



Assessing the Impact of Behavioral Activation Therapy on Physiological and Chemical Markers of Depression in Adolescents: A Study in Puducherry Schools

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 14 Nov 2023	<p>Background: According to WHO, Sep 2020 reported globally, depression is the leading cause of illness and disability among adolescents aged 15-19 years. Adolescence is a period in which an individual undergoes physical, psychological and cognitive changes. Additionally, the adolescent experiences changes in social expectations and perceptions. This affects how the adolescents feel, think, make decisions, and interact with the world around them. The main aim of the study is to assess the effectiveness of Behavioral Activation Therapy on Bio-physiological and Biochemical measures on Depression among Adolescents. Methods: True experimental research design (Pretest and posttest design) was obtained for this study to check the feasibility of the effectiveness of Behavioral Activation Therapy among adolescents with Mild and Moderate Depression. Demographic variables and a standardized tool Beck Depression Inventory-II (BDI-II) was given to the study participants. The total sample size was 150 adolescents with Mild and Moderate Depression. True experimental research design was used between two group pretest and posttest design). BMI and Salivary Cortisol was calculated prior to the interventions and after the interventions in experimental group and control group. Experimental group received Behavioral Activation Therapy and routine care for control group. Behavioral Activation Therapy involves 10 weeks sessions Situation-mood-activity cycle, solving intruistic issues, social skills training, shaping healthy behaviors, rewards and follow up behavior contract. Theduration of intervention was three months. After three months of duration Post test was conducted in both experimental and control group. The data were analyzed by using descriptive and inferential statistics. Data were tabulated by Sigma plot software.</p> <p>Keywords: Behavioral Activation Therapy, Adolescence, BMI, Salivary Cortisol, Depression.</p>
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1. Introduction

According to World Health Organization (WHO), adolescence is defined as a phase of life between the age group of 10-19 years. Adolescence are characterized by physical growth, emotional, psychosocial and behavioral growth, thus by bringing about the changes from childhood to adulthood. These changes usually occur a year or too earlier in girls than boys. Some of the physical changes are externally visible and some are internal. These changes are normal and natural and due to release of various hormones in both boys and girls. According to UNICEF (2021) estimated that globally, one in seven adolescents experience mental disorders. In this both boys and girls aged between 10-19 years had a prevalence of anxiety and depression about 42.9% According to Indian journal of Adolescent medicine (2019), reported statistically that adolescent period is one of the most dynamic periods of life, characterized by physical, social, emotional and cognitive changes. Globally, there are around 1.2 billion adolescents.

They constitute 20% of the world population with 90% living in low- and middle-income countries (LMICs) including 253 million from India. Adolescent depression is usually considered as a temporary condition specific to this period. It is often unidentified and untreatable (WHO 2022). Depression leaves adolescents vulnerable to social exclusion, discrimination, stigma, educational difficulties, physical health problems, and risky behaviors. Preeti Khanna et al (2020) conducted a cross-sectional study to assess the prevalence of anxiety and depression symptoms among adolescents to explore the association of these disorders with Body Mass Index. A total sample of 546 adolescents was selected between the age group of 13-15 years, studying in public schools. Anthropometric measurements were done by measuring the height through stadiometer and weight by Body fat monitor. After gathering the height and weight BMI were calculated for the adolescents. The results showed that there is an association between body weight and depression.

Body dissatisfaction is a reliable method of identifying depression. Body Mass Index (BMI) is the most common factor linked to body dissatisfaction. BMI is positively correlated with body dissatisfaction for adolescents in females. Body Mass Index, severe depression, and low self-esteem are associated with body dissatisfaction among college going students. Franklin et al found in a community, that a total samples of 2,813 Australian youths that body dissatisfaction mediated between obesity and negative self-esteem in females. Recent cross-sectional research survey study showed that a total of 1,490 youth in grades 7 through 12, obese youth reported higher body dissatisfaction and greater depressive symptoms, including anhedonia and negative self-esteem. This cohort research studies also had higher depression scores compared with overweight or normal-weight youth.

