

# Effect of Low Aerobic Capacity Exercise on Mental Well-Being in Early Adolescent

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## Abstract

**Background:** Adolescence represents a crucial developmental period characterized by significant physical and emotional changes. During this period, young people develop skills for coping with stress and developing resilience - two of the most important aspects in healthy development. Mental health is critical to assist with this process. Physical activity is generally considered to positively affect mental health; yet, research examining the effects of low intensity aerobic activities on early adolescents is limited.

**Aim:** The aim of the study is to find effect of aerobic capacity on mental well-being in early adolescent.

**Methodology:** Based on chosen criteria, 60 children between 10-14 years old (30 male, 30 female) were randomly assigned to either an exercise group or not in a dual-purpose study looking at physical and mental well-being. The Stirling Children's Well-Being Scale measured mental well-being while the 20-meter shuttle beep test measured aerobic fitness. The exercise group underwent a low impact, 4-week fitness program, while the control group received no intervention. Paired t-tests ( $p < 0.05$ ) compared pre-test and post-test scores in each group.

**Conclusion:** The study concludes that it is a planned, supervised, and low-intensity aerobic exercise programs significantly improve mental health and aerobic fitness in early adolescents. These findings support the idea that low-intensity aerobic exercise programs in schools are a safe, practical, and cost-effective means to improve emotional stability, optimism, self-esteem, and psychological well-being among adolescents.

**Keywords:** Low-intensity aerobic exercise, Mental well-being, Early adolescents, Physical activity, Adolescent health

## 1. Introduction

Adolescents' mental well-being is determined by how much they enjoy their lives, how contented they are with their experience, and their ability to meet the everyday challenges and expectations of life [1]. Stressful life events; negative thoughts; anxiety; depression; chronic illness; and lack of social support all have a negative correlation with mental well-being among adolescents with poor mental well-being [2][3]. Physical health, resilience, self-control, quality social relationships, and life purpose are all positive predictors of mental well-being [2][3]. Adolescents who suffer from mental health problems are more likely to experience stigma, discrimination, academic problems, and social exclusion than those with no

mental health disorders, particularly those from the economically disadvantaged and high-risk populations [4].

Children between the ages of 10 and 14 are going through an enormous amount of change...physically, mentally, socially and in terms of their identity; during this phase, they begin to develop their own sense of who they are and begin to make decisions for themselves. They start moving away from their parents/family and begin looking to their friends and the environment for social approval due to this significant amount of change in a short timeframe, these kids are very vulnerable to influences that can either support or hurt their mental well-being.

Physical well-being includes fitness or physical activity (especially aerobics) as well as oxygen consumption during sustained physical activity and is thus a strong predictor for cardiovascular and long-term health outcomes [9][10]. Studies show that there is a positive relationship between physical activity and overall brain function, emotional control and cognitive performance [11]. Also, ongoing regular aerobic activity has been associated with lower levels of depression and anxiety as well as improved mental health [14][16][17]. For this reason, promoting physical activity early in the adolescent years may provide an effective means of increasing physical and mental wellness.

### Review of Literature

Several studies have investigated the relationship between physical activity and mental health among children and adolescents. Research has shown that participation in regular physical activity improves emotional well-being, cognitive functioning, and social interaction among adolescents. Studies conducted on school-aged children have demonstrated that aerobic exercise contributes to improvements in mood, self-confidence, and stress management. Physical activity stimulates the release of endorphins and neurotransmitters that are associated with improved mood and emotional stability. However, most previous studies have focused on moderate to high-intensity exercise programs. Limited research has specifically examined the impact of low-intensity aerobic exercise on the mental well-being of early adolescents. Therefore, the present study aims to evaluate whether simple, structured, low-intensity aerobic exercises can positively influence mental well-being among adolescents.

### METHODOLOGY

Study Design: Pre-test and post-test experimental study.

Study Setting: Dr. A.P.J. Abdul Kalam College of Physiotherapy.

Source of Data: Rayat High School, Loni, Ahilyanagar.

Duration of Study: One year.

Sample Size: 60 participants.

Study Population: School children aged 10–14 years.

Inclusion Criteria: Students aged 10–14 years who were willing to participate in the study and who had parental consent.

Exclusion Criteria: Students with neurological disorders, cardiovascular conditions, or any musculoskeletal injury that could limit physical activity.

