

CHAPTER SEVEN

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7. DISCUSSION

Advances in technology have resulted in children spending time in television viewing which is one of the most easily modifiable causes of obesity among children (Robinson, Nited, & Has, 1999). Low levels of physical activity is definitely promoted by an automated and automobile oriented environment that is conducive to sedentary lifestyle (Bickel & Vuchinich, 2000). Hence weight management by changing sedentary lifestyle of adolescents through yoga practices was the goal of designing IAYT module for obesity in adolescents. Urbanization leads to consumption of huge amount of food items at home and at restaurants, plus consumption of high calorie food such as high fat, low fiber foods, and intake of sweetened beverages that have been shown to promote obesity (Access & Astrup, 2018),but it is only the external cause of overeating. The root cause of overeating is a form of stress resulting from demanding situations in the academic and personal lifestyle among adolescents. Regular practice of yoga, especially relaxation techniques reduces the risk of overeating. Meditation trains the mind to search for happiness from inside instead of searching outwardly. It also makes the mind to enjoy eating healthy food. The control over mind decreases the cravings towards junk and fast food resulting in proper intake of high fiber and less fat diet. The aim of yoga therefore is also the attainment of physical, mental, social and spiritual health mechanism and harmony between mind and body which prevents the onset of disease (Kumar, 2002).

This study intended to develop and validate a integrated yoga module for adolescent obesity and to assess the impact of 5 weeks integrated yoga intervention on anthropometric measures, BMI, cognition and psychological measures.

An integrated yoga module was developed from classical yoga texts and modern scientific literature. This model was validated by 16 yoga experts. Validated yoga module was used in the study. A pilot study on IAYT among 23 (Y-14 and C-9) showed significant improvement in lipid profile and anthropometric measures after one month compared to baseline. In study 2: A randomized control trial was performed among 53 participants, showed significant improvement in abdominal circumference, sit ups and subcutaneous fat, compared to the control group. There was also significant improvement in satiety response, and SLCT test performance. However, within the yoga groups significant improvement was seen in weight, BMI, hip circumference, total body circumference, subcutaneous fat, sit ups, muscle mass.

In third phase, pilot study an RCT (Randomized Controlled Trial) was conducted for one month on overweight & obese adolescent subjects of a residential school in Sangamner, Maharashtra, India who did not have any exposure to Yoga previously,

23 adolescents were intervened by validated IAYT (36 practices), and they were assessed pre- and post-intervention for variables out of which weight, serum triglyceride & triglycerides & very low- density lipoprotein showed statistically significant reduction where as waist circumference & high - density lipoprotein showed statistically non-significant reduction by validated IAYT on obesity in Yoga group. This could be due to short duration of study. There was significant reduction in BMI, pulse rate, hip circumference, serum total cholesterol in non-parametric test. So these results cannot be implicated universally. There is significant increase in mid-arm circumference in Yoga group & in control group. This could be because that integrated approach of yoga therapy for obesity practices are having more emphasis on below naval part of body especially focused on hips & thighs. Few practices were there like *suryanamaskara*, *chakarsana* & *bhujangasana* which were having effect on arm muscles but they were not significant.

Percentage of improvement (reduction) of serum triglycerides & very low -density lipoprotein were more in control group than that of Yoga group. The reason of this could be that all subjects were from same hostel & blinding on the intervention was not possible. Once the intervention started the control group was aware of the yga program though subtle practical details were not known to them. This might have also given them some motivation to do walking & other activities. This might have improved their parameters. All 14 adolescents completed the intervention, there were no adverse effects noticed during the study. However, RCT with larger samples are needed to validate its efficacy as a primary intervention.