Qudsia U. Khan et al (2020) conducted a Cross-sectional study on Relationship of Major Depression with Body Mass Index and Salivary Cortisol. A total of 60 participants aged between 18 years and 60 years were included in this study. The participants were divided into two groups. One group belongs to healthy individuals another group with severely depressed groups. Patient's BMI was estimated by measuring height in meters (m) and weight in kilograms (kg), and then dividing weight with square height. Salivary cortisol samples were collected in the early morning. Salivary cortisol level was done through ELISA. Data was analyzed and $p \leq 0.05$ was considered statistically significant. The mean BMI in normal healthy group was 22.02 ± 4.21 , while the mean BMI in severely depressive group was 24.64 ± 3.58 . The difference was statistically significant ($p = 0.012$). The mean salivary cortisol level was significantly raised in patients with major depression (2.23 ± 1.69 nmol/L) in contrast to healthy normal individuals (1.46 ± 0.91 nmol/L), with p -value = 0.031.

Depression may be a serious mental disturbance among adolescents which may often affect family relationships, social functioning and academic performance. It's been related to risk of mood disorder, poor dietary habits, violent behavior, drugs and substance abuse, alcohol consumption, unprotected sex, sexually transmitted infections and suicidal ideation among students. Studies suggest that a strong relationship exists between severity of depressive symptoms and suicidal ideation in college students. Depressive disorders are consistently the most prevalent psychiatric disorder among adolescents who commit suicide, with a prevalence ranging from 49% to 64%. When we feel depressed, we become less active. The opportunities to make more active is to be positive and reward things that happen to us. So that our mood will also be activated and energetic. Behavioral Activation (BA) is the only way to practice out the vicious cycle of Depression. It is a practical and evidence-based treatment for depression. Behavioral activation (BA) is an approach to mental health that involves behaviors to influence their emotional state. It is a part of cognitive behavioral therapy (CBT), but it can also be a standalone treatment. Most research studies have focused behavioral activation on its effect on depression. This is because of an individual with depression often lose interest in activities and they are no longer enjoy in their pleasurable activities. The symptoms of depression can intensify in one's hobbies that make individual losses his or her interest.

Behavioral activation (BA) is based on one key principle that is scheduling and completing meaningful, purposeful, rewarding activities which can lift our mood, energize us, and stimulate our interest, involve ourselves with pleasurable activities in our day-to-day life. This approach is efficient, easy to learn, and works across different age ranges, especially in adolescents to reduce the levels of depression.

According to Lewinsohn's et al (2020) originally developed Behavioral Activation to treat depression. Behavioral activation helps to ease depressive symptoms in different ways such as

- Rediscover what motivates and excites you
- Build your life around what you find valuable
- Develop specific, realistic goals
- Identify and remove obstacles to your progress

Behavioral activation is a part of behavioral side of cognitive-behavioral therapy that focuses on changing what people do. Behavioral activation primarily targets depression. Behavioral Activation Sessions starts with self-monitoring of activities that means (tracking) to determine that these activities will make a person feel better. Then a person schedules his/ her pleasant activities and achievement or mastery activities. Activities which make you to feel Pleasant improves emotions in such a way to feel happy and relaxed. Achievement activities promote a sense of mastery because an individual accomplishes something, but it could not be pleasant. Behavioral Activation is followed by the theory that when people become depressed, they stop doing activities which makes them feel better. To counteract the depression and stop the vicious cycle, an individual needs to schedule pleasant activities that promote achievement and mastery.