Outcome Measures:

1. Stirling Children's Well-Being Scale – to assess mental well-being.
2. 20-meter Shuttle Run (Beep Test) – to measure aerobic capacity.

Procedure: After obtaining permission from the school authorities and informed consent from participants

and their parents, baseline assessments were conducted. Participants were randomly allocated into exercise and control groups. The exercise group performed low-intensity aerobic exercise sessions for four weeks under supervision. Post-intervention assessments were conducted after completion of the exercise program.

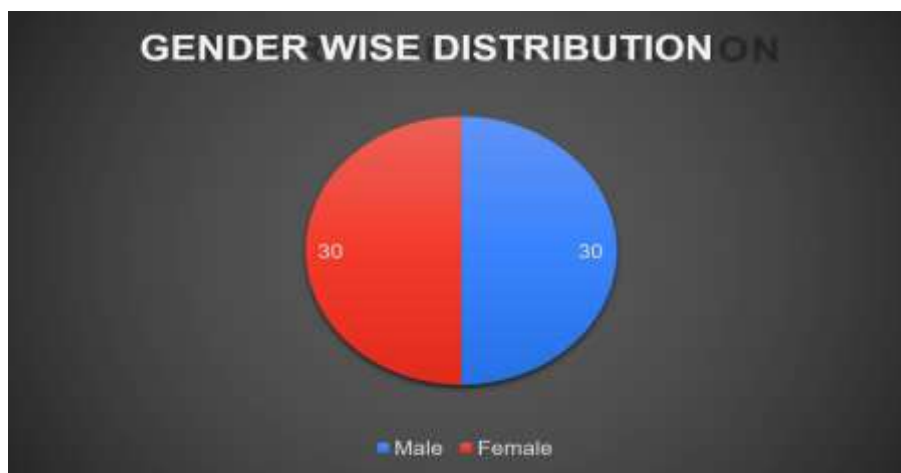
Statistical Analysis: Data were analyzed using paired t-test to compare pre-test and post-test values within groups. A significance level of  $p < 0.05$  was considered statistically significant.

**RESULTS:**

The results of the study indicated improvement in both mental well-being scores and aerobic capacity among participants who underwent the low-intensity aerobic exercise program. The exercise group showed a statistically significant improvement in post-test Stirling Well-Being Scale scores compared to the pre-test values. In contrast, the control group did not demonstrate significant changes in mental well-being scores.

| Age        | Sex  |        |       |
|------------|------|--------|-------|
|            | Male | Female | Total |
| 10-14 yrs. | 30   | 30     | 60    |

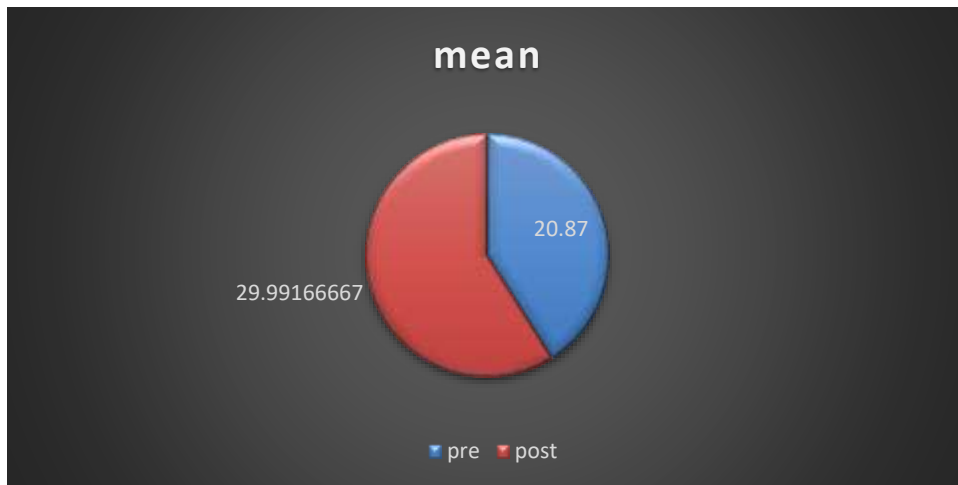
**Table No.1: Age and sex wise distribution**



