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Effect of Dynamic Exercise & PNF Training on Depression of Early, Middle & Late Adolescent Boys

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ABSTRACT-Dynamic exercise and PNF training are effective strategies for improving mental health during adolescence .This study examined how a 12-week dynamic exercise program and proprioceptive neuromuscular facilitation (PNF) training reduced depression levels in adolescent boys in Bangalore. 240 participants are divided into three developmental stages: early adolescence (n = 80), middle adolescence (n = 80), and late adolescence (n = 80). By using DASS Y questionnaire pre- and post-tests are conducted to assess the effectiveness of the intervention. Using two-way ANCOVA and Bonferroni post-hoc statistics, it was found that the experimental groups had significantly lower levels of depression across all three stages of development. The results emphasize the positive impact of the intervention on depression , indicating that targeted programs can effectively alleviate depressive symptoms in young males. This underscores the importance of early intervention strategies in promoting well-being during critical developmental phases. These findings suggest that incorporating dynamic exercise and proprioceptive neuromusc ular facilitation (PNF) training into mental health programs can be particularly beneficial for adolescents. By addressing mental health during these formative years, we can foster resilience and enhance overall psychological well-being.

Key words: Dynamic exercise, proprioceptive neuromuscular facilitation, Bonferroni post-hoc, Adolescent groups,DASS-Y .

I .INTRODUCTION

Dynamic exercise refers to physical exercises that involve constant, rhythmic motions, target large muscle groups, and elevate blood pressure and heart rate. Aerobic workouts often improve endurance, cardiovascular fitness, and overall physical well-being. Running, cycling, swimming, and dancing are a few examples. Dynamic activities are an excellent way to manage weight and maintain metabolic health since they improve the transport of oxygen to the muscles, increase energy levels, and encourage fat burning. Additionally, they promote muscle coordination and joint mobility, which lowers the chance of injury and improves functional fitness for day-to-day tasks. Resistance training that uses contractions against resistance to increase muscle strength, endurance, and flexibility is called proprioceptive neuromuscular facilitation (PNF) training. Resistance bands or bodyweight exercises can be used for PNF training. Exercise releases endorphins, sometimes referred to as "feel-good" chemicals, which elevate your mood and foster a sense of well-being.

One effective strategy for controlling and lessening depressive symptoms is exercise. Exercise releases endorphins, sometimes referred to as "feel-good" chemicals, which elevate your mood and foster a sense of well-being. Additionally, it boosts the synthesis

of neurotransmitters like dopamine and serotonin, which are essential for mood regulation and lowering depressive or anxious feelings. Frequent exercise can boost self-esteem, improve sleep, and offer a constructive diversion from negative thinking. Exercises like weight training, yoga, swimming, and walking can be very beneficial for one's physical and emotional well-being. Even modest quantities of exercise can promote long-term mental resilience and a sense of success.

The article's methodical structure makes it simple to understand the study. It starts with the objectives, which describe the aim and purpose of the study. The Hypothesis section then presents the tested assumptions of the study. Section II, Methodology describes the research design, participant selection, interventions, and data collection processes. Section III, Analysis of Data and Interpretation, provides a detailed description of the statistical methods and conclusions derived from the results. Section IV engage in a discussion on the findings, drawing comparisons with those from previous research similar to the study. Section V concludes by summarizing the results and providing suggestions for future research avenues or useful applications. Finally, the References section provides a list of all the sources cited in the article.

1. OBJECTIVES

The following objectives were framed for this study:

- To examine the effects of dynamic exercise and proprioceptive neuromuscular training on depression of early adolescence boys.
- To examine the effects of dynamic exercise and proprioceptive neuromuscular training on depression of middle adolescence boys.
- To examine the effects of dynamic exercise and proprioceptive neuromuscular training on depression of late adolescence boys.

