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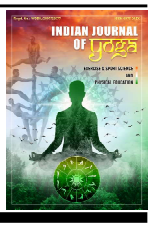

Experiment

Effect of Hatha Yoga on BMI and Health-Related Quality of Life of Obese Children: A Pilot Study

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ABSTRACT

The present study aimed to find out the effectiveness of six-week hatha yoga training programme on BMI and health-related quality of life on obese children. For the purpose of the study 10 obese children selected through random purposive sampling technique from Bolpur, Birbhum, West Bengal, India. They were divided into two groups, namely HYG (N-5) and CG (N-5). BMI was calculated through height and weight. SF 36 questionnaire was used to get the information on health-related quality of life. The gathered information were analysed through ANCOVA and the significant level was kept at 0.05. The ANCOVA revealed that the six week hatha yoga training program is effective for the improvement of BMI and health-related quality of life of obese children.

1. General introduction:

The global health problem of the 21st century is childhood obesity, which is growing daily in urban areas. Excessive intake of foods, genetic issues, low levels of activity, etc., is causing childhood obesity (Sahoo et al., 2015). Excessive fat carried by obese children in their bodies affects their health (World Health Organization, 2011). Regular physical activity, controlled food habits, and adequate water are necessary to maintain the ideal body weight and good health. (Pataky et al., 2014).

Obesity affects not just physical health but also social and psychological health (Williams, 2005). So the children's behavior is changing, and their social interactions are decreasing due to low self-esteem (Department of Health & Human, 2021). They also face various mental health problems like anxiety, depression, and being socially isolated from peers because of obesity (Childhood Obesity, 2023).

Due to obesity, children have less physical and social health (Sahoo et al., 2015) and poor mental health (Morrison et al., 2015). It was found that those with increased fat have a negative effect on their health-related quality of life (HRQOL) than those with normal fat (Ottova et al., 2012; Wong et al., 2013).

The health-related quality of life (HRQOL) questionnaire is a handy tool to know the status of obese children's physical, mental, emotional, and social health (Aguilar-Cordero et al., 2021). The HRQOL is mainly used to examine children's overall health-related quality of life (Yin et al., 2016). This HRQOL has been used effectively since 1980 to determine the overall quality of life (HRQOL Concepts | CDC, 2018).

Children need exercise or physical activities to reduce fat and improve overall health (Harvard T. H. Chan, 2012). So, yoga is vital in improving health and core muscle strength (10 Yoga Poses to Strengthen Your Core, 2020). Many types of yoga, like Karma yoga, Hatha yoga, Ashtanga yoga, etc., reduce body fat and improve health quality (Different Types Of Yoga, 2023).

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'Hatha' is a Sanskrit word that means 'stubborn'. Every day a stubborn practice of yoga for improving health is called hatha yoga. Hatha yoga exercises improve body posture, breathing techniques, muscle strength (Dawson, 2021), and health quality (Ashish, 2020). Besides these, many hold poses asanas included in hatha yoga also help to improve the body structure and core muscle strength (Jain, 2019)

1.1. Aim and Objectives: The present study aimed to determine the effect of six weeks hatha yoga training program on the health-related quality of life of obese children.

2.1 Participants:

We selected ten (10) obese children aged 12 to 18 years from Bolpur, Birbhum, West Bengal, India, through a random purposive sampling technique. According to WHO BMI criteria (Ghosh & Mukherjee, 2022), we have divided them into two groups equally (See Table 1 and Table 2), namely, the Hatha Yoga Group (HTG, N-05) and the Control Group (CG, N-05).

