the eight-weeks of resistance training program. These improvements were not observed to the same extent in the control group which followed traditional training routines. Specifically, the increase in muscular endurance and flexibility along with reductions in resting heart rate and improvements in breath-holding capacity suggest enhanced cardiovascular and musculoskeletal efficiency due to resistance based intervention. These findings are consistent with previous research by Hammami *et al*., (2017), who reported that strength training significantly improved agility and repeated sprint ability in adolescent handball players. Similarly, Granacher *et al*., (2012) emphasized the positive impact of resistance training on muscular fitness and athletic performance in youth athletes. Lloyd and Faigenbaum (2016) also advocated for age appropriate resistance training to enhance both health and sport specific physical qualities in young populations. In conclusion,

the results of the present study underscore the effectiveness of resistance training in improving muscular endurance, flexibility, resting heart rate and breath holding time thereby supporting its inclusion in training programs aimed at enhancing athletic performance among school level handball players.

CONCLUSIONS

Within the limitations of the present study, the following conclusions were drawn

1. The experimental group, comprised of individuals who underwent resistance training achieved a notably significant improvement in muscular endurance, flexibility, resting heart rate and breath holding time school level Handball players.
2. In contrast, the control group exhibited insignificant improvement in physical fitness variables specifically muscular endurance, flexibility, resting heart rate and breath holding time school level Handball players.

REFERENCES

1. Behm, D. G., & Faigenbaum, A. D. (2017). Countering resistance training myths in children and adolescents. *Strength & Conditioning Journal, 39*(1), 24–33.
2. Chaouachi, A., Othman, A. B., Hammami, R., Drinkwater, E. J., & Behm, D. G. (2014). Strength training and combination of balance and plyometric exercises in children. *Journal of Strength and Conditioning Research, 28*(2), 401–412.
3. Granacher, U., Muehlbauer, T., & Behm, D. G. (2012). Effects of resistance training in youth athletes on muscular fitness and athletic performance: A conceptual model. *European Journal of Sport Science, 12*(1), 5–15.
4. Hammami, R., Negra, Y., Billaut, F., & Chelly, M. S. (2017). Effects of lower-limb strength training on agility, repeated sprinting, and change-of-direction in U-15 male handball players. *Journal of Strength and Conditioning Research, 31*(3), 838–845.
5. Hoff, J., & Helgerud, J. (2004). Strength and endurance training for soccer players: Physiological considerations. *Sports Medicine, 34*(3), 165–180.
6. Lloyd, R. S., & Faigenbaum, A. D. (2016). Youth resistance training: Past practices, new perspectives, and future directions. *Pediatric Exercise Science, 28*(1), 43–52.
7. Michalsik, L. B., Aagaard, P., & Madsen, K. (2015). Locomotion characteristics and match-induced impairments in physical performance in male elite team handball players. *International Journal of Sports Medicine, 36*(7), 595–607.

8. Ramadan, J., Barac-Nieto, M., & Al-Zaid, N. S. (2002). Responses to exercise, fitness, and training of children and adolescents. *Sports Medicine, 32*(9), 555–576.
9. Zapartidis, I., Vareltzis, I., Gouvali, M., & Kororos, P. (2009). Physical fitness and anthropometric characteristics in different levels of young team handball players. *The Open Sports Sciences Journal, 2*(1), 22–28.
10. American College of Sports Medicine. (2009). American College of Sports Medicine position stand: Progression models in resistance training for healthy adults. *Medicine & Science in Sports & Exercise, 41*(3), 687–708.
11. Faigenbaum, A. D., Kraemer, W. J., Blimkie, C. J., Jeffreys, I., Micheli, L. J., Nitka, M., & Rowland, T. W. (2009). Youth resistance training: Updated position statement paper from the National Strength and Conditioning Association. *Journal of Strength and Conditioning Research, 23*(5, Suppl), S60–S79.
12. Fiatarone, M. A., O'Neill, E. F., Ryan, N. D., Clements, K. M., Solares, G. R., Nelson, M. E., ... & Evans, W. J. (1994). Exercise training and nutritional supplementation for physical frailty in very elderly people. *The New England Journal of Medicine, 330*(25), 1769–1775.
13. Kerr, D., Ackland, T., Maslen, B., Morton, A., & Prince, R. (2001). Resistance training over 2 years increases bone mass in calcium-replete postmenopausal women. *Journal of Bone and Mineral Research, 16*(1), 175–181.
14. Kraemer, W. J., & Ratamess, N. A. (2004). Fundamentals of resistance training: Progression and exercise prescription. *Medicine & Science in Sports & Exercise, 36*(4), 674–688.
15. O'Connor, P. J., Herring, M. P., & Carvalho, A. (2010). Mental health benefits of strength training in adults. *American Journal of Lifestyle Medicine, 4*(5), 377–396.
16. Phillips, S. M., & Winett, R. A. (2010). Uncomplicated resistance training and health-related outcomes: Evidence for a public health mandate. *Current Sports Medicine Reports, 9*(4), 208–213.
17. Roubenoff, R., & Hughes, V. A. (2000). Sarcopenia: Current concepts. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 55*(12), M716–M724.
18. Strasser, B., Siebert, U., & Schobersberger, W. (2010). Resistance training in the treatment of the metabolic syndrome: A systematic review and meta-analysis of the effect of resistance training on metabolic clustering in patients with abnormal glucose metabolism. *Sports Medicine, 40*(5), 397–415.

19. Granacher, U., Muehlbauer, T., & Behm, D. G. (2012). Effects of resistance training in youth athletes on muscular fitness and athletic performance: A conceptual model. *European Journal of Sport Science, 12*(1), 5–15.
20. Hammami, R., Negra, Y., Billaut, F., & Chelly, M. S. (2017). Effects of lower-limb strength training on agility, repeated sprinting, and change-of-direction in U-15 male handball players. *Journal of Strength and Conditioning Research, 31*(3), 838–845.
21. Lloyd, R. S., & Faigenbaum, A. D. (2016). Youth resistance training: Past practices, new perspectives, and future directions. *Pediatric Exercise Science, 28*(1), 43–52.