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Effect of Calisthenic exercise on stress response among School going children in selected school of Bhubaneswar, Odisha

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ABSTRACT

Introduction: Calisthenic exercises helps the body become firmer and more energized, which improves general health and promotes mental health, which has found helpful in reducing stress, and anxiety.

Aim of the study: The purpose of this study was to assess the effectiveness of Calisthenic exercises on stress among school going children.

Method: Randomized controlled study, 220 school-age youngsters, were randomly allocated into two equal groups: the experimental group (n = 110) and the control group (n = 110) were assigned by Callisthenic exercises for 30 minutes each day for three weeks. Each participant received a self-structured questionnaire to collect demographic data. Perceived Stress Scale collected measures of degree of stress - Children (PSS - C).

Result: After completed Calisthenic exercises, 57.27% of children had moderate stress level. Experimental group participants recorded better stress level reduction than the control group. The level of stress ratings before and after the test were significantly different (U value=3198, p value=0.00001) with mean difference 20.98, SD was $\pm$5.82 at 0.05 level of significance.

Conclusion: Calisthenics are a type of exercise that both lowers mental tension and physically promotes brain function. Additionally, making Calisthenics a regular part of the education curriculum in schools may assist in improving children' cognitive and psychological wellness.

Keywords: *Callisthenic exercise, Stress, School-going children*

1. INTRODUCTION

Instead of simply being free of illness or other impairments, Health is described by the World Health Organization as a complete state of mental, physical, and social well-being. This means that physical, mental, or psychic abnormalities can lead to illness in humans. In recent times, people of all ages are thought to be affected by illness, the onset of diseases, and disabilities due to stress, which is expanding rapidly and experiencing an increase in expectations **(1)**. An intense contact between a person and their environment is considered as the stress. In this relationship, work-related boundaries may be viewed as potentially surpassing the person's abilities **(2)**. In comparison to uneasiness or anxiety, stress also promotes creativity, talents, and energy, though it has the possibility of leading to physical or mental strain and illness And psychological factor that affects school performance is stress **(3)**.

In addition to becoming an issue in the workplace, stress and anxiety can also have an impact on children. The children may experience stressors such as social, environmental, intellectual, emotional, personal, and family. This stress could impair with the children' ability to learn and academic success **(4)**. The stress put on by these common occurrences may have long-term impacts on children's health, causing in anxiety and other health issues. Providing the children coping mechanisms may enable them to deal with these stressors more effectively and prevent future health problems **(5)**. Regular workouts will verify for their improved mood due to the stimulation of brain chemicals called neurotransmitters during exercise. Because neurotransmitters are known to help, you feel better and less anxious by mediating other people's moods and emotions. **(6)**. According to a recent UNICEF (2021) report [10], India has the highest percentage of teenagers worldwide, with "253 million numbers; every fifth person is between 10 and 19 years old." For society, the nation, and the entire world to grow, these teenagers' safety is essential **(7)**. According to a meta-analysis by Malhotra and Patra, 23.3% of school-aged adolescents and over 6.5% of the community had significant mental health problems **(8)**. According to recent studies, there is evidence to support the assertion that "every hour a student commits suicide and that almost 12% of Indian students between the ages of 4 and 16 suffer from mental health issues." **(9)**.Calisthenics are exercises that can be done anywhere by use of body weight as resistance. Without joining a gym, callisthenics is a great way to boost your mood and build muscle **(10)**. Calisthenics are a type of active, aerobic exercise. They are delightful, rhythmic exercises that may be done alone or in a group setting and are easily changed to meet the fitness levels of the participants. Jumping jacks are a common Calisthenic that also promote heart health and stress reduction **(11)**. These workouts are believed to enhance mental health, which aids in the treatment of conditions including depression, stress, and anxiety. Calisthenic exercises can aid in reducing body fat and promoting fitness **(12)**. Exercise releases endorphins, the body's natural benzodiazepines, into the bloodstream, which can make people feel tranquil and at ease before, during, and for three hours after exercise. Smokers may quit or cut back since exercise makes it more difficult to perform aerobically, and others may eat more healthfully to enhance performance **(13)**.

2. METHODS

Design and sample

This is a pilot ongoing randomized controlled study with an intention-to-treat design. We conducted a quasi-experimental study amongst school going children between March and April 2022. Using an interviewer-based questionnaire that was already pretested, the study used a quantitative approach. The participants in the study were determined by convenient sampling. They included 220 school going children (11-14 years, 7th and 8th standard) studying in Kalinga High School, Sampur and Saraswai sisu Mandir, Ghatikia, Bhubaneswar, Odisha and who had stress. The children were assigned randomly into an experimental group and control group by using Flip coin method.