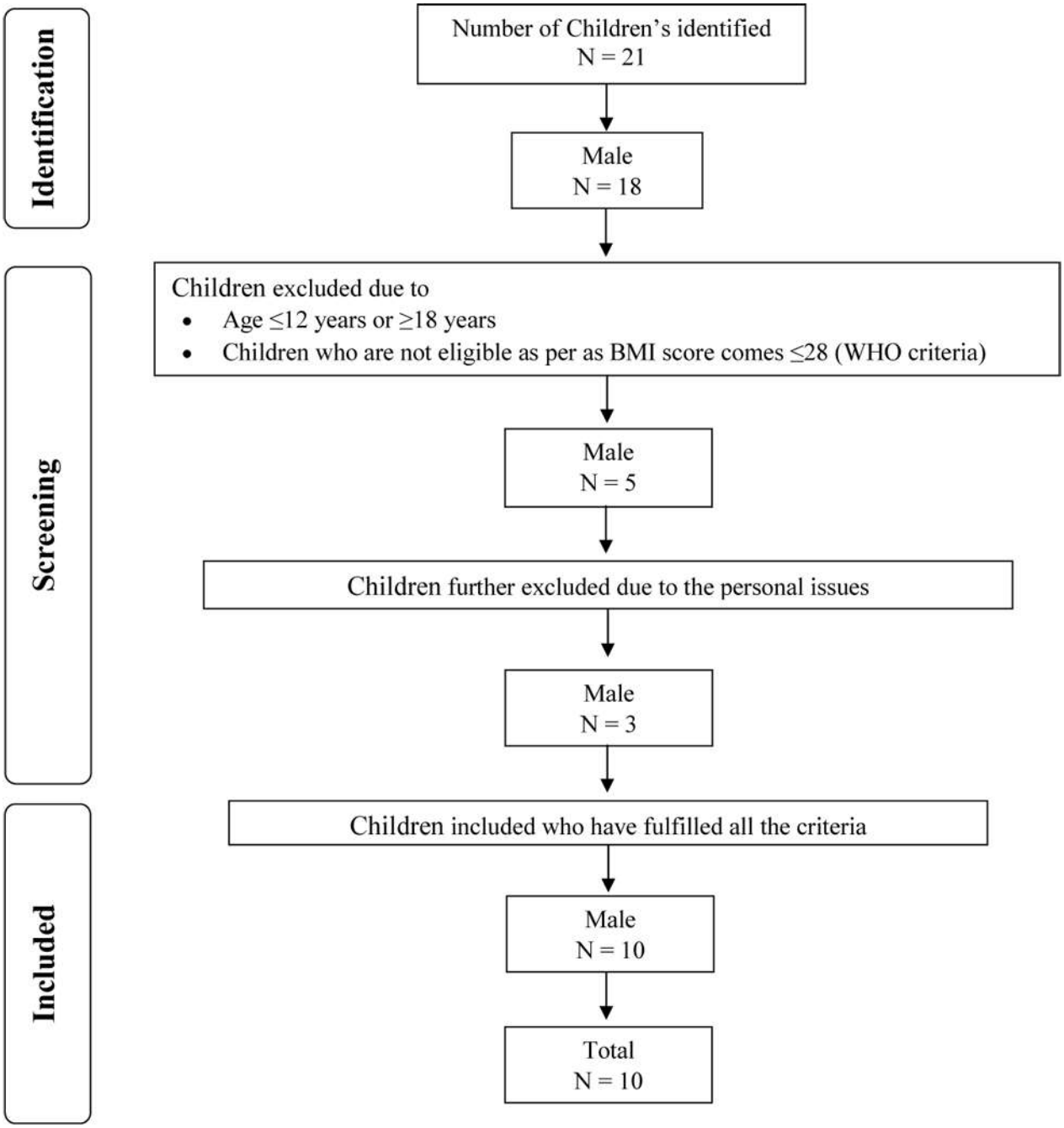
Table – 1: Inclusion and exclusion criteria of the participants.

Inclusion Criteria
❖ Children from Bolpur, Birbhum, West Bengal, India. ❖ Children Age 12 to 18 years male. ❖ Children eligible as per as BMI score comes ≥28 (WHO criteria).
Exclusion Criteria
❖ Children not from Bolpur, Birbhum, West Bengal, India. ❖ Children aging ≤12 years or ≥18 years. ❖ Children who are not eligible as per as BMI score comes ≤28 (WHO criteria)

Table – 2: BMI of Training and Control Group

Criteria	Subject	Training Group	Control Group
BMI	1	30.26	30.02
	2	30.18	28.26
	3	30.08	28.16
	4	30.04	28.13
	5	30.02	28.04

Figure 1: Flow chart of Inclusion and Exclusion Criteria of the participants



2.2. Criterion Measures:

After reviewing the available literature, the researchers selected the appropriate criterion measures (Table 3) to get information about the selected subjects' health-related quality of life and BMI.