2. HYPOTHESES

The following hypotheses were developed in accordance with the aforementioned objectives:

- It was hypothesized that 12 weeks of training in dynamic exercise & proprioceptive neuromuscular facilitation would significantly reduce the depression of early adolescent boys.
- It was hypothesized that 12 weeks of training in dynamic exercise & proprioceptive neuromuscular facilitation would significantly reduce the depression of middle adolescent boys.
- It was hypothesized that 12 weeks of training in dynamic exercise & proprioceptive neuromuscular facilitation would significantly reduce the depression of late adolescent boys.

II. METHODOLOGY

- The investigation evaluates how the researcher's training plan affects the depression variable among the students in the adolescent group.
- ***Study Design:*** The study employed a randomized treatment design with 240 adolescent's boy students from banglore.divided into three equal groups of 80 in each early adolescents 80 middle adolescents & 80 late adolescents each age group is further divided into control group 40 & experimental group 40.
- ***Inclusion Criteria:*** students are then to instructed to participate in the 12-week study, with no pre-existing medical conditions .
- ***Exclusion Criteria:*** Students with medical conditions, injuries, or disabilities affecting physical activity, were not involved in the study.
- ***Data Collection and Intervention****:* Data was collected using pre- and post-tests on depression , measured through a DASS-Y questionnaire , before and after the 12-weeks intervention of dynamic exercise and proprioceptive neuromuscular facilitation training across early, middle, and late adolescent groups, who underwent three sessions per week.

- ***Statistical Technique*:** Each group's pre and post data were analyzed using the same statistical procedure. The two-way analysis of covariance (ANCOVA) using pre reading as a covariate and relevant descriptive were used to determine the significance of the group differences. For a more thorough examination of pairwise comparisons, the Bonferroni post-hoc test was used in conjunction with the bar diagram and profile plot.

III.ANALYSIS AND DATA INTERPRETATION

Table 1.1 Descriptive Statistics of depression Split by Group

Group	Time	N	Min	Max	Mean	SD Error	SD
Control	**Pre**	120	2.00	11.00	6.69	0.14	1.53
	Post	120	2.00	10.00	6.15	0.13	1.49
Experimental	**Pre**	120	2.00	9.00	5.98	0.12	1.34
	Post	120	1.00	6.00	3.94	0.11	1.22

Interpretation: Table 1.1 presents the descriptive statistics of the depression scores obtained from the pretest and posttest of both the control and experimental groups. The table presents the subsequent information: In the pretest of the control group, the mean score is 6.69, with a standard deviation of 1.53 and a standard error of 0.14. In contrast, the posttest mean score is 6.15, with a standard deviation of 1.49 and a standard error of 0.13. In the experimental group, the pretest mean score is 5.98, with a standard deviation of 1.34 and a standard error of 0.12. The posttest outcomes indicate a mean score of 3.94, accompanied by a standard deviation of 1.22 and a standard error of 0.11.

Table 1.2 Descriptive Statistics of depression Split by Age Group

Age Group	Time	N	Min	Max	Mean	SD Error	SD
Early Adolescence	Pre	80	2.00	9.00	5.87	0.17	1.57
	Post	80	2.00	8.00	5.15	0.16	1.45
Middle Adolescence	Pre	80	4.00	11.00	6.50	0.14	1.28
	Post	80	2.00	10.00	5.46	0.17	1.53
Late Adolescence	Pre	80	2.00	10.00	6.63	0.16	1.47
	Post	80	1.00	9.00	4.52	0.23	2.09

Interpretation: Table 1.2 presents the descriptive statistics of depression scores across various age groups: The further observations are as follows:

- Early Adolescence: The mean depression score in the pretest is 5.87, with a standard deviation of 1.57 and a standard error of 0.17; the minimum and maximum values are 2.00 and 9.00, respectively. The mean depression score in the posttest is 5.15, with a standard deviation of 1.45 and a standard error of 0.16; the minimum and maximum values are 2.00 and 8.00, respectively.
- Middle Adolescence: The pretest reveals a mean depression score of 6.50, with a standard deviation of 1.28 and a standard error of 0.14; the scores range from a minimum of 4.00 to a maximum of 11.00. In the posttest, the mean depression score decreased to 5.46, with a standard deviation of 1.53 and a standard error of 0.17; the minimum and maximum values recorded were 2.00 and 10.00, respectively.
- Late Adolescence: In the pretest, the mean depression score is 6.63, with a standard deviation of 1.47 and a standard error of 0.16; the minimum and maximum scores are 2.00 and 10.00, respectively. In the posttest, the mean depression score was 4.52, with a standard deviation of 2.09 and a standard error of 0.23; the minimum and maximum values were 1.00 and 9.00, respectively.