Within yoga group in short duration of one month significant results are achieved in many variables. Weight, blood pressure, mid-arm circumference, waist circumference, fasting blood sugar, high-density lipoprotein, very low- density lipoprotein, serum triglycerides were normally distributed in Yoga group. There is significant reduction in weight, diastolic blood pressure, fasting blood sugar, very low- density lipoprotein, serum triglycerides after intervention. There is significant increase in mid-arm circumference. BMI, pulse rate, hip circumference, serum total cholesterol, low- density lipoprotein were not normally distributed in yoga group. There is significant reduction in BMI, pulse rate, hip circumference and serum total cholesterol. This is result proves efficacy of our IAYT.

Excessive adipose tissue also affects the physical inactivity leading to psychological increased sensitivity. These children with obesity had poorer cognitive function results in decreased measures of intra individual response, even after accounting for intellectual abilities, aerobic

fitness so focus of this study was to evaluate the Yoga based validated intervention on anthropometric and physical variables in adolescent obesity.

Specific anthropometric and physical tests are selected as variables were selected in order to conserve comfort and convenience of the participants with average age of 11 ± 1.4 years. Hip circumference, total body fat percentage, subcutaneous fat of trunk and legs whereas these parameters is reduced in control group but without significance. Subcutaneous fat reduction leads to significant increase of muscle percentage of trunk and leg region. This provides evidence of efficacy of validated yoga based intervention on reduction of adipose tissue in hip, trunk and leg region resulting in reduction of total body fat percentage and overall body weight. Abdominal circumference is reduced significantly in Yoga group and without significance in control group. Yoga group has improved significantly better in this parameter than control group.

Psychological Parameters like BAQ (body awareness questionnaire), Parameters like RES

(Rosenberg self-esteem scale), CEBQ-EF (child eating behavior questionnaire - enjoyment of food), CEBQ-SR (satiety responsiveness), CEBQ-SE (slowness in eating), CEBQ-FR (food responsiveness), CEBQ - EOE(child eating behavior questionnaire - emotional over-eating) ,CEBQ- DD (desire to drink),CEBQ- FF (food fussiness) , CEBQ - EUE (emotional under-eating) were assessed pre and post.

Variables like BAQ and RES increased but without significance. According to one study, obese adolescents have lower levels of physical activity, higher inactivity and a larger perception of ideal body size than non-obese adolescents (Penny Gordon-Larsen, 2001). The perception of bodily awareness has been increased with yoga group. Yoga group participants became more physically active due to intervention. So body awareness questionnaire scores improved well.

One review published article quotes that early adolescents, female gender exposure to victimization, history of greater parental control on feeding are the factors which make overweight children to possess low self esteem (Lowry, Sallinen, & Janicke, 2007). In Yoga group, it has been seen that self esteem has increased when that of control group has been decreased as Yoga intervention has positive impact on will power building leading to increased self esteem. Yoga concepts include another important measure of an evolving personality, which is the knowledge about one's unlimited potential to move towards perfect harmony with Nature (Sudheer Deshpande, H R Nagendra, 2009). Breathing pattern is regularized due to yoga practices, which trains the mechanism to use the abdominal in synchronization with respiratory

muscles and breathing system. Lung capacity is increased which results in stamina building and development in vital energy (Nagendra, H. R., 1983).

The Child Eating Behaviour Questionnaire, CEBQ; is a parent-report instrument to assess 'obesogenic' eating behaviours in children with obesity. In this study, associations were examined between three CEBQ scales, satiety responsiveness, SR; food responsiveness, FR; enjoyment of food, EF and four aspects of eating behaviour like eating without hunger, caloric compensation, eating rate and energy intake at a meal. An easily-administered measure such as the CEBQ will be valuable in gathering data on the scale required to study the behavioural phenotype associated with obesity risk (Carnell & Wardle, 2007). Obese individuals are more emotionally reactive and more likely to overeat when distressed than are those of normal weight. This study compared the emotional reactivity and emotional eating of normal and overweight female college students in the natural environment. Correlational analyses indicated that emotional distress associated with snacks and emotional eating associated with both snacks and meals were related to subjects' percentage overweight (Lowe & Fisher, 1983).