Table – 3: Criterion Measures

Tool	Variables	Scoring
Health Related Quality Of Life (SF 36)	Physical Functioning	Number
	Role Physical	
	Bodily Pain	
	General Health	
	Vitality	
	Social Functioning	
	Role Emotion	
	Mental Health	
Body Mass Index (BMI)	Height	Meter
	Weight	Kg

2.3. Design of the Study:

At first, the researcher randomly selected the fatty children by seeing the children's physiques. Then the children's weight is measured by a weight machine, and height is measured with the Stadiometer. We calculated the BMI by their Weight and Height. We selected children with BMI scorese"28 by WHO criteria for the study. According to their BMI, we selected ten (10) children and divided them into two groups, i.e., Hatha Yoga Group (HYG) N - 05 and Control group (CG) N – 05 (see Table 2). The researcher explained the benefits of the study. We have also explained the procedure for answering the questionnaire. The Hatha Yoga training program was administered for a week of three days and forty minutes per season, which is a six-week training program. Before the training program started, we pre-tested the selected parameters through SF 36 (SF36_healthsurvey_ch6.Pdf, n.d.) and took the post-test after the six weeks of the training program for both groups. The HYG did six weeks of hatha yoga training, and the CG did regular daily activities.

The researcher reviewed many articles, research papers, and journals, saw many Web portals and YouTube videos, and then prepared and finalized the hatha yoga training program (see Table 4) with the consultation of experts.

Table – 4: Hatha Yoga Training Programme

Day	Exercise Name	Repetition (Sec.)		Recovery (Sec.)	Set
		Right	Left	Each side	
DAY-1	1) Tadasana (Garg, 2023)	20		30	3
	2) Vrikshasana (Gupta, 2023)	20	20	30	
	3) Halasana (Ray et al., 2011)	20		30	
	4) Paschimottanasana (KANWALJEET et al., 2009)	20		30	
	5) Sarvangasana (Ray et al., 2011)	20		30	
Day-2	1) Vrikshasana (Gupta, 2023)	20	20	30	3
	2) Bhujangasana (Ray et al., 2011)	20		30	
	3) Boat Pose (Huang et al., 2013)	20		30	
	4) Salabhasana (lily, 2013)	20		30	
	5) Virabhadrasana (Lau et al., 2015)	20	20	30	
Day-3	1) Vrikshasana (Gupta, 2023)	20	20	30	3
	2) Adho Mukha Svanasana (Gupta, 2023)	20		30	
	3) Sarvangasana (Ray et al., 2011)	20		30	
	4) Dhanurasana (Lau et al., 2015)	20		30	
	5) Eka Pada Adho Mukha Svanasana (Santuka, 2022)	20		30	

2.4. Statistical Tools Used:

In this study, the researcher used mean and standard deviation for the descriptive statistics to get pre-test and post-test score information. The normality of the data tested through skewness and kurtosis scores. We used the Analysis of covariance (ANCOVA) in SPSS software to know the effectiveness of hatha yoga on BMI and health-related quality of life of obese children. In all the variables analyses, the significance level was kept at 0.05. The improvement of BMI and health-related quality of life between the two groups separately, i.e., pre-test and post-test scores has been shown through percentage. The researchers also showed the graphical representation of pre-test and post-test performance.

3. Result:

The researcher tries to establish the effectiveness of six weeks of hatha yoga training program on BMI and health-related quality of life of obese children. The ANCOVA and descriptive analysis were used to interpret the pre-test and post-test data.

TABLE 5: Descriptive Analysis of BMI

Variable	Hatha Yoga Group				Control Group			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BMI	30.12	0.100	27.32	0.324	28.52	0.842	28.80	0.846

The above table shows the mean and SD scores of pre and post-test data of BMI for both groups. The post-test mean scores for HYG show improvement over the pre-test mean score, but no changes can be seen in CG's pre-test and post-test BMI scores. (see Table 5 & Fig. 1) The skewness scores (pre and post) range between -2 and +2, and the kurtosis scores (pre and post) range between -7 and +7 for both groups, proves that the normality of the data (Hair et al., 2010). (See Table 6)