Table 1.3: Descriptive Statistics of Depression split by Group, Age group & Time

Group	Age Group	Time	N	Min	Max	Mean	SD Error	SD
Control	Early Adolescence	Pre	40	2.00	9.00	6.35	0.29	1.84
		Post	40	2.00	8.00	5.70	0.27	1.74
	Middle Adolescence	Pre	40	5.00	11.00	6.97	0.18	1.18
		Post	40	4.00	10.00	6.50	0.17	1.13
	Late Adolescence	Pre	40	2.00	10.00	6.75	0.23	1.48
		Post	40	2.00	9.00	6.25	0.23	1.46
Experimental	Early Adolescence	Pre	40	3.00	7.00	5.40	0.17	1.08
		Post	40	3.00	6.00	4.60	0.12	0.77
	Middle Adolescence	Pre	40	4.00	8.00	6.02	0.19	1.20
		Post	40	2.00	6.00	4.42	0.17	1.12
	Late Adolescence	Pre	40	2.00	9.00	6.52	0.23	1.48
		Post	40	1.00	4.00	2.80	0.13	0.82

Interpretation:

Table 1.3 displays the descriptive statistics of the depression scores obtained before and after training for the group, age group, and period. The table displays the following results:

The control group's pretest results show an average score of 6.35 with a standard deviation (SD) of 1.84 for the early adolescent group. The average score for the middle adolescent group is 6.98, with a standard deviation (SD) of 1.18. The average score for the late adolescent group is 6.75, with a 1.48 standard deviation (SD). On the other hand, the early adolescence group's posttest results indicate an average score of 5.70 with a 1.74 standard deviation (SD). The average score for the middle adolescent group is 6.50, with a standard deviation (SD) of 1.13. The average score for the late adolescent group is 6.25, with a 1.46 standard deviation (SD).

• *Experimental group: According to the pretest results, the early adolescent group had an average score of 5.40 and a standard deviation (SD) of 1.08. The average score for the middle adolescent group is 6.03, with a standard deviation (SD) of 1.20. The average score for the late adolescent group is 6.53, with a 1.48 standard deviation (SD). The following numbers show a decrease in depression after the training, according to the post-test results. The average score for the early adolescent group is 4.60, with a standard deviation (SD) of 0.77. The average score for the middle adolescent group is 4.42, with a standard deviation (SD) of 1.12. The average score for the late adolescent group is 2.80, with a standard deviation (SD) of 0.82.* Overall, the findings show that, while all groups' levels of depression dropped in the experimental group between pre- and post-tests, the post-adolescent group benefited the most, followed by the teenage and early adolescent groups. The control group exhibits some improvement even though they did not get any particular intervention

Table 1.4 Analysis of Covariance results of the Intervention program on Depression

Source	Sum of Squares	df	Mean Square	F-ratio	p-value
Depression Pre	250.70	1	250.70	578.49	<0.05
Group	160.24	1	160.24	369.76	<0.05
Age Group	65.01	2	32.51	75.01	<0.05
Group X Age Group	84.93	2	42.46	97.99	<0.05
Within Group	100.93	233	0.43	--	--

Conclusion: The following conclusions are drawn from the above table:

• There is a substantial correlation between the pretest and posttest scores for depression [F (1,233) = 578.49, p-value < 0.05].
• The group that received treatment and the group that did not showed a significant difference in post-test depression scores (after correcting for pre-depression scores) when the age group is ignored [F (1,233) =369.76, p-value <0.05].