**Pie chart no 1. Age and sex wise distribution**

|       |             |                     | Student's Paired 't' test value | 'p' value and significance      |
|-------|-------------|---------------------|---------------------------------|---------------------------------|
|       | Pre         | Post                |                                 |                                 |
|       | Mean ± SD   | Mean ± SD           |                                 |                                 |
| Group | 20.87±1.987 | 23.9916666667±1.998 | 28.376                          | p=0.0001, extremely significant |

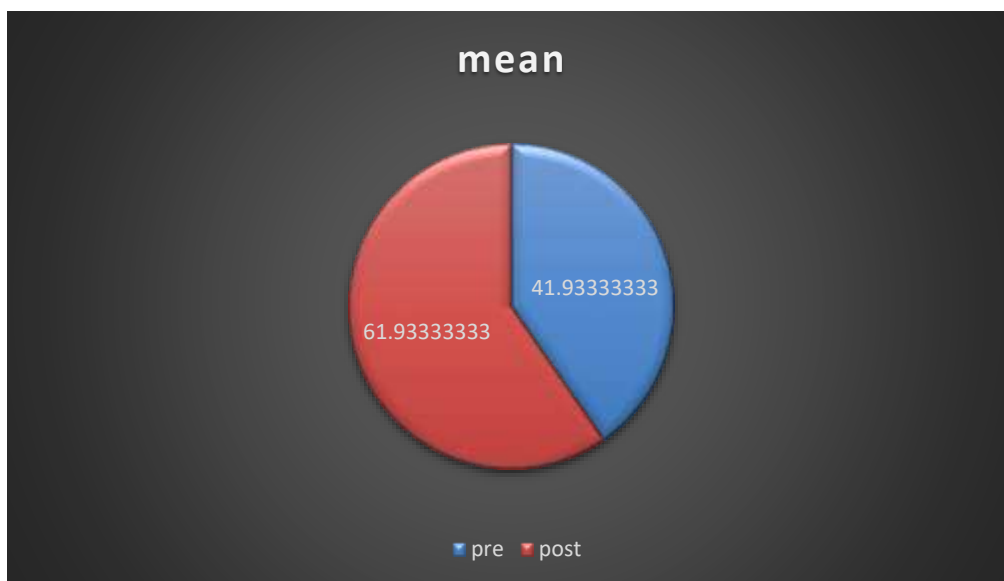
**Table No. 2 Comparison of the mean of Pre and Post values of Shuttle beep test to check aerobic fitness of Group.**



**PIE CHART 2. Comparison of the mean of Pre and Post values of Shuttle beep test to check aerobic fitness of Group.**

|              | Stirling scale      |                     | Stu-<br>dent's<br>Paired<br>'t' test<br>value | 'p' value<br>and sig-<br>nificance         |
|--------------|---------------------|---------------------|---|--|
|              | Pre                 | Post                |   |  |
|              | Mean ± SD           | Mean ± SD           |   |  |
| <b>Group</b> | 41.9333333333±3.156 | 61.9333333333±2.934 | 39.754  | P<0.0001,<br>extremely<br>signifi-<br>cant |

**Table No. 3: Comparison within the mean of Pre and Post values of Stirling scale for assessment wellbeing of Group.**



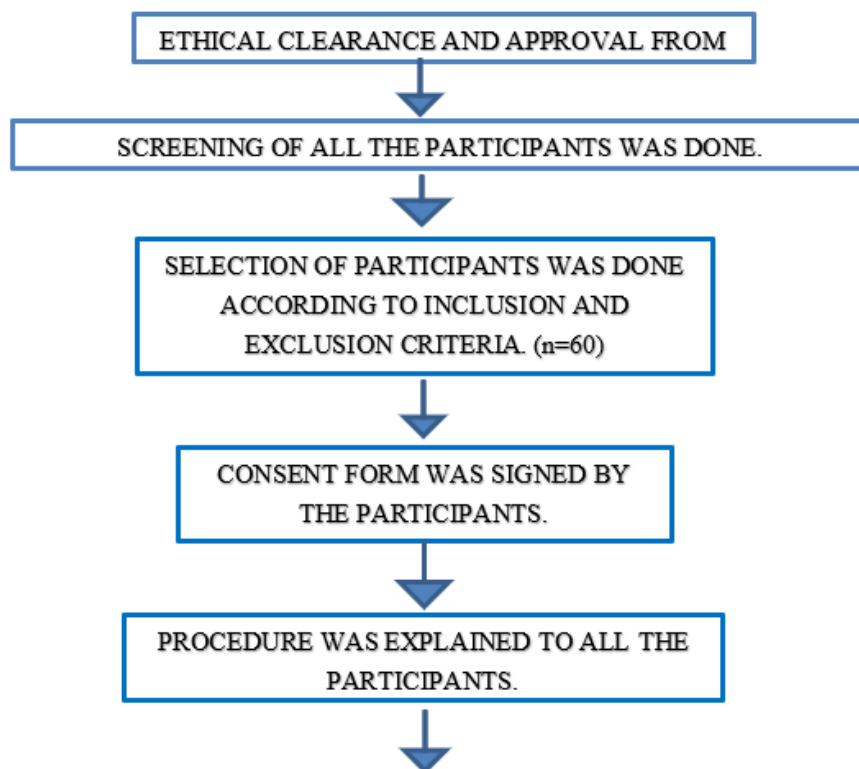
**PIE CHART NO 3. Comparison within the mean of Pre and Post values of Stirling scale for assessment wellbeing of Group.**