Inclusion and exclusion criteria

School going children those who were aged between 11 to 14 years. Children who were well at the time of data collection and had no medical history. Those who were agreed to take part in this study and available.

Children who had previously participated in a Callisthenic exercise programme and the exclusion criteria included people who had ailments that were orthopaedic-related. Those who were having any systemic diseases, uncooperative subjects and were unable to comprehend.

Procedure and instrument

A standardized scale and a structured questionnaire were used to evaluate the participants' sociodemographic information. 14-question Perceived Stress Scale for Children (PSS-C) was used to determine the stress levels among school-age children.

The necessary approval was obtained from the relevant authorities, and the parents' and children' informed consent was secured. Prior to the intervention researcher had taken sample those are having stress and were placed into two groups trial and comparison group. Through randomization, the sample was split into an experimental and control group according to the sample allocation technique (flip coin method). They were provided a pre-test questionnaire during the initial two days, and they were asked to respond positively to each item in order to determine their level of stress prior to Calisthenics. An experimental group received three weeks of callisthenics following the assessment and before the demonstration.

The researcher took attendance before performing the Calisthenics. Every day for 30 minutes the experimental group performed the Callisthenic exercises from 3:30 to 4:00 p.m. Each activity under Callisthenic exercise was taken three minutes, after each activity 1 minute rest taken, continued for 30 minutes for 3 weeks. Each participant was given a task to complete while being observed, corrected, and given an assignment. Every day, the researcher observed the participants' Calisthenics and provided encouragement.

	Exercise	Duration
1.	Jumping jacks	3 min
2.	Neck rolls	3 min
3.	Free – hand neck resistance	3 min

4.	Arm circles	3 min
5.	Alternating toe touches	3 min
6.	Trunk twists	3 min
7.	Abductor/adductor leg raises	3 min
8.	Prone leg extension	3 min
9.	Standing one-legged toe raises	3 min

9 x 3 = 27, 1 min pause after every 3 exercises.

Experimental and control group was given a post-test one day after the completion of intervention period to assess the effect of the Callisthenic exercise. The Perceived Stress Scale - Children (PSS-C) post-test was given at the completion of three weeks of Callisthenic exercise sessions in order to measure the level of stress experienced by school-age children during the fourth week.

Data analysis

In order to evaluate the baseline data, frequency and percentage were being used. The mean, standard deviation, frequency, and percentage of children enrolled in school were computed to analyse stress.

Chi-square analysis were done to determine the interrelation between the Callisthenic exercises on stress response between school going children with chosen demographic profiles. Nonparametric variables were assessed using the Wilcoxon Signed Rank Test and the Mann-Whitney 'U' test and assess the impact of Callisthenics in reducing stress among school going children by using IBM SPSS software (version 20).

3. RESULTS

Table-1: Distribution of participants' frequency (f) and percentage (%) values in relation to their socioeconomic variables.

N=220(n1=110 +n2=110)

Demographic information	**Experimental group**		**Control group**	
	(f)	**(%)**	**(f)**	**(%)**
Age in years				
11 to 12	43	39	38	34.5
13 to 14	67	**61**	72	**65.4**
Gender				
Male	56	**50.9**	74	**67.3**
Female	54	49.1	36	32.7
Educational standard				
7^{th}	53	48.2	50	45.5
8^{th}	57	**51.8**	60	**54.5**
Occupation of father				
Government	25	22.7	11	10
Private	25	22.7	33	30
Business	39	**35.5**	40	**36.4**
Others	21	19.1	26	23.6
Occupation of mother				