• When group levels are ignored, there is a significant difference in the impact of age group on post-test depression scores (after adjusting for pre-test depression scores) [F(2,233)=75.01, p-value <0.05].

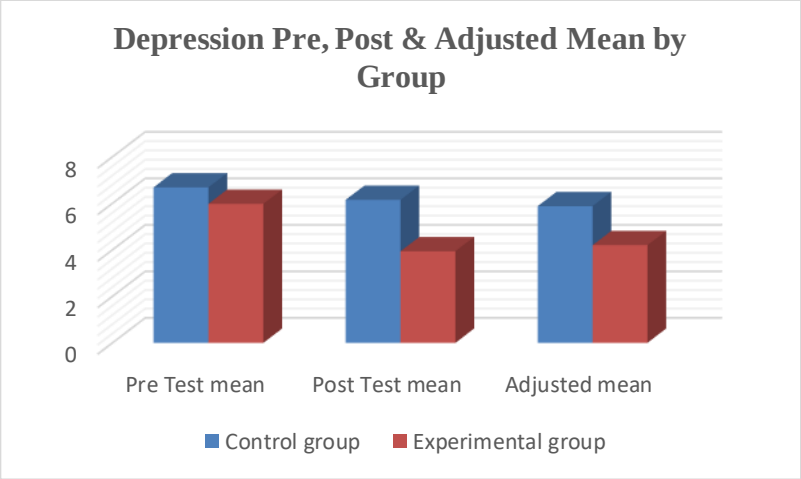
• After adjusting for pre-test depression, there is a statistically significant interaction between group and age group on post-test depression [F (2,233) =97.99, p-value <0.05].

Table 1.5 Depression Pre Test, Post Test & Adjusted Post Test Mean Scores split by Group

Group	Pre Mean	Post Mean	Adjusted Mean
Control	6.69	6.15	5.88
Experimental	5.98	3.94	4.20

INTERPRETATION: Table 1.5 displays the mean scores for each group. The pretest mean, posttest mean, and adjusted mean for the control group are 6.69, 6.15, and 5.88, respectively. The pretest mean for the experimental group is 5.98. The adjusted mean is 4.20, and the posttest mean is 3.94.

Figure- 1.1: Pre, Post and Adjusted Posttest Mean scores of Depression



Interpretation: Table 1.5 is illustrated graphically in figure 1.1. Students in the experimental group had lower depression scores than those in the control group, according to this multiple bar graph that compares the fixed (for pre-test) post-test mean score to the pre-test mean score for both groups.

Table 1.6 Depression Mean Scores split by Age Group

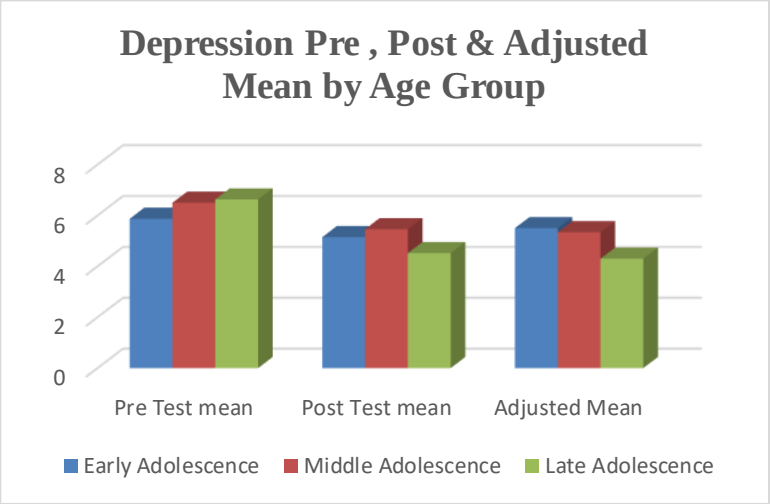
Age Group	Pre Mean	Post Mean	Adjusted Mean
Early Adolescence	5.87	5.51	5.50
Middle Adolescence	6.50	5.46	5.34
Late Adolescence	6.63	4.52	4.30

Interpretation: Table 1.6 presents the average scores for the different age groups as outlined below:
• **Early Adolescence**: The mean scores for the early adolescent group are as follows: pretest mean is 5.87, posttest mean is 5.15, and the adjusted mean is 5.36.