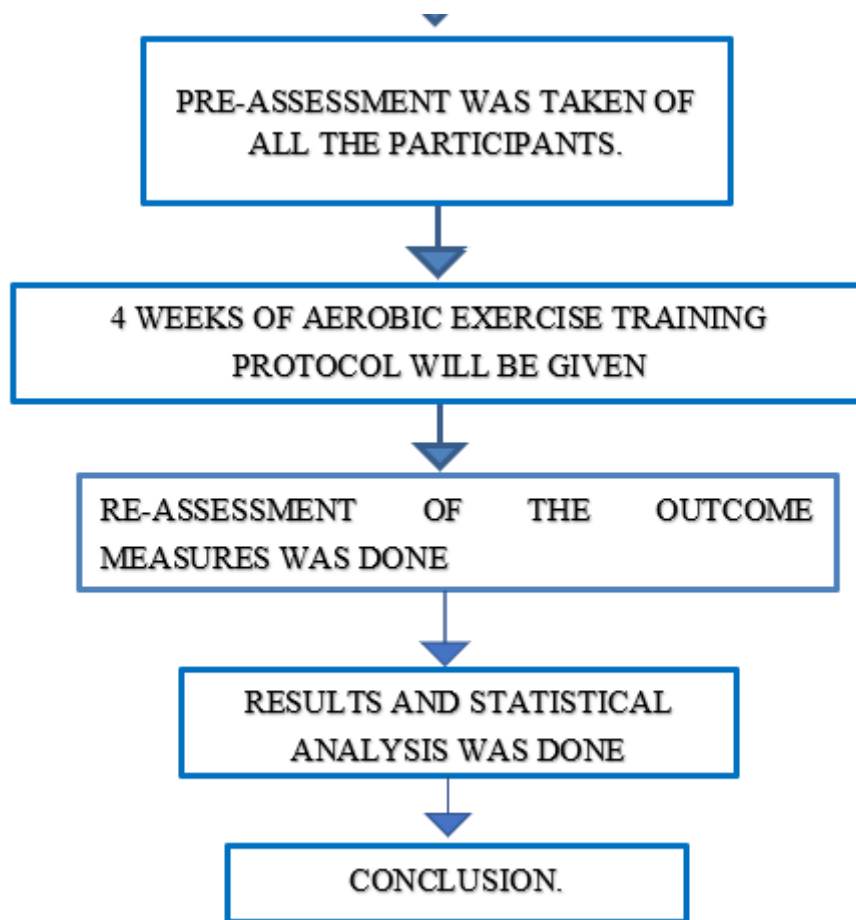
| Week               | Warm Up Phase (5 mins)  | Exercise Phase (20 mins)  |                        |               | Cool Down Phase (5 mins)  |
|--------------------|---|---|------------------------|---------------|---|
|                    |   | Exercises   | Intensity              | Duration      |   |
| Week1 (Adaptation) | <ul style="list-style-type: none"> <li>• Slow walking around ground – 2 min</li> <li>• Arm circles, shoulder rolls – 1 min</li> <li>• Marching on spot – 1 min</li> <li>• Knees and pelvis rotation- 1 min</li> </ul> | <b>Aerobic:</b><br>Brisk walking / slow jogging around playground                 | Min 1-2 round<br>200 m | <b>10 min</b> | <ul style="list-style-type: none"> <li>• Slow walking – 2 min</li> <li>• Static stretching: Neck, shoulder, arms, back, hamstring, quadriceps and calf – 3 min</li> <li>• Relaxation: Jacobson's technique – 1 min</li> </ul> |
|                    |   | <b>Strengthening:</b><br>• Body-weight squats                                     | 5 reps × 2 sets        | <b>2 min</b>  |   |
|                    |   | • Wall push-ups   | 5 reps × 2 sets        | <b>1 min</b>  |   |
|                    |   | • Step-ups on low bench (6 each leg × 1 set)                                      | 6 each leg × 1 set     | <b>1 min</b>  |   |
|                    |   | <b>Breathing (3 min):</b><br>Diaphragmatic breathing (nose in-hale, mouth exhale) | 5 reps × 2 sets        | <b>3 min</b>  |   |
|                    |   | <b>Small game drill:</b><br>Running relay   | Min 5 rounds<br>50 m   | <b>2 min</b>  |   |