Need for the study

Worldwide, Depression is a common mental health problem among adolescents. Depression is associated with significant disability in adolescents. Due to depression, adolescents undergo serious social and educational impairments that results in the increased rate of smoking, substance misuse (misuse of drug substances) that results in obesity. So it is the important period to recognize and treat adolescent depression. Worldwide, more than 264 million people suffer from depression. Depression is the leading cause of disability in the world (World Health Organization, 2020). According to substance abuse and mental health services association 2018, an adolescent has the highest rate of major depressive episodes (14.4%) among the age group of 12-17 years. Moderate and severe depression rise from 23.2% to 41.1% from 2007 to 2018 (Journal of Adolescent Health, 2019) According to National Crime Records Bureau, the suicide rate in Puducherry still remains much higher than the national average of 10.4 per lakh population in 2019. The number of deaths by suicide has come down from 500 in 2018 to 493 in 2019. Among the 493 deaths, 348 are males and 145 females. A majority of these deaths are due to an illness (120) or looming family problems (110). Rural Puducherry has recorded more youth suicides and the trend shows that males are more vulnerable in the Union territory than females. Socio-economic and political factors are also major reasons behind high suicide rates in Puducherry.

Kalaipriya Gunasekaran et al (2022) conducted an explanatory mixed-method design to assess the mental health status among adolescents in Puducherry. A total of adolescents aged 13-17 years attending Government schools in urban and rural Puducherry. Stratified random sampling was used to select the samples. Mental health status was screened by using a validated Youth Report Measures for Children and Adolescents – SDQ and students with higher score were considered to be at risk of mental health illness. Among 329 adolescent, 25.5% are found to be at risk of mental health illness. One fourth of the adolescents were found to be at risk of mental health illness, so periodic screening must be done at schools, for early identification and proper treatment of mental disorders. Alireza Karimpour-Vazifehkhori et al (2019) conducted a study to assess the effectiveness of Behavioral Activation Therapy on Reward seeking behavior on depressive people.

A total of 300 samples, in that 60 samples were selected through random sampling technique. Behavioral activation treatment was given including eight treatment sessions and 5 weeks later, a follow-up study was conducted. The data were collected by using a Beck Depression Inventory-II and behavioral activation system (BIS)/ behavioral inhibition system (BAS) Carver and White questionnaires, before the intervention and after the intervention and five weeks after the intervention. Data were analyzed. Results showed that there is a significant increase in the two components of the BAS including reward seeking and response to reward in the intervention group, which indicates an increase in positive affect and appetitive motivation for reward seeking and decreases the risk of depression. Also, the results showed a significant decrease in the BIS and depression in the intervention group, which indicates a decline in experiencing negative emotions.

The study concluded that this treatment will increase the positive reinforcement and lead to learning cues that predict possible rewards in environments. This study is going to assess the effectiveness of the Behavioural Activation Therapy (BAT) helps to reduce the depressive symptoms. It is believed that findings of the present study indicating the influence of BAT on reduction of depression level in adolescents which will facilitate the treatment of the individuals and prevent the stress factors stimulates the depressive symptoms. Thus, the researcher is very much interested in conducting this study.

Statement of the problem

A study to assess the effectiveness of Behavioral Activation Therapy on bio physiological and biochemical measures on depression among adolescents at selected schools in Puducherry.

Objectives

- To assess the level of depression both in experimental and control group before and after the intervention among adolescents.
- To assess the effectiveness of behavioral activation therapy on depression among adolescents in experimental group.
- To assess the effectiveness of behavioral activation therapy on level of bio physiological & biochemical parameters among adolescents with depression in experimental group.
- To associate the pretest and posttest level of bio physiological & biochemical parameters among adolescents with depression both in experimental and control group.
- To correlate the pretest and posttest level of bio physiological & biochemical parameters among adolescents with depression both in experimental and control group.

2. Materials And Methods

Study Design

This study focused on the evaluation of the effectiveness of Behavioral Activation Therapy (BAT) among adolescents who are affected by both Mild and Moderate Depression. Participants were randomly assigned to the control group and experimental group. Tools containing demographic variable, Standardized Beck Depression Inventory- II were used for pre and post assessment for both the groups. Bio physiological and Bio chemical parameters such as BMI and Salivary cortisol were studied to assess the level of depression before and after the interventions.