FIG 1: Descriptive Analysis of BMI

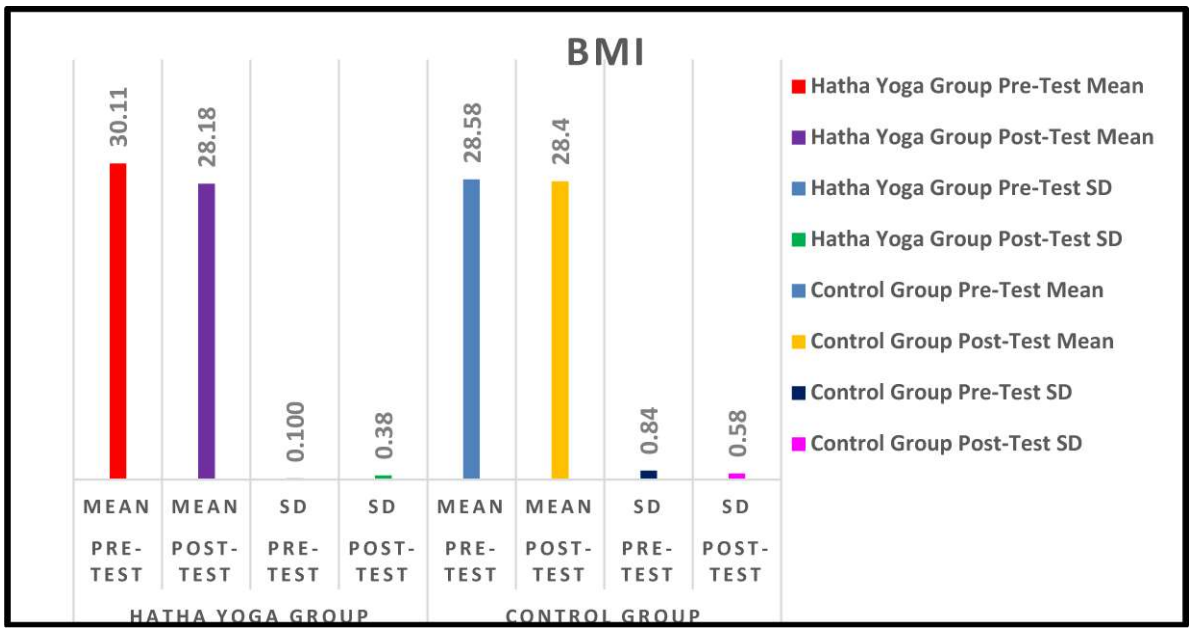


TABLE 6: Normality of BMI Scores

Variable	Hatha Yoga Group				Control Group			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	A	B	A	B	A	B	A	B
BMI	.751	-1.296	.408	-1.062	2.188	4.826	.213	.219

A – Skewness; B - Kurtosis

TABLE 7: ANOVA Table of Pre-test Data for BMI

Variables	Sources of Variance	d.f	Mean Square	F-ratio	Sig.
BMI	Between Groups	1	.230	.527	.491
	within Groups	7	.436		

$p \geq 0.05$

Above table show that the pre-test BMI score for both groups was equal, as the p-value was found to be greater than the significant value of 0.05.

The post-test BMI score in HYG is significantly better than the pre-test score in comparison to CG or not; we calculated ANCOVA (See Table 8), and the significance level was kept at 0.05. The effect of the six-week hatha yoga training program significantly reduced the BMI score in HYG as the cal. 'F' value (6.64) is greater than the tab. 'F' value (5.59).

TABLE 8: Analysis of Covariance of BMI score

Variables	Sources of Variance	d.f	Mean Square	F-ratio	Sig.
BMI	Between Groups	1	.230	.527	.491
	within Groups	7	.436		

Regarding the percentage of improvement, we found that due to the six-week hatha yoga training program, the BMI of the HYG reduced by 9.30%. Whereas in CG, the BMI increased by 0.98% (See Table 9 & Fig. 2).

TABLE 9: Percentage of Improvement of BMI

Variable	Hatha Yoga Group				Control Group			
	M*	M**	MD^	Impr.^^	M*	M**	MD^	Impr.^^
BMI	30.12	27.32	2.80	9.30%	28.52	28.80	- 0.28	- 0.98%