|                                    |   |  |                          |               |  |
|------------------------------------|---|--|--------------------------|---------------|--|
| Week 2<br>(Volume built up)        | <ul style="list-style-type: none"> <li>• Brisk walking – 1 min</li> <li>• Range of motion of upper limb- 1 min</li> <li>• Dynamic leg swings &amp; trunk rotation – 2 min</li> <li>• Easy skipping on spot – 1 min</li> </ul> | <b>Aerobic:</b><br>Continuous brisk walk / light jog                     | Min 2-3 round<br>200 m   | <b>12 min</b> | <ul style="list-style-type: none"> <li>• Slow walk – 2 min</li> <li>• Stretching: Neck, shoulder, arms, back, hamstring, quadriceps and calf. – 3 min</li> <li>• Relaxation: Jacobson's technique – 1 min</li> </ul>   |
|                                    |   | <b>Strengthening:</b>  |                          | <b>5 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Squats</li> </ul>               | 5 reps × 2 sets          | <b>2 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Wall push-ups</li> </ul>        | 5 reps × 2 sets          | <b>1 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Standing heel raises</li> </ul> | 5 reps × 2 sets          | <b>1 min</b>  |  |
|                                    |   | <b>Breathing:</b><br>Inspiratory Hold (3 secs hold)                      | 5 reps × 2 sets          | <b>2 min</b>  |  |
|                                    |   | <b>Small sport drill:</b><br>Ball passing in circle                      |                          | <b>1 min</b>  |  |
| Week 3<br>(Controlled progression) | <ul style="list-style-type: none"> <li>• Walking with arm swing – 2 min</li> <li>• Marching with high knees – 1 min</li> <li>• Knees and pelvis rotation – 1 min</li> <li>• Side stepping – 1 min</li> </ul>                  | <b>Aerobic:</b><br>Interval walking (2 min brisk + 1 min slow × 3)       | Min 3- 4 rounds<br>200 m | <b>10 min</b> | <ul style="list-style-type: none"> <li>• Slow walking – 2 min</li> <li>• Stretching: Neck, shoulder, arms, back, hamstring, quadriceps and calf – 3 min</li> <li>• Relaxation: Jacobson's technique – 1 min</li> </ul> |
|                                    |   | <b>Strengthening:</b>  |                          | <b>6 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Squats</li> </ul>               | 5 reps × 2 sets          | <b>2 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Lunges</li> </ul>               | 6 each leg × 1 set       | <b>2 min</b>  |  |
|                                    |   | <ul style="list-style-type: none"> <li>• Wall push-ups</li> </ul>        | 5 reps × 2 sets          | <b>2 min</b>  |  |
|                                    |   | <b>Breathing:</b><br>Inspiratory Hold (5 secs hold)                      | 5 reps × 2 sets          | <b>2 min</b>  |  |
|                                    |   | <b>Small sport drill:</b><br>Throwball                                   |                          | <b>2 min</b>  |  |