Study focused primarily on general trends of soft drink consumption may be linked to weight gain. This study examines how the Child Eating Behaviour Questionnaire (CEBQ) construct 'Desire to Drink' (DD) relates to drink consumption, preferences and BMI-SDS. Findings suggest that the construct desire to drink in children is related to a liking for consuming sweetened drinks, and does not appear to simply denote greater thirst or hunger (Claire Sweetman, 2008).

An appetitive profile characterized by more responsiveness to and enjoyment of food, more emotional eating, lower responsiveness to internal satiety and lower fussiness is associated with weight (Webber, L., Hill, C., Saxton, J., et.al, 2009).

Fussiness could be protective against overeating by reducing the effective choices for a child (Dovey, Staples, Gibson, & Halford, 2008).

Yoga being a promotive tool to establish deeper satisfaction at mind can promote fussiness. Yoga programs are potentially effective for the reduction of huge eating (ShaneMcIveraPaulO'Halloranb1MichaelMcGartlandc2, 2009).

Variables like CEBQ-EF, CEBQ-EOE and CEBQ-FR decreased with significance. Variables like CEBQ-SR, CEBQ-SE, CEBQ-DD, CEBQ-FF and CEBQ-EUE decreased but without significance.

Analysis of between Yoga and control group states that BAQ of Yoga group is increased where as that of Control group is increased but without significance .

Parameters like SLCT were normally distributed which is increased with significance.

Parameters like DLST were not normally distributed which also increased with significance. Analysis of in between Yoga and control group states that DLST of Yoga group is increased than that of Control group but without significance. SLCT of Yoga group is increased than that of Control group with significance.

Yoga is associated to improve cognitive functions like perception, quickness of alertness .It can improve cognitive functions such as remote memory, mental balance, attention and concentration, delayed and immediate recall, verbal retention and recognition tests (Gothe, (Gothe, Neha P., McAuley, 2015).

So SLCT & DLST improved well with Yoga group both tools needs good concentration, memory and attention. Studies measuring mental health outcomes have shown decreases in anxiety, and increases in cognitive performance after yoga interventions. Similar studies have also shown cognitive advantages amongst yoga practitioners versus non-practitioners (Desai Radhika, Tailor, Anisha, 2015). Yoga intervention practices like dynamic suryanamaskara, asana, loosening practices are focused to reduced abdominal adipose tissue. According to one RCT, yoga intervention had moderately strong positive effects on anthropometric variables in women with abdominal obesity. Yoga is safe in women and can be recommended as a technique for combating abdominal obesity in women. Our study provides efficacy of yoga in same concern in adolescent population. Yoga improves emotional wellbeing in children. Yoga had been reported to have shown the beneficial effects on different psycho-physiological variables (Bhardwaj & Agrawal, 2013). The mechanisms underlying these benefits have not been clearly worked out and may involve complex neuro-chemical changes and modified functioning of brain areas within the limbic circuit.

TABLE NO. 27: OVERVIEW OF STUDY ONE & TWO

OVERVIEW OF STUDY 1 & 2				
Description	Study One		Study Two	
	Pilot		Main	
Aim	To check Feasibility of IAYT		To Check Effects of IAYT On Variables Included	
School	Dhruv Acedemy,Residencia Sangmaner,Maharashtra		Dr Kalmadi Shymarav,Kaveri Education Day School,Pune,Maharashtra	
Design Of Study	Two Groups		Two Groups	
	RCT		RCT	
Duration	Intervention 30 Days		40 Days	
Subjects	23 Randomised in Y & C		53 Randomised in Y & C	
Participants	Yoga	Control	Yoga	Control
	Pre	Post	Pre	Post
	14	14	9	9
Socio Demographic Data	Collected Age,Gender, Standard		Collected Age,Gender, Standard	
Variables				
Anthropometric measurements	Weight (kg)		Weight (kg)	
	Height (cm)		Height (cm)	
	Body Mass Index (kg/m2)		Body Mass Index (kg/m2)	
	Mid arm circumference		Mid arm circumference	
	Abdominal circumference		Abdominal circumference	
	Waist circumference		Waist circumference	
	Hip circumference		Hip circumference	
	Systolic Blood pressure		Systolic Blood pressure	
	Diastolic Blood pressure		Diastolic Blood pressure	
	Pulse rate		Pulse rate	
BMI Parameters	NO		Total body fat percentage Resting metabolism Subcutaneous fat (Whole body) Muscle percentage (Whole body) Subcutaneous fat (Arms) Muscle percentage (Arms) Subcutaneous fat (Trunk) Muscle percentage (Trunk) Subcutaneous fat (Legs) Muscle percentage (Legs)	