• **Middle Adolescence**: The pretest average for the middle adolescent group is 6.50. The recalibrated average stands at 5.31.

• **Late Adolescence**: The average score from the posttest is 5.46. The mean score for the late adolescent group in the pretest is 6.63. The adjusted mean stands at 4.30, while the posttest mean is recorded at 4.52.

Figure- 1.2: Pre, Post and Adjusted Posttest Mean scores of Depression



Interpretation: Table 1.6 is graphically shown in figure 1.2. The adjusted mean depression score, the post-test depression score, and the pre-test mean depression scores for the early, middle, and late adolescent groups are displayed in this multiple bar graphic.

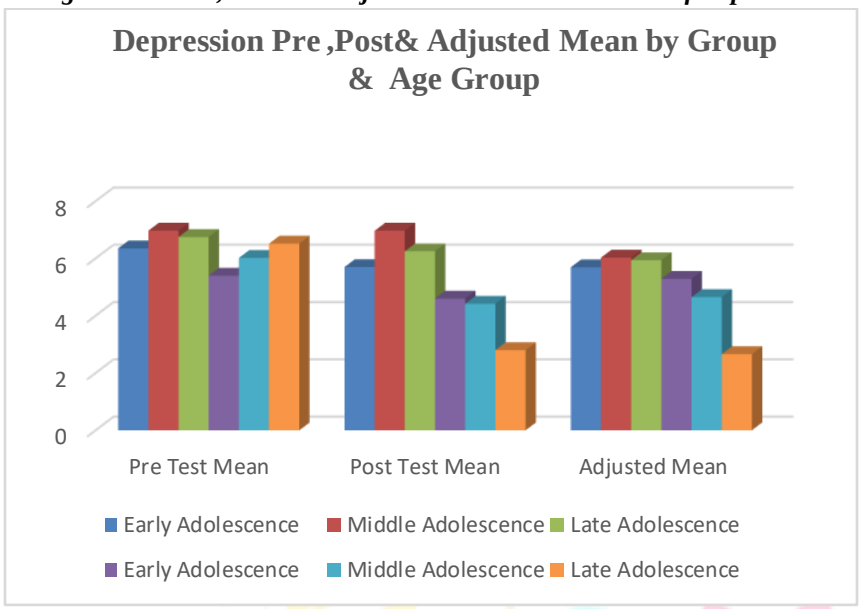
Table 1.7 Depression Mean Scores split by Group & Age Group

Group	Age Group	Pre Test Mean	Post Test Mean	Adjusted Mean
Control	Early Adolescence	6.35	5.70	5.69
	Middle Adolescence	6.97	6.50	6.03
	Late Adolescence	6.75	6.25	5.94
Experimental	Early Adolescence	5.40	4.60	5.29
	Middle Adolescence	6.02	4.42	4.65
	Late Adolescence	6.52	2.80	2.66

Interpretation: Table 1.6 displays the mean scores for the various group and their respective age group. The following are some observations:

- **Control group**: The pretest mean is 6.35, the posttest mean is 5.70, and the corrected mean for early adolescence is 5.69. The adjusted mean, pretest mean, and posttest mean for middle adolescence are 6.97, 6.50, and 6.03. The adjusted mean, pretest mean, and posttest mean for late adolescence are 5.94, 6.75, and 6.25, respectively.
- **Experimental group**: The adjusted mean, pretest mean, and posttest mean for early adolescence are 5.29, 4.60, and 5.40, respectively. The adjusted mean, pretest mean, and posttest mean for middle adolescence are 4.65, 4.42, and 6.02, in that order. The adjusted mean, pretest mean, and posttest mean for late adolescence are 2.80, 2.66, and 6.52, in that order.