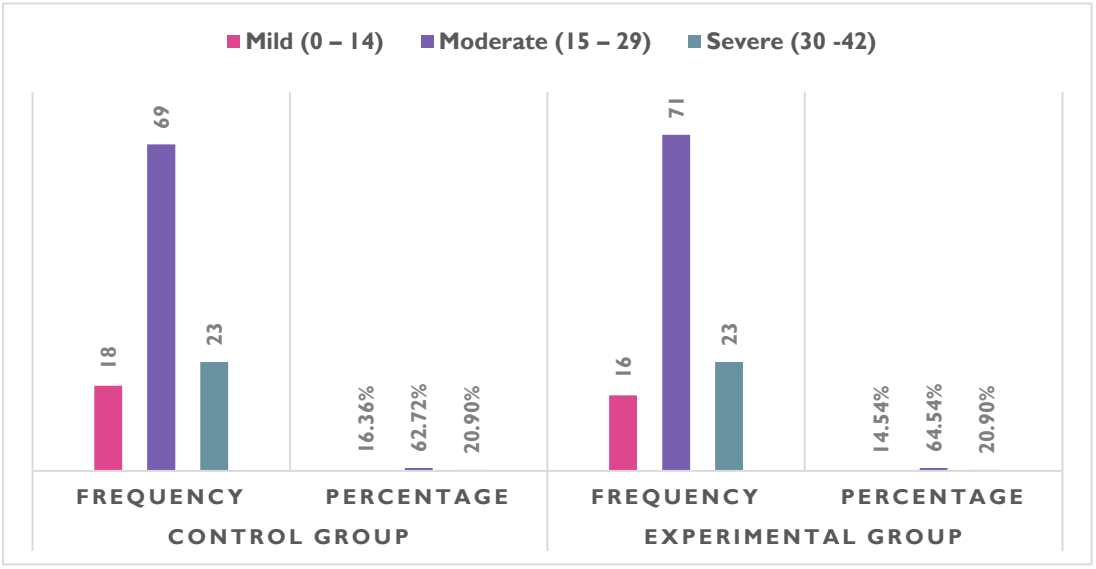
Government	19	17.3	3	2.7
Private	14	12.7	8	7.3
Business	8	7.3	2	1.8
Others	69	**62.7**	97	**88.2**
Monthly family income in rupees				
<10,000	61	**55.5**	25	22.7
10,001 – 20,000	19	17.3	35	**31.8**
20,001 – 30,000	14	12.7	35	31.8
>30,001	16	14.5	15	13.6
Types of family				
Nuclear	63	**57.3**	56	**50.9**
Joint	34	30.9	48	43.6
Extended	13	11.8	6	5.5
Residence				
Rural	13	11.8	36	32.7
Urban	97	**88.2**	74	**67.3**
Study time per day in hours at home				
<1	28	25.5	6	5.5
1 – 2	30	27.3	40	36.4
>2	52	**47.3**	64	**58.2**
Method of recreation				
Gardening	11	10	7	6.4
Playing	55	50	52	**47.3**
Watching TV	13	11.8	29	26.4
If any others	31	**28.2**	22	20
Rest and sleep time per day in hours				
8	91	**82.7**	97	**83.6**
9	12	10.9	7	4.5
10	7	6.4	6	6.4

61% children were 13-14 years in intervention group and 65.4% in control group. In relation to gender of the children, 50.9% were male in treatment group and 67.3% male in comparison group. In relation to educational standard 51.8% were 8th in experimental class and 54.3% in control group. 35.5% children's occupation of father were business in test group and 36.4% in placebo group. In occupation of the mother of the children, 62.7% were others in experimental class and 88.2% in control group. 55.5% of children's monthly family income were <10,000 rupees in intervention group and 31.8% of children had monthly family income of 10,001 to 20,000 rupees in control class. 57.3% of children's family type were nuclear in test

group and 50.9% in comparison group. 88.2% of children had rural residence in experimental class and 67.3% of children in control group. 47.3% of children had >2 hours study time per day at home in treatment group and 58.2% had the same study time in placebo group. 28.2% children's method of recreation were other than gardening, playing and watching TV in intervention group and 26.4% children's method of recreation were watching TV in comparison group. In relation to rest and sleep time per day in hours of the children, 82.7 were 8 hours in treatment group and 83.6% in placebo group.

Chart – 1: Pre-test division of stress levels for both the experimental group and control group by frequency (f) and percentage (%).

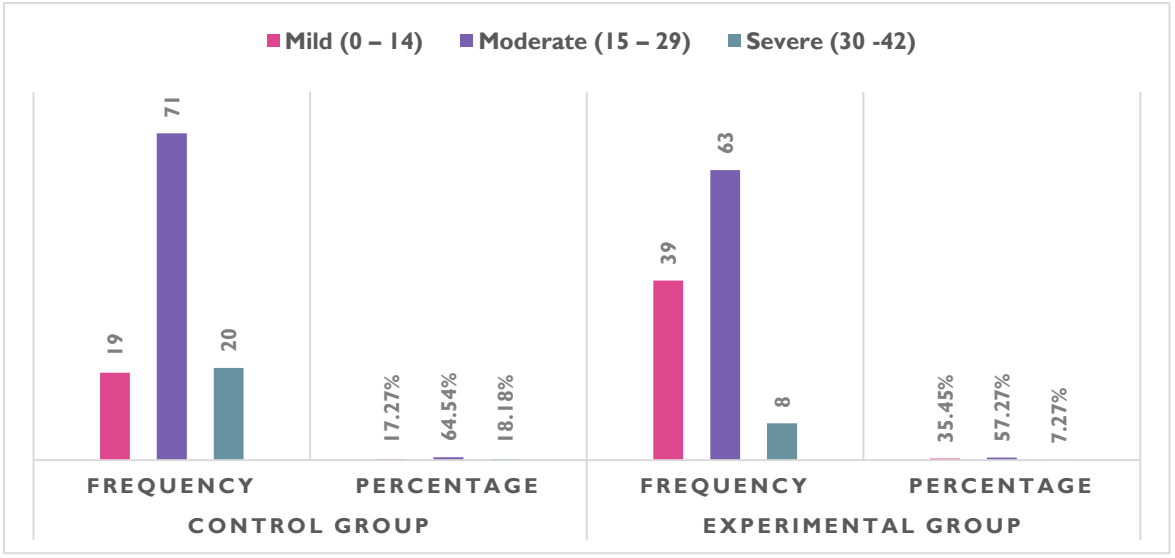
N=220(n1=110 +n2=110)