CONTD.		OVERVIEW OF STUDY 1 & 2	
Description	Study One	Study Two	
	Pilot	Main	
Physical Tests	No	Sit Ups	
		Flemingo Balance Test	
Psychological tests	No	Body Awareness Questionnaire (BAQ)	
		Child Eating Behavior Questionnaire (CEBQ)	
		Rosenberg self - esteem Scale (RSES)	
Cognitive tests	No	Six Letter Cancellation Test	
		Digit Letter Substitution test	
Bio Chemical	1:FBS :Fasting Blood Sugar	No Permission Granted	
	2:LIPID PROFILE		
	Total Cholestrol		
	High Density Lipoprotin	by parents	
	Low Density Lipoprotin	Planned and purchased KITS for Leptin	
	Very Low Density Lipoprotin	For collecting blood samaples,	
	3:Triglycerides	For pre and post	
	Low- Density Lipoprotein		
	High Density Lipoprotien		
Diet	Four Meals	Non residential	
Monite ring	Same for all participants	Home Food	
	Residential School	Home	
	Mess		

7.1 COMPARISION WITH OTHER STUDIES

Rshikesan et al in a study on the effect of integrated approach of yoga therapy on Male obesity and psychological parameters in an RCT. Total 80 subjects with Body Mass Index (BMI) between 25 to 35 kg/cm² were enrolled and randomized into two equal groups in which 72 subjects (yoga n = 37 and control n=35) completed the trial. Yoga group mean age \pm SD was 40.03 \pm 8.74 and Control group mean age \pm SD was 42.20 \pm 12.06. A 14 weeks special IAYT (Integrated Approach of Yoga Therapy) yoga training was given to the Yoga group and no specific activity was given to Control group. After the 14 weeks of yoga training the Yoga group was asked to continue the yoga practice for the next 3 months and the Control group was not given any physical activity.

The assessments were anthropometric parameters of body weight (Wt), BMI (Body Mass Index), MAC (Mid-upper Arm circumferences of left and right arm), WC (waist wircumference), HC (hip circumference), WHR (waist hip ratio), SKF (skin fold thickness) of biceps, triceps, sub scapular, suprailiac and cumulative skin fold thickness value), Percentage body fat based on SKF and Psychological questionnaires of PSS (perceived stress scale) and

AAQW (acceptance and action questionnaire for weight related difficulty). Assessments were taken after 3 months of yoga training, for both yoga and control groups. Within group, between group and correlation analyses were carried out using SPSS 21. It was found that the weight of the yoga and control groups decreased after the intervention. The weight (wt) reduction in yoga group was significant and reduction in control group was not significant. In yoga group left MAC change was significant and in control group it was not significant. The BMI was reduced in both groups but reduction was significant in yoga (Rshikesan, Subramanya, & Nidhi, 2016).