Settings and Samples

Participants were chosen from selected schools Mutharaiyar Higher Secondary School, Puducherry. Adolescents who met the inclusion criteria were included for the research study. The sample size of the study is Seventy-Five in each group.

Methodology

After obtaining ethical approval from Institutional Ethical Committee. The researcher obtained permission from constituent Principal and class adviser of each participant. After that data were collected with the use of Demographic variable and Beck Depression Inventory-II, Informed consent was explained to each participant. All the participants were explained about Behavioral Activation Therapy sessions. The researcher motivated to follow the activities in the morning and evening. This Behavioral Activation Therapy was practiced for the period of three months among 150 adolescents 75 in experimental and 75 in control group were segregated for the main study. The researcher established rapport with the participants. The participants in the experimental group were made to sit in a circular fashion facing each other and researcher is the moderator to implement the therapy. Privacy and pleasant environment were chosen for implementing BAT program. The BAT was administered for a month period with 30-45mts sessions for 3 days per week. Activity worksheets were given for them to practice daily. If they are not doing on time researcher will call them and remind to do the worksheets. At the end of the week after each session the adolescents has to submit their worksheets. Sessions was based on resolving intruistic issues which includes time management presentation by the researcher, Brain storming sessions to identify the cause of problem in the adolescents. Social skills training and shaping behaviors helps them to modify them into a positive mood with positive reinforcement and rewards.

In the interventional group out of 75, all of the participants were attended the sessions regularly. The 75 samples had regular follow up of sessions and their depression level was observed to decrease from moderate to mild.

At the end of the session Post-test level of depression will be assessed using BDI-II, for both experimental and control group. The biomarker for Depression will be taken again and compared for the related findings in both experimental and control group.

Ten weeks of Behavioral Activation Therapy sessions

Module/session	Material covered in each Sessions
<p>Session 1: 3 Weeks Introduction: Behavioral Activation Therapy Program & Situation – Activity – Mood Cycle Resolving Intruistic Issues</p>	<ul style="list-style-type: none"> * Self-monitoring of activities and mood by the researcher through open ended questions * Explained the model of depression used in behavioural activation treatment plan. * Researcher helped the adolescents to find out the situation – mood-activity cycle by using the model of depression. * Provided psycho-education about adolescent depression. <ul style="list-style-type: none"> ✓ Researcher motivates them to write their problems clearly. “Pump You Up” and “Bring You Down” activities. (Make the most of good feelings.) ✓ Time management (Presentation)(PowerPoint presentation was done by the researcher. ✓ Discussion through Brain storming sessions – Identified the factors/cause of the problem. ✓ Situational Vignettes is used for the adolescents to know whether they have healthy relationship and behaviour. (Selecting Good or Bad peer group)
<p>Session 2: 3 Weeks Social skills Training Shaping (Training Healthy Behaviors) Rewards</p>	<ul style="list-style-type: none"> *Maintained eye to eye contact *Understanding emotional regulation with the adolescents *Understanding IPR interaction <ul style="list-style-type: none"> - Moving away - Moving against - Moving towards *Systemic Breathing exercises (Researcher explained about this technique and encouraged the adolescents to practice. <ul style="list-style-type: none"> *Thought stopping *Fist relaxation *Positive reinforcement is used for them to modify the maladaptive(unhealthy) behaviour into adaptive behaviour(healthy) *For adaptive behaviour rewards will be given through the form of (appreciation, tokens – utilized by the students by giving money, food materials.)
<p>Session 3: 2 Weeks Follow up Behavior contract (Ending of the treatment)</p>	<ul style="list-style-type: none"> *Discussed about the improvement of healthy behaviours with friends and family members.