In experimental pre-test group 64.54% children had moderate stress and 20.9 % had severe stress in both intervention and comparison group.

Chart – 2: Distribution of stress levels between the intervention group and the comparison group in terms of frequency (f) and percentage (%) in the post-test.

N=220(n1=110 +n2=110)



Maximum 57.27% of children in the experimental post-test group reported high stress levels, compared to 18.18% of children in the control group who had extreme stress.

Table-2: Comparison of before-test & after-test stress level of intervention group by Wilcoxon Signed Rank 'z' test.

N=220(n1=110 +n2=110)

Group	Item	Mean ± SD		Z- value	p value
		Pre-test	Post-test		
Experimental group	Stress	23.89±6.22	20.98±5.82	3.399	0.001*

P≤0.05*(statistically significant)

In the intervention group, with a statistically significant p value of 0.001, the mean post-test stress rating was lower than the mean pre-test stress level. The pre-test and post-test findings significantly differed at a p value less than 0.05 scale of significance of school-going children in the reduction of stress through Callisthenic exercises.

Table-3: Wilcoxon Signed Rank 'z' test was used for comparison of placebo group's before test and after test stress level.

N=220(n1=110 +n2=110)

Group	Item	Mean±SD		Z- test	p value
		Pre-test	Post-test		
Control group	Stress	24.42±5.91	25.24±5.96	1.298	0.194

P≤0.05*(statistically significant)

The mean score of post-tests stress level was higher than the mean score of pre-tests stress level in comparison group, with the p value 0.194, which was not statistically significant. There were no considerable difference between before test and after test ratings of school-going children in lowering of stress through Calisthenic exercises at p value greater than 0.05 level of significance.

Table-4: Comparison of post-test stress level of intervention & comparison group by Mann-Whitney U test.

N=220(n1=110 +n2=110)

Item	Groups	Mean±SD	Mann-Whitney U value	p value
Stress	Experimental group	20.98±5.82	3198	0.000*
	Control group	25.24±5.96		

P≤0.05*(statistically significant)

The 'U' value of 3198 with a p value of 0.000, which was a true different, indicated significant statistically of the mean post-test level of stress for both the treatment and placebo groups. Inferences suggest that the level of stress was reduced in the post-test of the treatment group at a p value less than 0.05 level of importance since the post-test results of the experimental group and control group differed significantly.

Table -5: Association between the level of stress with the sociodemographic factors by Chi-square analysis in intervention group.

N=220(n1=110 +n2=110)

Demographic Variables	Level of stress			Chi-square	df	P value
	Mild (0 – 14)	Moderate (15 – 29)	Severe (30 – 42)			
Age in years						
11 – 12	8	26	9	0.982	2	0.612
13 -14	8	45	14			
Gender						
Male	14	34	8	11.225	2	**0.004***
female	2	37	25			
Educational standard						
7th	16	31	6	22.859	4	**0.000***
8th	0	40	17			
Occupation of father						
Government	2	19	9	6.880	6	0.332
Private	6	11	14			
Business	5	26	8			
Others	3	15	15			
Occupation of mother						
Government	4	14	1	7.190	6	0.304
Private	2	7	5			
Business	0	5	3			
Others	10	45	14			
Monthly family income in rupees						
≤10,000	8	48	5	18.074	6	**0.006***
10,001 – 20,000	4	10	5			
20,0001 – 30,000	2	5	7			
≥30,001	2	8	6			
Types of family						
Nuclear	8	42	13			
Joint	8	19	7	4.706	4	0.319
Extended	0	10	3			