In our study, the duration of intervention was shorter, 5 weeks, 53 were enrolled and randomized into two equal groups in which 53 subjects (yoga $n = 25$ and control $n=28$) completed the trial. Along with physical & anthropometrics parameters, psychological questionnaires: body awareness questionnaire (BAQ), child eating behaviour questionnaire (CEBQ), and rosenberg self - esteem scale (RSES). Cognitive test. digit letter substitution test & six letter cancellation test & physical fitness test: physical test sit ups in standing & Flamingo balance test. BMI parameters - total body fat percentage, resting metabolism, subcutaneous fat (whole body, arms, trunk, legs). Muscle percentage (whole body arms, trunk, legs). Study was on adolescent participants. The result of our study showed in yoga

In another study of 10 weeks, $n=36$ by Butzer et al showed the effects of a classroom-based yoga intervention on cortisol and behaviour in second- and third-grade students. It was a Pilot Study with a single group and preadolescent aged participants. The results revealed that second graders showed a longitudinal effect in which baseline cortisol concentrations significantly decreased from before to after the entire 10-week intervention. There was a lack of a control group (Butzer et al., 2015). Our study is an RCT with 53 subjects and adolescent aged participants.

Ankit et al conducted a study on incidence of obesity among school going children of urban and rural area of Moradabad (Gaur & Gupta, 2016). It was an observational Study. Our study is an interventional RCT Study.

In a study by Ramajayam the influence of 3 months Suryanamaskar on body fat and basal metabolic rate of obese children was studied between the age group of 13-16 yrs. In this study significant improvement in BMI was observed.

Only Suryanamaskara was the intervention and only physical parameters were studied. In our study the age range was 11 -17 years. The intervention was Integrated Approach of Yoga

Therapy, which had apart from Suryanamaskar, other *asanas* specifically for weight & fat loss, pranayama, meditation, lectures and counselling. Assessments studied were physical, anthropometrics, BMI, psychological and Cognitive.

Alwyn et al did a study on overweight and obese adolescent girls on the importance of promoting sensible eating and activity behaviours which was an observational study (A. S., Todd, Street, & Hills, 2015). Our study is an interventional RCT study with Integrated Approach of Yoga Therapy (IAYT).

In a study by Choukem et al overweight and obesity in children aged 3–13 years in urban Cameroon, was studied for the prevalence and association with socio-economic status. Anthropometric assessments were taken and it was a cross-sectional study. In this study the prevalence of overweight and obesity in nursery and primary school children aged 3–13 years was 12.5%, without any statistical evidence of a gender difference. Results suggest that strategies to tackle children overweight/ obesity in SSA should consider these modifiable factors. In our study, physical, psychological & cognitive assessments were taken and it was an RCT.

Komal et al did a study on Suryanamaskar as an equivalent approach towards management of physical fitness in obese females aged between 20-40 years. Outcome Measures: body composition, cardio-respiratory, muscle endurance and flexibility (Shimpi et al., 2015). In our study both male and female participants with an age between 11 and 17 years were included and the outcome measures were physical, psychological & cognitive assessments.

Telles et al studied the short term health impact of a yoga and diet change on obesity with 47 subjects with an intervention of 6 days, with yoga and diet change program. The assessments were body mass index (BMI), waist and hip circumferences, mid-arm circumference, body composition, hand grip strength, postural stability, serum lipid profile and fasting serum leptin levels. Following 6 days of yoga and a vegetarian diet, there was a significant decrease in BMI, lean mass, water content, waist circumference, hip circumference, total cholesterol, high density lipoprotein (HDL) and serum leptin levels ($p < 0.05$). In contrast, there was a significant increase in bilateral hand grip strength and postural stability at 20, 40, and 60 seconds ($p < 0.05$) comparing the values at the end of the camp with the values at the beginning; t-test for paired data.