|        |  |  |                     |               |   |
|--------|--|--|---------------------|---------------|---|
| Week 4 | <ul style="list-style-type: none"> <li>• Brisk walking – 2 min</li> <li>• Dynamic mobility (arms, hips, ankles) – 2 min</li> <li>• Easy pace skipping – 1 min</li> </ul> | <b>Aerobic:</b> Continuous brisk walking / light jog   | 4-5 rounds<br>200 m | <b>12 min</b> | <ul style="list-style-type: none"> <li>• Slow walk – 2 min</li> <li>• Stretching: Neck, shoulder, arms, back, hamstring, quadriceps and calf – 3 min</li> <li>• Relaxation: Jacobson’s technique - 1 min</li> </ul> |
|        |  | <b>Strengthening:</b>                                  |                     | <b>5 min</b>  |   |
|        |  | • Squats   | 5 reps × 2 sets     | <b>2 min</b>  |   |
|        |  | • Step-ups   | 8 each leg × 1 set  | <b>1 min</b>  |   |
|        |  | • Wall push-ups  | 5 reps × 2 sets     | <b>1 min</b>  |   |
|        |  | <b>Breathing (2 min):</b><br>Deep Breathing            | 5 reps × 2 sets     | <b>2 min</b>  |   |
|        |  | <b>Small sport drill:</b><br>Two leg Hop + simple math |                     | <b>1 min</b>  |   |
|        |  |  |                     |               |   |

Table No.3 Week Structured Aerobic Capacity Exercise Program





| Sr No. | Questions                                       | Never | Not much of the time | Some of the time | Quite a lot of time | All of the time |
|--------|---|-------|----------------------|------------------|---------------------|-----------------|
| 1      | I think good things will happen in my life      | 0%    | 63.30%               | 36.60%           | 0%                  | 0%              |
| 2      | I have always told the truth                    | 3.30% | 33.30%               | 61.67%           | 1.67%               | 0%              |
| 3      | I've been able to make choices easily           | 0%    | 61.67%               | 38.30%           | 0%                  | 0%              |
| 4      | I can find lots of fun things to do             | 1.67% | 38.30%               | 56.67%           | 3.30%               | 0%              |
| 5      | I feel that I am good at some things            | 1.67% | 61.67%               | 36.67%           | 0%                  | 0%              |
| 6      | I think lots of people care about me            | 0%    | 35%                  | 65%              | 0%                  | 0%              |
| 7      | I like everyone I have met                      | 1.67% | 63.30%               | 31.67%           | 3.30%               | 0%              |
| 8      | I think there are many things I can be Proud of | 0%    | 43.30%               | 53.30%           | 3.30%               | 0%              |
| 9      | I've been feeling calm                          | 0%    | 13.30%               | 31.67%           | 55%                 | 0%              |
| 10     | I've been in a good mood                        | 0%    | 11.67%               | 28.30%           | 60%                 | 0%              |

|    |                                       |       |        |        |        |    |
|----|---------------------------------------|-------|--------|--------|--------|----|
| 11 | I enjoy what each new day brings      | 0%    | 65%    | 30%    | 5%     | 0% |
| 12 | I've been getting on well with people | 1.67% | 43.30% | 53.30% | 1.67%  | 0% |
| 13 | I always share my sweets              | 0%    | 1.67%  | 20%    | 78.30% | 0% |
| 14 | I've been cheerful about things       | 0%    | 46.67  | 51.67% | 1.67%  | 0% |
| 15 | I've been feeling relaxed             | 0%    | 0%     | 35%    | 39%    | 0% |

**Table No. 4: PRE-STERLING SCALE PERCENTAGE**

| Sr. No. | Questions                                  | Never | Not much of the time | Some of the time | Quite a lot of time | All of the time |
|---------|--|-------|----------------------|------------------|---------------------|-----------------|
| 1       | I think good things will happen in my life | 0%    | 3.30%                | 6.60%            | 43.30%              | 46.60%          |
| 2       | I have always told the truth               | 1.60% | 18.30%               | 16.60%           | 35%                 | 28.30%          |
| 3       | I've been able to make choices easily      | 0%    | 1.60%                | 20%              | 50%                 | 28.30%          |
| 4       | I can find lots of fun things to do        | 0%    | 0%                   | 25%              | 38.30%              | 36.60%          |
| 5       | I feel that I am good at                   | 0%    | 0%                   | 18.30%           | 41.60%              | 40%             |