3. Results and Discussion

Table 1: Comparison of demographic variables of control and experimental groups for homogeneity

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S.No.	Variable	Category	Con	Exp	Statistics
1	Gender	Male	38	40	$\chi^2 = 0.0267$ P = 0.870
		Female	37	35	
2	Type of family	Nuclear	55	55	$\chi^2 = 0.0341$ P = 0.854
		Joint	20	20	
3	Place of living	Urban	44	46	$\chi^2 = 0.0278$ P = 0.868
		Rural	31	29	
4	Education of head of family	Graduate	5	3	$\chi^2 = 0.132$ P = 0.716
		Schooling	70	72	
5	Occupation of head of family	Professional	7	8	$\chi^2 = 1.074$ P = 0.584
		Office worker	3	1	
		Unskilled/Skilled	65	66	

6	Family history of psychiatric illness	No	52	50	$\chi^2 = 0.0306$ P = 0.861
		Yes	21	25	
Con = Control; Exp = Experimental n = 75 each.					

Table 1 revealed that there is a probability of demographic variables ≤ 0.05 and less was considered as statistically significant. The distribution of gender, type of family, place of living and family history of psychiatric illness was similar in both control and experimental groups showing the homogeneity of groups.

Table 2: Effectiveness of Behavioral Activation Therapy on depression in adolescents n = 75

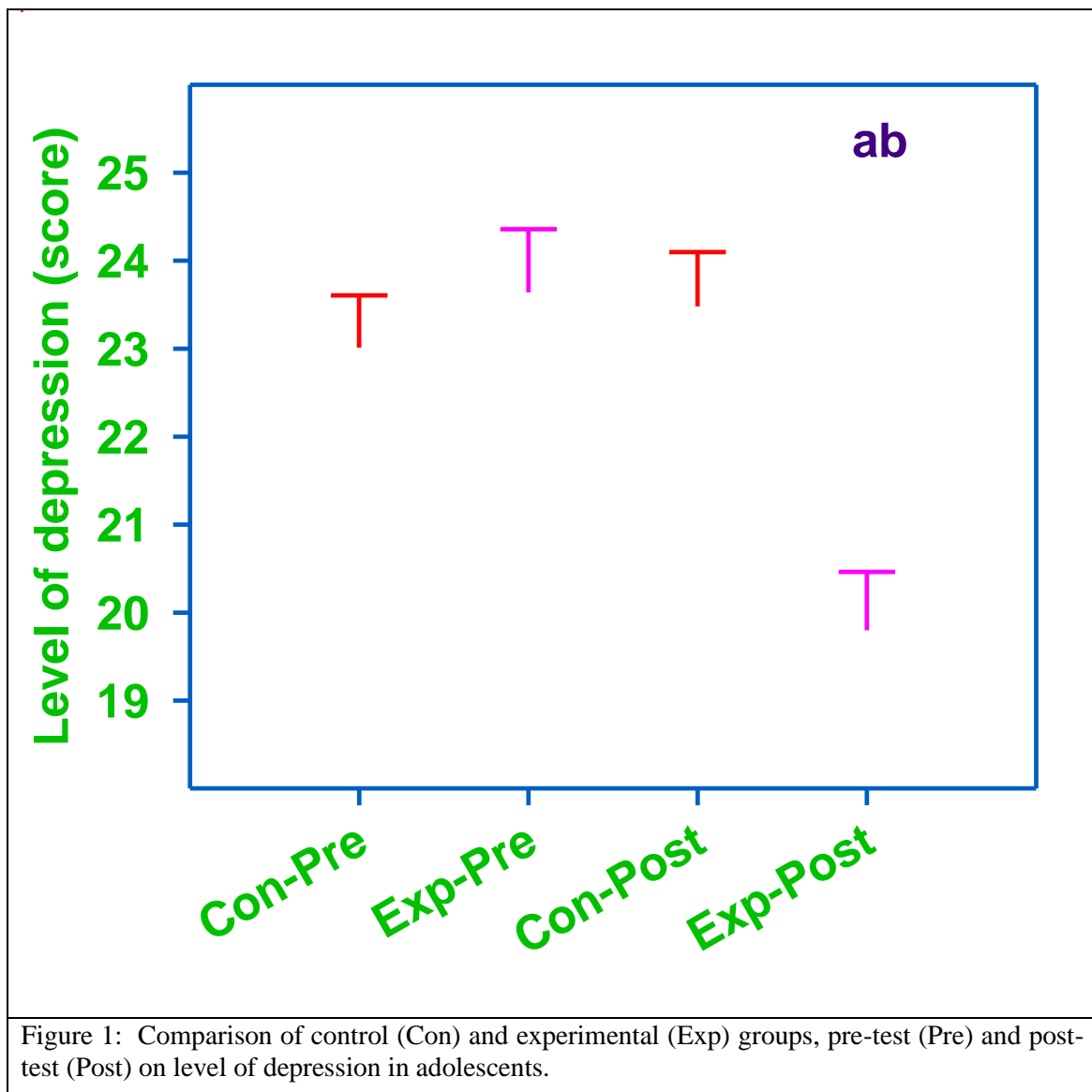
Test	Group	Depression Level			Statistical analysis	
		Mild	Moderate	Severe	Mean	All tests
Pre test	Control	16	45	14	23.013	P = 0.148
	Experimental	23	35	17	23.640	
Post test	Control	15	43	17	23.480	
	Experimental	55	8	12	19.800	