It was a single group study (S Telles, Naveen, Science, & , 2009). Our study had 53 subjects 25 in Yoga & 28 in Control with intervention duration of 40 days. Intervention was Integrated Approach of Yoga Therapy, IAYT. The study was an RCT, Assessments - Weight (kg) Height (cm) Body Mass Index (kg/m²) mid arm circumference, abdominal circumference, Waist circumference, Hip circumference, Systolic Blood pressure, Diastolic Blood pressure, Pulse rate. BMI Parameters :Total body fat percentage, Resting metabolism ,Subcutaneous fat (Whole body, arms, trunk, legs) ,Muscle percentag (Whole body, arms, trunk, legs).Physical fitness tests Sit ups. Flamingo Balance test. Psychological Tools: CEBQ test, BAQ scale & RSE scale. Cognitive Test: SLCT.DLST.

Joshua et al in a trial studied Yoga in a public school to see if it improves adolescent mood and affect. It had 47 subjects with an intervention of a single yoga class.Only psychological parameters were assessed (Khalsa & S., 2014). Our study with 53 subjects, with an intervention of 40 days, and Integrated approach of Yoga therapy assessed the subjects on physical, psychological & cognitive levels.

Holger Cramer et al studied women with abdominal obesity which was a randomized controlled trial. It had female adult participants. It focussed on abdominal obesity with yoga intervention ($n = 40$) & a waiting list ($n = 20$). Assessments were physical & psychological. Waist circumference was the primary end point (H Cramer, Thoms, *Ärzteblatt*, 2016). In our study adolescent boys & girls were the participants with a focus on overall obesity and there was yoga intervention,in yoga ($n = 25$) control ($n = 28$) with physical, psychological & cognitive assessments.

In a study by Daniels at el, the complications of obesity in children and adolescents was studied, it was an observational study (D. S, 2009). Our study was an interventional study. Kelly et al studied the global burden of obesity in 2005 and projections to 2030. It was an observational Study. Our study was an interventional study.

Studies have shown that the right nostril breathing *prāṇāyāma* called *sūrya anuloma viloma* corresponds to sympathetic dominance (Telles S, Nagarathna R, 2008),and increases metabolic rate. It has been proven that *sūrya anuloma viloma* can alter metabolic rate which can be used for therapeutic purposes such as weight loss (Telles, S., Nagarathna, & Nagendra, 1995).Based on these observations the imbalance that occurs in obese can be hypothesized as being a dominance of *chandra nāḍi*. Hence we advised practice of *sūrya anuloma viloma* nostril breathing & had been included in our study, as part of the yoga intervention for adolescent

obesity. This practice is useful in reducing weight. It increases metabolic rate and hence burns calories and reduces weight.

This can be perceived as dominance of the right nostril breathing. Several studies on uni-nostril breathing *prāṇāyāma* provide support to these (H, 1994). Nostril dominance as a characteristic of changing every 2-6 hours and illness results when this ultradian rhythm is disturbed. This could be used as a physiological diagnostic measure of health and illness. It appears from these that the cumulative affect of intensive daily practices are more effective even in shorter span of four to five weeks of intervention.

7.2 MECHANISMS

7.2.1: Annamaya Kośa Mechanism: *Asana* Effect:

The current Urbanization has led to encouraging the consumption of high calorie Food intake from various eatery places that has led to fat accumulation promoting high risk obesity leading to wide range of serious health complications (Access & Astrup, 2018) (Kitzinger & Karle, 2013).

Physical exercise has played an important role in the management of obesity not just in adults but also in the adolescent group. Unlike the physical exercises, *asanas* such as Dhanurasana, Dhanurasana Swing, Shalabhasana Naukasanana plays an important role in the reduction of the weight, BMI, abdominal obesity & subcutaneous fat (Bashir, 2015).

At Annamaya kosha level, *asanas*, kriya practices are the most feasible methods / practices that aids in the weight reduction. The same can be seen emphasized by Sage Patanjali by introducing the concepts of (*prayatna*) effort and (*prayatna shaithilya*) effortless into the practices of *asanas* to attain (*sthiram, sukham*) steady, stable comfort conditions that leads to an unlimited expansion of feeling (*anantasamāpatti*).