|    |   |       |       |        |        |        |
|----|---|-------|-------|--------|--------|--------|
|    | some things                                     |       |       |        |        |        |
| 6  | I think lots of people care about me            | 1.60% | 1.60% | 13.30% | 35%    | 48.30% |
| 7  | I like everyone I have met                      | 0%    | 1.60% | 20%    | 28.30% | 50%    |
| 8  | I think there are many things I can be proud of | 0%    | 0%    | 18.30% | 41.60% | 40%    |
| 9  | I've been feeling calm                          | 1.60% | 1.60% | 13.30% | 58.30% | 25%    |
| 10 | I've been in a good mood                        | 0%    | 1.60% | 18.30% | 56.60% | 23.30% |
| 11 | I enjoy what each new day brings                | 0%    | 0%    | 18.30% | 41.60% | 40%    |
| 12 | I've been getting on well                       | 0%    | 1.60% | 21.60% | 45%    | 31.60% |

|    |                                 |       |       |        |        |        |
|----|---------------------------------|-------|-------|--------|--------|--------|
|    | with people                     |       |       |        |        |        |
| 13 | I always share my sweets        | 1.60% | 0%    | 15%    | 38.30% | 45%    |
| 14 | I've been cheerful about things | 0%    | 1.60% | 23.30% | 38.30% | 36.60% |
| 15 | I've been feeling relaxed       | 0%    | 0%    | 15%    | 46.60% | 38.30% |

**Table No.5: POST STIRLING SCALE PERCENTAGE SCALE**

### Discussion

The present study evaluated the effect of low-intensity aerobic exercise on mental well-being in early adolescents. The results demonstrated that participation in structured aerobic exercise resulted in improvements in psychological well-being.

These findings are consistent with previous research that has highlighted the positive relationship between physical activity and mental health among adolescents. Aerobic exercise is believed to enhance neurotransmitter activity, improve circulation to the brain, and reduce stress levels, which collectively contribute to improved emotional health.

The findings of the present study suggest that even low-intensity exercise programs can produce meaningful improvements in mental well-being when performed regularly.

### Conclusion

The study concludes that structured and supervised low-intensity aerobic exercise programs significantly improve mental well-being and aerobic capacity among early adolescents. Incorporating simple physical activity programs in school settings may help promote emotional stability, improve mood, and enhance overall psychological health in adolescents.

### Clinical Implications

Low-intensity aerobic exercise programs can be easily implemented in school environments to improve both physical and psychological health among adolescents. Physiotherapists and physical education teachers can collaborate to design structured exercise programs that promote mental well-being and healthy lifestyle habits during early adolescence.

## Limitations

The study was conducted on a limited sample size from a single school, which may affect the generalizability of the findings. The duration of the intervention was relatively short, and long-term effects were not evaluated.