* Pre-Test Mean **Post-Test Mean ^Mean Difference ^^ % of Improvement

FIG 2: Percentage of Improvement of BMI

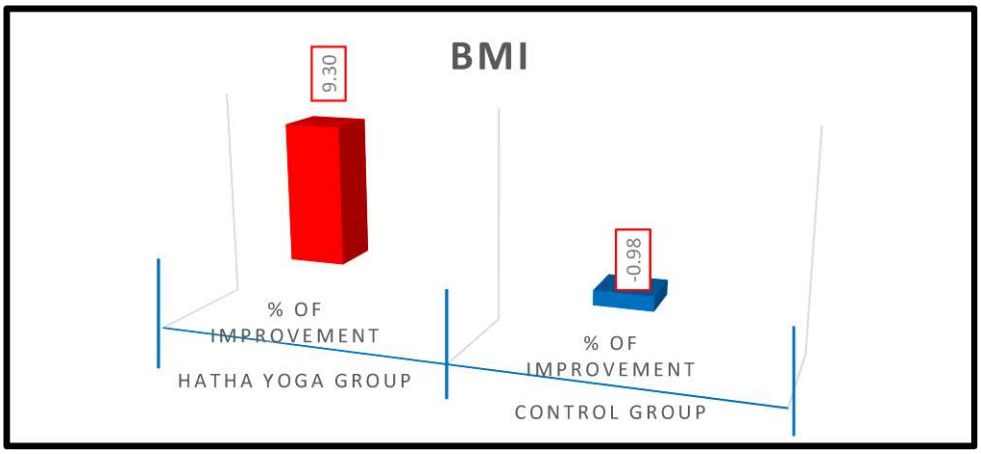


TABLE 10: Descriptive Analysis of Different Sub-Scales of Health-Related Quality of Life

SCALE	HATHA YOGA				CONTROL GROUP			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical Functioning	35	13.23	61	20.43	27	7.58	30	10
Role Physical	10	13.69	90	13.69	20	11.18	25	0
Bodily Pain	46.00	12.51	66.80	12.38	47.6	6.02	44.2	15.50
General Health	36.40	13.69	65.60	4.72	38.2	6.53	32	4.47
Vitality	43.00	19.56	61.00	6.52	38	2.74	31	12.45
Social Functioning	52.50	22.36	67.50	6.85	52.5	13.69	32.5	6.85
Role Emotion	26.67	27.89	80	29.81	33.33	23.57	13.33	18.26
Mental Health	42.40	17.11	60	6.32	40.8	8.20	35.2	11.45

The above table shows the mean and SD scores of both groups' pre and post-test data of various health-related quality-of-life subscales. The post-test mean scores for the HYG group show improvement over the pre-test mean score for all the subscales but not in the CG group. The mean score shows that the six weeks training program is effective for the HYG group (See Table 10 and Fig. 3 & 4). The skewness scores (pre and post) range between -2 and +2, and the kurtosis scores (pre and post) range between -7 and +7 for both groups, proves that the normality of the data (Hair et al., 2010). (See Table 11)

FIG 3: Descriptive Analysis of Health-Related Quality of Life in Hatha Yoga Group