Figure- 1.3: Pre, Post and Adjusted Posttest Mean scores of Depression



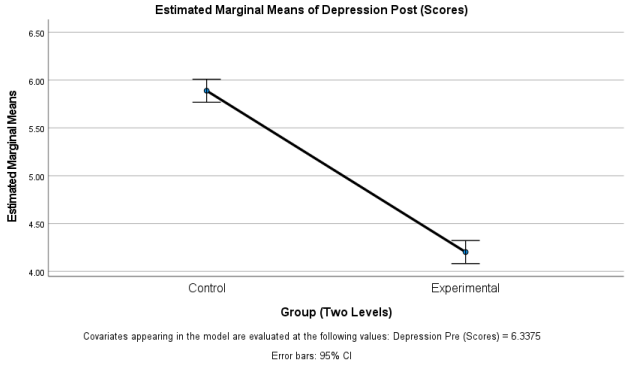
Interpretation: Table 1.7 is graphically represented in image 1.3. Both the control group and the experimental group's early, middle, and late teenage groups' pre-test mean depression scores, post-test depression scores, and adjusted mean depression scores.

Table 1.8 Pairwise Comparison of Depression Score between Groups

Control Group	Experimental Group	Mean Difference	p-value	95% confidence interval for Difference	
				Lower Bound	Upper Bound
5.89	4.20	1.687	<0.05	1.514	1.859

Conclusion: The p-value < 0.05 indicates a significant difference between the experimental and control groups' post-depression scores (adjusted for pre) at the 5% level of significance. Therefore, it is clear from the above table that the samples in the experimental group had lower post-depression scores (adjusted to pre) than the samples in the control group.

Figure - 1.4: Profile plot showing Adjusted posttest Mean scores of depression Experimental and Control Group



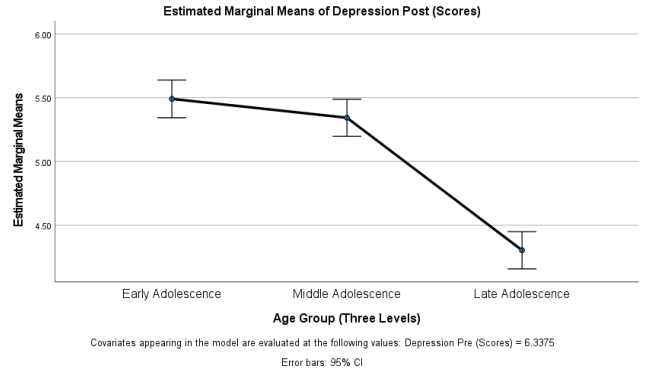
Interpretation: The graphical representation indicates that the experimental group's posttest depression mean scores (adjusted for pre-treatment) are lower than the control group's posttest mean scores.

Table 1.9 Pairwise Comparison of Depression Scores between Age Group

Age Group			Mean Difference	p-value	95% confidence Interval for Difference	
Early Adolescence	Middle Adolescence	Late Adolescence			Lower Bound	Upper Bound
5.49	5.34	--	0.14	0.49	-0.11	0.40
5.49	--	4.30	1.18	<0.05	0.92	1.44
--	5.34	4.30	1.03	<0.05	0.79	1.29

Conclusion: Between middle and late adolescence, as well as between early and late adolescence, there are statistically significant variations in the adjusted mean scores of depression. The corresponding p-values are less than 0.05. Nonetheless, there was no appreciable difference in depression between the groups in early and middle adolescence. (p-value = 0.049). We can therefore draw the conclusion that the adjusted post-test mean of depression scores for the early adolescence group is substantially greater than that of the middle and late adolescence groups.

Figure - 1.5: Profile plot showing adjusted posttest Mean scores of depression of Early, Middle and Late Adolescence Group



Interpretation: In terms of efficacy, the late adolescence group fared better than any other group, according to the graphical representation, while the middle adolescence group came in second and the early adolescence group came in last.

Note*:* The test for simple effect was conducted since there is a substantial interaction between the age group and the group. The outcomes are as follows.