## REFERENCES

1. Tamminen N, Reinikainen J, Appelqvist-Schmidlechner K, Borodulin K, Mäki-Opas T, Solin P. Associations of physical activity with positive mental health: A population-based study. *Mental Health and Physical Activity*. 2020 Mar 1;18:100319.
2. Bell SL, Audrey S, Gunnell D, Cooper A, Campbell R. The relationship between physical activity, mental wellbeing and symptoms of mental health disorder in adolescents: a cohort study. *International Journal of Behavioral Nutrition and Physical Activity*. 2019 Dec 26;16(1):138.
3. Diener E, Ryan K. Subjective well-being: A general overview. *South African journal of psychology*. 2009 Dec 1;39(4):391-406.
4. <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health>
5. <https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions>.
6. Yilmazer, T. (2013). National and Global Adolescent Health. *Turkey Clinics J Fam Med-Special Topics*, 4(1), 1–6.
7. Adana, F., & Kutlu, Y. (2009). The Effect of Parent Attitudes on Self Concept of the Adolescents. *Journal of Anatolia Nursing and Health Sciences*,12(2), 18–24.
8. Huang, Y. C., and Malina, R. M. (2002). Physical activity and health-related physical fitness in taiwanese adolescents. *J. Physiol. Anthropol. Appl. Human. Sci.* 21, 11–19.doi: 10.2114/jpa.21.11
9. Catley, M. J., and Tomkinson, G. R. (2013). Normative health-related fitness values for children: analysis of 85347 test results on 9-17-year-old Australians since 1985. *Br. J. Sports Med.* 47, 98–108.doi: 10.1136/bjsports-2011-090218
10. Carnethon, M. R., Gidding, S. S., Nehgme, R., Sidney, S., Jacobs, D. R. Jr., and Liu, K. (2003). Cardiorespiratory fitness in young adulthood and the development of cardiovascular disease risk factors. *JAMA* 290, 3092–3100.doi:10.1001/jama.290.23.3092
11. Browne RA, Costa EC, Sales MM, Fonteles AI, de Moraes JF, de França Barros J. Acute effect of vigorous aerobic exercise on the inhibitory control in adolescents. *Revista Paulista de Pediatria (English Edition)*. 2016 Jun 1;34(2):154-61.
12. Baquet G, Van Praagh E, Berthoin S. Endurance training and aerobic fitness in young people. *Sports medicine*. 2003 Dec;33(15):1127-43.
13. Karami H, Dehnou VV, Nazari A, Gahreman D. Regular training has a greater effect on aerobic capacity, fasting blood glucose and blood lipids in obese adolescent males compared to irregular training. *Journal of Exercise Science & Fitness*. 2021 Apr 1;19(2):98-103.
14. Lindwall M, Ljung T, Hadžibajramović E, Jonsdottir IH. Self-reported physical activity and aerobic fitness are differently related to mental health. *Mental Health and Physical Activity*. 2012 Jun 1;5(1):28-34.
15. Granero-Jiménez J, López-Rodríguez MM, Dobarrio-Sanz I, Cortés-Rodríguez AE. Influence of physical exercise on psychological well-being of young adults: A quantitative study. *International journal of environmental research and public health*. 2022 Apr 3;19(7):4282.

16. Stroth S, Hille K, Spitzer M, Reinhardt R. Aerobic endurance exercise benefits memory and affect in young adults. *Neuropsychological rehabilitation*. 2009 Jan 1;19(2):223-43.
17. Bernstein EE, McNally RJ. Acute aerobic exercise hastens emotional recovery from a subsequent stressor. *Health Psychology*. 2017 Jun;36(6):560.
18. Rodriguez-Ayllon M, Cadenas-Sanchez C, Estévez-López F, et al. Physical activity and mental health in children and adolescents: a systematic review and meta-analysis. *Sports Medicine*. 2019.
19. Lubans DR, Richards J, Hillman CH, et al. Physical activity for cognitive and mental health in youth: a systematic review. *British Journal of Sports Medicine*. 2016.
20. Biddle SJH, Ciaccioni S, Thomas G, Vergeer I. Physical activity and mental health in children and adolescents: an updated review. *Mental Health and Physical Activity*. 2019/2020.
21. Dursun P. Optimism, hope and subjective well-being: a literature overview. *Çatalhöyük Uluslararası Turizm ve Sosyal Araştırmalar Dergisi*. 2021 Jun 6(6):61-74.
22. Chu PS, Saucier DA, Hafner E. Meta-analysis of the relationships between social support and well-being in children and adolescents. *Journal of social and clinical psychology*. 2010 Jun;29(6):624-45.

## References

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  - Roger R.F., Leonardo W.D., Donald J.T.
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12. Please follow these when specifying names of the authors:
  - The first name first, then a space (only if the first character of the middle name isn't given, full middle name is given or no middle name is given), then optionally middle name, then a space, then the last name.
  - No comma between first name, middle name and last name of each author.
  - Separate the authors' names with a comma and a space. Do not write “and” before the last author's name.
13. Please do not write journal/publisher's name with abbreviations, write full name; or acronym may be used if the publisher is well-known with the acronym.

### Example of List of References

1. Roger R.F., Leonardo W.D., Donald J.T., “Title of Our Research Paper”, Name of the Publisher/Journal, April 2015, 7 (3), 129–151.
2. Jack C.M., “Electromagnetic Effects on the Different Kinds of Water”, Journal of Electromagnetic Effects, 1992, 2 (4), 47–76.
3. Samuel J., “Fine Particles, Thin Films and Exchange Anisotropy”, Magnetism, 1963, 3 (1), 271–350.
4. Kate E., Title of the Research Paper. (Unpublished)
5. Andrew S. “Effect of Non-visible Electromagnetic Particles on Photosynthesis”. <https://www.example.com/volume-14/issue-5/effect-of-non-visible-electromagnetic-particles-on-photosynthesis>