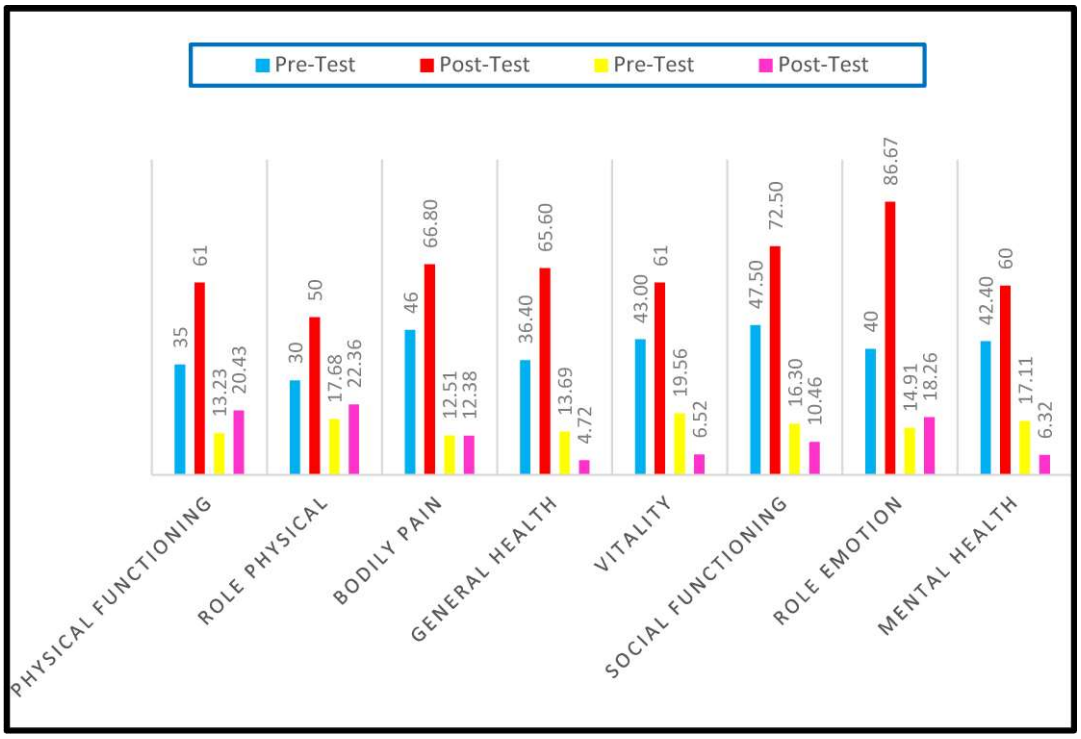


FIG 4: Descriptive Analysis of Health-Related Quality of Life in Control Group

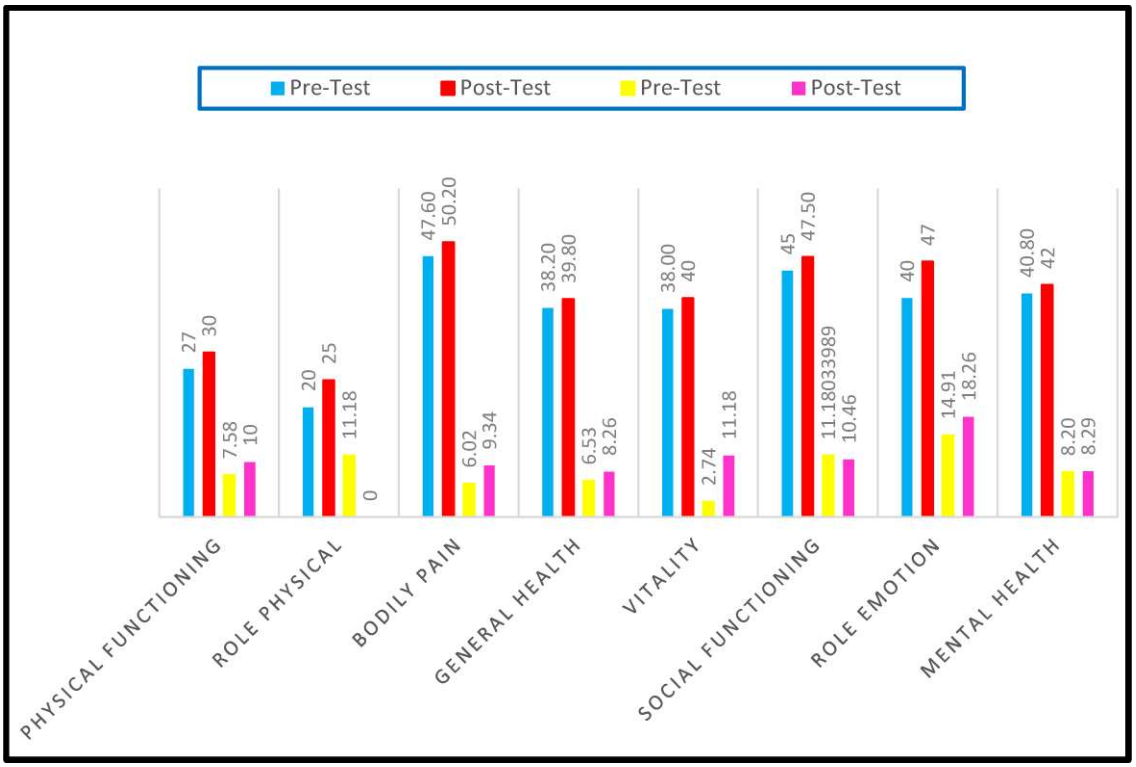


TABLE 11: Normality of Scores for Different Sub-scales of Health-Related Quality of Life

Sub-Scale	Hatha Yoga Group				Control Group			
	Pre-Test		Post-Test		Pre-Test		Post-Test	
	A	B	A	B	A	B	A	B
Physical Functioning	.810	.673	-2.070	4.416	-1.118	1.456	-.937	-.187
Role Physical	2.236	5.000	.000	2.000	-2.236	5.000	.000	.000
Bodily Pain	.529	.052	.439	-.584	-.609	-3.333	.670	-.114
General Health	.669	1.060	.179	-.869	.225	-.573	.573	.581
Vitality	-.879	-1.437	.541	-1.488	-.609	-3.333	.000	.200
Social Functioning	-.541	-1.488	.512	-.612	1.258	.313	.512	-.612
Role Emotion	2.235	4.998	-.609	-3.333	2.236	4.998	.001	2.000
Mental Health	-.691	-2.581	.000	-1.200	-1.022	.918	-.236	-1.963