Table 1.10 Pairwise Comparison of Depression Scores between Age Group with respect to Control & Experimental Group

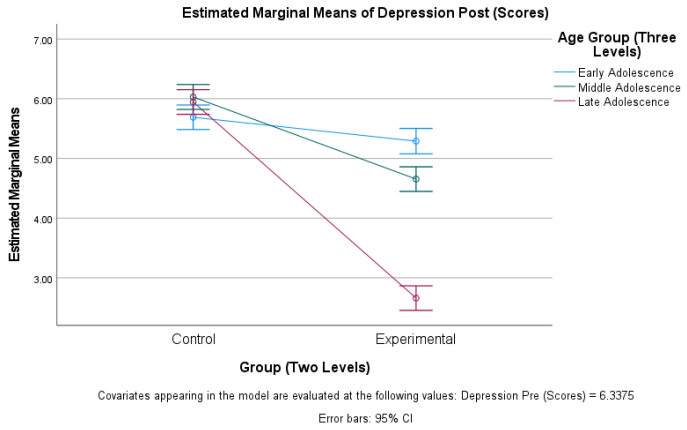
Group	Age Group			Mean Difference	p-value
	Early Adolescence	Middle Adolescence	Late Adolescence		
Control	5.69	6.03	--	-0.34	0.70
	5.69	--	5.94	-0.26	0.26
	--	6.03	5.94	0.84	1.00
Experimental	5.29	4.65	--	0.63	<0.05
	5.29	--	2.66	2.62	<0.05
	--	4.65	2.66	1.99	<0.05

Conclusion: The following conclusions are drawn from the above table:

• **Control group**: There is no appreciable difference in depression between the early adolescent and middle adolescence, early adolescence and late adolescence, and middle adolescence and late adolescence groups (the p-values for these comparisons are 0.70, 0.26, and 1.00, respectively).

• **Experimental Group**: All corresponding p-values < 0.05 indicate statistically significant differences in the adjusted mean depression scores between the early adolescent and late adolescent, early adolescence and late adolescence, and middle adolescence and late adolescence groups.

Figure - 1.5: Profile plot showing adjusted Posttest Mean scores of depression of Early, Middle and Late Adolescence Group



Interpretation: The overlap of the plots (lines) in Figure 1.5 indicates a relationship between time and treatments. Nonetheless, the experimental group's depression scores decreased as a result of the treatments, according to the marginal mean plot. In all three experimental groups, the post-test score is lower than the pre-test score. In comparison to the early and middle adolescent groups, the late adolescent group undergoes a larger decline.

Table 1.11 Pairwise Comparison of Depression Score of Control & Experimental Group with respect to Age Group

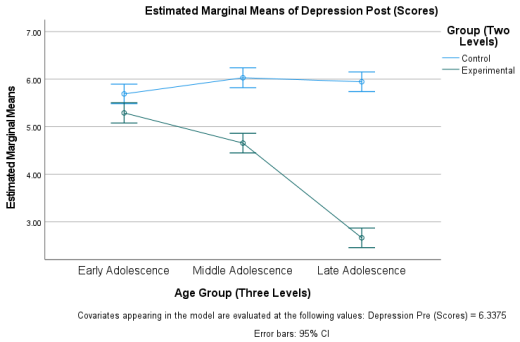
Age Group	Group		Mean Difference	p-value
	Control	Experimental		
Early Adolescence	5.70	4.30	0.40	<0.05
Middle Adolescence	6.03	4.70	1.38	<0.05
Late Adolescence	5.94	2.70	3.28	<0.05

Conclusion: The following are the conclusion drawn from the above table.

- **Early adolescence:** There exists statistically significant difference between control and experimental group in adjusted depression scores among students of early adolescence the (p-value = < 0.05).
- **Middle adolescence:** There exists a statistical significant difference between control and experimental group in adjusted depression scores (p-value < 0.05). Further, the adjusted depression among students of middle adolescence the experiment is less when compared with control group, which is a clear indication of effectiveness of treatment on depression.