Residence						
Rural	1	10	2	1.041	2	0.594
Urban	15	61	21			
Study time per day in hours at home						
<1	5	20	3	11.412	4	**0.022***
1 – 2	5	23	2			
>2	6	28	18			
Method of recreation						
Gardening	0	11	0	10.096	6	0.121
Playing	11	34	10			
Watching TV	2	8	3			
If any others	3	18	10			
Rest and sleep time per day in hours						
8	14	59	18	3.068	4	0.546
9	2	6	4			
10	-	6	1			

P≤0.05*(statistically significant)

The computed p value was less than the tabular value at a significance level of 0.05, implying an interrelation between the before test stress level and certain demographic factors such as gender, educational standard, monthly family income in rupees, and study time per day in hours at home. The levels of stress among school-age children were inferred to be highly associated with the gender, educational level, monthly family income in rupees, and study time per day in hours at home.

Table - 6: Chi-square analysis of the selected sociodemographic variables with the stress level in the comparison group.

N=220(n1=110 +n2=110)

Demographic Variables	**Level of stress**			**Chi-square**	**df**	**P value**
	Mild (0 – 14)	**Moderate (15 – 29)**	**Severe (30 – 42)**			
Age in years						
11 – 12	3	30	5	12.667	16	0.697
13 -14	6	61	5			
Gender						
Male	4	63	7	14.608	16	0.554
female	3	30	3			
Educational standard						
7^{th}	5	42	4	9.886	16	0.873
8^{th}	3	50	6			
Occupation of father						

Government	2	09	-	47.519	48	0.492
Private	1	30	2			
Business	6	30	4			
Others	3	19	4			
Occupation of mother						
Government	1	2	-	53.352	48	0.276
Private	4	6	19			
Business	1	2	-			
Others	9	80	9			
Monthly family income in rupees						
≤10,000	4	18	3	41.516	48	0.734
10,001 – 20,000	2	29	4			
20,0001 – 30,000	3	30	1			
≥30,001	4	10	1			
Types of family						
Nuclear	6	45	5			
Joint	4	40	4	26.382	32	0.746
Extended	2	3	1			
Residence						
Rural	3	30	3	12.499	16	0.709
Urban	7	60	7			
Study time per day in hours at home						
<1	2	4	1	20.796	32	0.936
1 – 2	6	30	4			
>2	7	50	6			
Method of recreation						
Gardening	2	4	1	50.669	48	0.369
Playing	10	40	2			
Watching TV	3	23	3			
If any others	4	14	4			
Rest and sleep time per day in hours						
8	10	84	10	60.824	64	0.518
9	1	3	1			
10	-	1	-			

P≤0.05*(statistically significant)

The selected demographic component and the level of stress experienced before to the test did not associated. The levels of stress among school-going youngsters and their chosen demographic factors in the comparison group did not significantly associate.

4. DISCUSSION

In present study, the majority children's family monthly income in both experimental group (55.5%) and control group (22.7%) were below 10,000 rupees. This result is supported by Christy Vijay et al also stated in his study that, stress was so much more common as the socioeconomic status of the 43.6% of parents deteriorated. This illustrates that teenager whose parents had low socioeconomic status had higher stress levels **(14)**.

In this study, before administering the Calisthenic exercises, maximum 64.54% of children had moderate level of stress score in treatment and 20.9 % had severe stress in both treatment and placebo group. Evangelista RAGT et al also found in his study that stress response of students was 7.62±8.58 before the callisthenics training session **(15)**.

In present study, after administering the Calisthenic exercises, Maximum 57.27% of children in the experimental class scored moderately stressed, whereas 18.18% of children in the control class scored severely stressed. Balarmathi et al (2016), also stated that Teenagers who participated in the post-test in his study reported both moderate (82.95%) and low (17.04%) academic stress. **(16)**.

Dr. Yajuvendra Singh Rajpoot (2021) stated that after receiving Calisthenic exercises in the experimental group of his study, children's anaerobic capacity significantly increased from 31.86 to 43.81 and from 30.68 to 35.39 in the control group. The outcome of this study indicates the variance in aerobic capacity and anaerobic capacity among the before test and after test means **(17)**.

The results of this investigation showed a significant association between stress levels and their demographic profiles of eighth standard children had monthly family income below 10,000 and their study time between 1 to 2 hours per day at home. Krisha Lal stated that the relationship between adolescent academic stress and demographic and IQ characteristics. This study found that the male senior secondary school students had less academic stress than their female counterparts **(18)**.

5. CONCLUSION

Calisthenic exercises are beneficial in decreasing stress levels among school-aged children, according to the study's findings. Calisthenics are a type of physical activity that both lowers mental tension and physically enhances brain function. Additionally, making Calisthenics a regular part of the education curriculum may assist in improving children' cognitive and psychological development.

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