A – Skewness; B - Kurtosis

TABLE 12: ANOVA Table of Pre-Test Data for Different Sub-Scales of Health-Related Quality of Life

Sub-Scale	Sources of Variance	d.f	Mean Square	F-ratio	Sig.
Physical Functioning	Between Groups	1	489.919	2.170	0.184
	within Groups	7	225.726		
Role Physical	Between Groups	1	390.625	3.182	0.118
	within Groups	7	122.768		
Bodily Pain	Between Groups	1	147.612	1.269	0.297
	within Groups	7	116.284		
General Health	Between Groups	1	0.053	0.001	0.975
	within Groups	7	51.707		
Vitality	Between Groups	1	121.298	1.547	0.254
	within Groups	7	78.386		
Social Functioning	Between Groups	1	30.625	0.254	0.63
	within Groups	7	120.625		
Role Emotion	Between Groups	1	254.721	0.540	0.486
	within Groups	7	471.541		
Mental Health	Between Groups	1	81.415	1.611	0.245
	within Groups	7	50.541		

$p \geq 0.05$

Above table show that the pre-test BMI score for both groups was equal, as the p-value was found to be greater than the significant value of 0.05.

The post-test scores for different subscales in HYG is significantly better than the pre-test scores in comparison to CG or not; we calculated ANCOVA (See Table 13), and the significance level was kept at 0.05. The effect of the six-week hatha yoga training program significantly improved all the sub scales of health-related quality of life as the p-values for all the sub scales are lesser than 0.05.

TABLE 13: Analysis of Covariance for Different Sub-Scales of Health-Related Quality of Life

Sub-Scale	Sources of Variance	d.f	Mean Square	F-ratio	Sig.
Physical Functioning	Between Groups	1	2889.644	12.802	0.009
	within Groups	7	225.726		
Role Physical	Between Groups	1	703.125	5.727	0.048
	within Groups	7	122.768		
Bodily Pain	Between Groups	1	742.067	6.382	0.039
	within Groups	7	116.284		
General Health	Between Groups	1	1651.328	31.936	0.001
	within Groups	7	51.707		
Vitality	Between Groups	1	923.948	11.787	0.011
	within Groups	7	11.787		
Social Functioning	Between Groups	1	1504.016	63.146	0.010
	within Groups	7	120.625		
Role Emotion	Between Groups	1	7105.145	15.068	0.006
	within Groups	7	471.541		
Mental Health	Between Groups	1	738.003	14.602	0.007
	within Groups	7	50.541		

$p \leq 0.05$

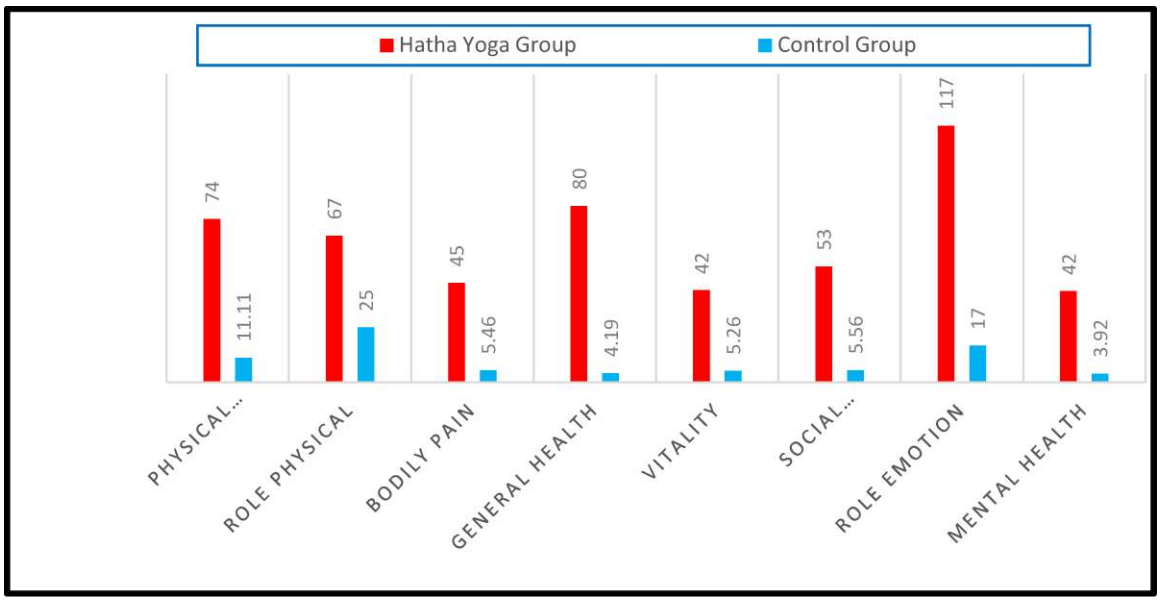
The percentage of improvement for various sub scales of health related quality of life is presented in Table 14 and Fig. 5. The table show that the percentage of improvement in HYG is much better than the CG.