- **Late adolescence:** There exists a statistical significant difference between control and experimental group in adjusted depression scores (p-value < 0.05). Further, the adjusted depression among the students in the experiment is less when compared with control group, which is a clear indication of effectiveness of treatment on depression.

Figure - 1.6: Profile plot showing Adjusted Posttest Mean scores of depression of Early, Middle and Late Adolescence group of both Control and Experimental Group



Interpretation: The disparities in posttest outcomes between the control and experimental groups across different age groups were clearly shown by the graphical representation. The experimental group has lower depression scores than the control group. The late adolescence group beat all other groups in terms of efficacy, whereas the middle adolescence group came in second and the early adolescence group last in terms of relevance.

Table 1.12: Percentage of Relative Changes in Experimental groups with respect to Control

Group	Experimental
Control	30.22%

Interpretation: Following twelve weeks of treatment, the experimental group's depression decreases by 30.22% as compared to the control group.

Table 1.13: Percentage of Relative Changes in Experimental group with respect to Control group in different age groups

Group	Experimental			
Control	Age	Early Adolescence	Middle Adolescence	Late Adolescence
	Early Adolescence	7.02%	--	--
	Middle Adolescence	--	22.88%	--
	Late Adolescence	--	--	55.21%

Interpretation: Table 1.13 shows that, in comparison to their respective control groups, depression decreased by 7.02% in the early adolescent group, 22.88% in the middle adolescence group, and 55.21% in the late adolescence group. These results suggest that teenagers' depression levels may improve more significantly as they become older, maybe because of improved coping mechanisms and social support. This pattern emphasizes how crucial it is to implement focused interventions that are appropriate for every developmental stage in order to successfully address adolescent psychology.

This suggests that after a 12-week program of dynamic exercise and PNF training, the late adolescent group saw the most decrease in depression.

IV.Discussion & Findings

The pre- and post-test results of depression showed a significant difference between the experimental and control groups after 12 weeks of training in Dynamic exercise and PNF training. Compared to the control group, the experimental group experienced an

overall reduction in depression of 30%. Tables and figures from 1.1 to 1.13 display the results related to depression, revealing differences between early adolescence, middle adolescence, and late adolescence groups.

The early adolescence group showed a reduction of 7.02%, the middle adolescence group showed a reduction of 22.88%, and the late adolescence group showed a reduction of 55.21% in depression when compared with their respective control groups. These findings indicate that as adolescents progress in age, they may experience more significant reductions in depression levels, possibly due to increased coping strategies and social support. This trend highlights the importance of targeted interventions tailored to each developmental stage to effectively address the psychology of adolescence.

This indicates that the late adolescence group experienced the greatest reduction in depression following a 12-week program of dynamic exercise and PNF training. This suggests that late adolescents are particularly responsive to such interventions, likely due to their evolving emotional and psychological resilience. Consequently, focusing on this age group could yield substantial benefits in mental health outcomes through structured physical activity programs.

These results are also supported by the following studies:

• The study by Nicola J. Wiles et al. at the University of Bristol, UK (2011), which studied 2951 adolescents to understand the relationship between physical activity and depression,. Their result showed that there was a reduction in depression symptoms in the children involved in the physical activity over a period.

• The University of Texas' Carroll W. Hughes et al. (2013) conducted a study on depressed adolescents treated with exercise (DATE), assessing a standardized aerobic exercise program to treat adolescents with major depressive disorder who were not on medication. Twelve weeks of training significantly reduced depression symptoms.

V. CONCLUSION AND RECOMMENDATIONS

CONCLUSION

- The 12-week Dynamic exercise & PNF training program significantly reduced the depression in students belong to the early, middle & late adolescence groups.

RECOMMENDATIONS

The following recommendations were made based on the conclusions:

1. The similar training programs should be added in the curriculum in educational institutions to foster physical and mental well-being among students.
2. Future research could explore the effects of training plan on other psychological parameters such as aggression, concentration, pressure etc.

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