Table 2 reveals that in the pretest Control group 16, 22% were mild depression 45, 60% were having moderate depression and 14 18 % were severe depression. In the Experimental group 31% showed mild depression, 35 adolescents 47% showed moderate depression and 17, 22% were showed severe depression. In the post test in experimental 55 adolescents 73% have showed an effective change from moderate to mild depression. It was statistically significant (P=0.001). Analyzing the pre-test and the post-test together also revealed statistically significant change in depression (P=0.148). This shows that the Behavioral Activation Therapy is beneficial in reducing the depression level.

Table 3: Comparison of control and experimental groups on salivary cortisol

Table 3: Comparison of control and experimental groups on salivary cortisol by two-way RM ANOVA with Bonferroni 't' test.			
S.No	Groups and comparisons	Tests	Cortisol (ng/L)
1	Control	Pre-test	7.121 ± 0.204
	Control	Post-test	6.855 ± 0.225
	Experimental	Pre-test	7.491 ± 0.166
	Experimental	Post-test	6.569 ± 0.117
2	Significance among groups (Control and Experimental)		F = 6.763 P = 0.010
	Significance among tests (Pre-test and Post-test)		F = 0.121 P = 0.729
	Significance in the interaction (groups X tests)		F = 7.343 P = 0.008
3	Significance between Pre-tests (Control and Experimental)		t = 1.032 P = 0.303
	Significance between Post-tests (Control and Experimental)		t = 3.566 P < 0.001
4	Significance within Control (Pre-test and Post-test)		t = 2.162 P = 0.032
	Significance within Experimental (Pre-test and Post-test)		t = 1.670 P = 0.097
Values are mean ± SE n = 75 each in control and experimental groups			

Table 3 revealed that The Control and Experimental Post-tests showed significance (P < 0.001). Significant change was observed among Control Pre-Test and Post-test (within group) (P = 0.032). Among Experimental Pre-test and Post-test no significant change was observed (P = 0.097). The control group showed 5.2 % increase and the experimental group showed 4.2 % decrease in salivary cortisol. This shows that the intervention is beneficial in decreasing the salivary cortisol.



Depression is one of the most common psychiatric problems. As per the UNICEF (2021) estimated that globally, one in seven adolescents experience mental disorders. In this both boys and girls aged between 10-19 years had a prevalence of anxiety and depression about 42.9%.