TABLE: 14 Percentage of Improvement in Health-Related Quality of Life

Sub-Scale	Hatha Yoga Group				Control Group			
	M*	M**	MD^	Impr.^^	M*	M**	MD^	Impr.^^
Physical Functioning	35	61	26	74%	27	30	3	11.11%
Role Physical	30	50	20	67%	20	25	5	25%
Bodily Pain	46	66.80	21	45%	47.60	50.20	3	5.46%
General Health	36.40	65.60	29	80%	38.20	39.80	2	4.19%
Vitality	43.00	61	18	42%	38.00	40	2	5.26%
Social Functioning	47.50	72.50	25	53%	45	47.50	3	5.56%
Role Emotion	40	87	47	117%	40	47	7	16.67%
Mental Health	42.40	60	18	42%	40.80	42	2	3.92%

* Pre-Test Mean **Post-Test Mean ^Mean Difference ^^ % of Improvement

FIG: 5 Percentage of Improvement in Health-Related Quality of Life



4. Discussion:

The researcher measures the health quality, weight, and height to investigate the effects of the hatha yoga training program on BMI and health-related quality of life of obese children. In this study, the researcher showed that the effects of the six-week training program significantly improve the health-related quality of life and reduce body fatness, which means the reduction of BMI level on HYG. The pre-test and post-test percentage improvement shows that HYG has much more improvement than CG on BMI and health-related quality of life of obese children. The researcher would like to show a few reasons behind such results.

The yoga asana reduces body fat and improves BMI levels (Upadhyah et al., 2019). The researcher used Bhujangasana, Boat pose (Naukasana), Eka Pada Adho Mukha Svanasana (Santuka, 2022), Halasana (Plow pose) (How to Do Halasana - Plow Pose, 2022), Salabhasana (Locust pose), Dhanurasana (Divya, 2022), etc. these asanas in the training program by HYG, which are very much helpful to reduce the obesity level (Hainsworth et al., 2014) as well as increases flexibility (Petriè et al., 2014; Bisht, 2022). So, maybe this is why the six-week hatha yoga training program is effective on HYG in reducing the BMI level.

In this study the researcher found adho mukha svanasana, vrikshasana, tadasana, paschimottanasana this asana is mainly helps to increase the strength, tone up the body and improve immunity power of entire body (Gupta, 2023) also improves the physical functioning and mental health (Ashish, 2020) of obese children; Virabhadrasana improves the body posture (4 Benefits of Hatha Yoga and How It Can Improve Your Physical and Mental Health, 2020) and in many study shown the improvement of role physical (Grabara, 2016); bhujangasana exercise reduces the pain of the body (10 Yoga Poses to Try When Your Back Is Killing You, 2018) and improves the body flexibility and also various asana improves the bodily pain and general health (Markil et al., 2010; Wile, 2019); paschimottanasana, vrikshasana, Dhanurasana etc. make the body relaxed and energiged ("6 Yoga Asanas That Can Boost Immunity and Improve Your Breathing," 2021) this is called as vitality (Satchidananda, 2012; Hatha Yoga, n.d.; Yoga for Vitality and Energy, 2023); many yogic asana helps to reduces the stress, anxiety, depression (BS, 2019) which comes under the social functioning, role emotion and mental health (Iehp109.Pdf, n.d.; The Social Benefits of Practicing Yoga, 2021).

The researcher investigates and found the similarity of various research that hatha yoga training program decreases body fat, improves the BMI level (Na Nongkhai et al., 2021), and health-related quality of life (Cramer et al., 2017) of obese children.

5. Conclusion:

Based on the analysis and result, the researcher would like to conclude that the six-week hatha yoga training program effectively reduces body fatness and improves health-related quality of life, flexibility, and BMI level. So, this training program is recommended for obese children to improve their health-related quality of life and BMI.

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