Based on the Objectives of the study discussion follows:

Effectiveness of Behavioral Activation Therapy on Depression among adolescents in experimental group.

Table 2 reveals that in the pretest Control group 16, 22% were mild depression 45, 60% were having moderate depression and 14 18 % were severe depression. In the Experimental group 31% showed mild depression, 35 adolescents 47% showed moderate depression and 17, 22% were showed severe depression. In the post test in experimental 55 adolescents 73% have showed an effective change from moderate to mild depression. It was statistically significant ($P=0.001$). Analyzing the pre-test and the post-test together also revealed statistically significant change in depression ($P=0.148$). This shows that the Behavioral Activation Therapy is beneficial in reducing the depression level.

Takagaki k et al, (2018) evaluated a study on the effectiveness of Behavioral Activation Therapy on Depressive symptoms. A total sample of 118 adolescents were participated in the study. 62 participants belong to Experimental Group and 56 participants from control group. Behavioral Activation Therapy consisted of five-weekly sessions with 60-minute duration. Participants underwent a structured interview and completed self-report scales at 1 year post-assessment. Students receiving treatment had significantly decrease in mean Beck Depression Inventory, second edition scores at 1-year follow-up than control group students. The effect size (Hedges' g) for between-group differences at 1-year follow-up was -0.41.

Effectiveness of behavioral activation therapy on level of bio physiological & biochemical parameters among adolescents with depression in experimental group.

Table 3 revealed that The Control and Experimental Post-tests showed significance ($P < 0.001$). Significant change was observed among Control Pre-Test and Post-test (within group) ($P = 0.032$). Among Experimental Pre-test and Post-test no significant change was observed ($P = 0.097$). The control group showed 5.2 % increase and the experimental group showed 4.2 % decrease in salivary cortisol. This shows that the intervention is beneficial in decreasing the salivary cortisol. Zhkowska et al (2022) conducted a Systemic review and meta-analysis study on cortisol and development of depression in adolescence. Twenty-six studies were included in the systematic review and 14 were eligible for the meta-analysis, but only one study included young adults in their sample. Results from the meta-analysis demonstrated that elevated morning cortisol levels was associated with Major Depressive Disorder (MDD) development in adolescence and young adulthood in the future. However, morning cortisol levels did not significantly differ between healthy controls and individuals with Major Depressive Disorder in cross-sectional studies. Cortisol level in the afternoon and cortisol stress response also did not differ between adolescents with Major Depressive Disorder and healthy controls. Qualitative synthesis of the three studies examined the nocturnal cortisol level that showed a higher nocturnal cortisol which was both longitudinally and cross-sectionally associated with Major Depressive Disorder (MDD) in adolescence. A significant overall effect was found showing that higher baseline cortisol levels in adolescence were associated with the development of depression at a later stage (MDD $n = 122$; no MDD $n = 739$), (SMD= 0.37, 95% CI 0.10, 0.64, $p = .006$). The heterogeneity between the studies was low ($\chi^2 = 8.31$, $I^2 = 40\%$, $p = .14$).

The overall findings of this main study report showed that the tools are effective and appropriate for reducing the level of Depression. Salivary cortisol was carried out by a laboratory technician in Fastha Computerized Lab, Pondicherry which enhanced accuracy and consistency in the reports. The study highlights the need and awareness about their thoughts, emotions and restless mood to feel relaxed in adolescents.

4. Conclusion

Recent trend move towards Behavioral Activation Therapy creates awareness to propose new research in psychiatry. Our present study is about an effect of a Therapy in reducing the level of Depression. Main study reveals that there is a significant relationship between pre and post assessment of Beck Depression Inventory among the adolescents. The feasibility of conducting such research study justifies the need to put an effort to get an overall effectiveness of this therapy to reduce the level of depression among adolescents in India

Conflict of interest:

There is no conflict of interest.

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