The subjects (school students) when exposed to consistent practices of yoga postures, in combination with *Śīthilikarana Vyāyama* (techniques of loosening the joints, stretching the muscles) reported refreshed and rejuvenated feeling, while one of the girl reported her improvement of regulation of menstruation and her PCOD problem. This indicates that yoga promotes in releasing of tensions due to monotonous activities. (Redline, & Taveras, 2014).

The below table gives a description about the selected practices and the significant results outcome in the Annamaya kosha as per this study.

TABLE NO 28

ANNAMAYA KOSHA PRACTICES

Annamaya kosha	Output	Selected Practices	Assessments	Significant Result
1.Kriyas (cleansing techniques)	1. Clears constipation	Kapalbhati Kriya		Activating and revitalizing the organs & toning up their functions Development of deep internal awareness.
2. Shithileekarana Vyayamas	1. Mastery over hunger pangs	Jogging, Jumping	Anthropometric Measurements	Reduction in Weight ,BMI
(loosening practices) and	Exercise effect of Yoga to spend calories	Spinal Twisting, Hip Rotation		Reduction in Weight ,BMI
Suryanamaskara	Regulation of Pranic circulation.	Dyanmic Suryanamskar with breathing	BMI	Reduction in subcutaneous fats of whole body
3.Asanas in standing, sitting prone,& supine	1. Reduces adiposity in specific parts with emphasis on abdomen, hips and arms.	Chakkichalana, Ushtrasana, Dhanurasana,Shalbhasan Chakrapadasana, Padsanchalana	Physical Test	Waist , Hip Circumference Increased Muscle percentage of whole body. Reduction in subcutaneous fats of all body parts
	2. Trains mind to be stable and calm during stressed condition.			
4.Deep relaxation	1. Improves metabolism	ITR ,QRT,DRT	Bio Chemical (Pilot)	Sr Triglyceride,VLDL
	2. Re-gaining and restarting efficiency of body system.			

The study indicates a significant change in the vital parameters of obesity such as subcutaneous fat, body weight, and abdominal obesity. The study also has indicated an enhancement in the muscular strength, reduction of fat and improved body flexibility. The intervention of 4 & 5 weeks of regular *asana* practices has resulted in a considerable positive change in the anthropometrics of the participants. The results also indicate that YogaĀsana helps for physical revitalization along with deep relaxation and mental calmness. The study indicates that yoga participants realized that yoga is much more than physical postures.

7.2.2: Prāṇamaya Koṣa

At *Pranayama Kosha* level – The pranayama techniques when added in complementary to the Asana practices have resulted in harmonizing the physiological system by slowing down the breath process, decreased metabolism, lowering the heart rate and reduced muscle tension (Vallath Nandini, 2010). *Prāṇa* is the subtle vital-energy that coordinates all cellular functions of a living body based on the demand driven dynamic mechanisms. A steady and balanced supply of *Prāṇa* is essential for a healthy body and mind. A breakdown of these mechanisms leads to blockage in the energy channels (*nāḍis*) resulting into disorganized flow of *prāṇa* in it. Obesity could be one of the causes of the improper assimilation of *prana*.

Yogic *pranayama* and the alternate/single nostril breathing have proven to be significant in balancing the pranic energies of the human body and aiding in weight loss. The single nostril breathing (right nostril) practiced for 27 times for four times in a day, were found to be significantly different as compared to the effect of a left nostril breathing/*pranayama* (Telles S, Nagarathna R, 2008).

One of the study has suggested that school-based practices of *pranayama* during short & long breaks or after-school in good environments in school playground, has a vital role in obesity and overweight reduction in children (Sigmund et al., 2012).

Studies have shown that the right nostril breathing *prāṇāyāma* called *sūrya anuloma viloma* corresponds to sympathetic dominance (Telles S, Nagarathna R, 2008) and increases metabolic rate. It has been proven that *sūrya anuloma viloma* can alter your metabolic rate which can be used for therapeutic purposes such as weight loss (S. Telles et al., 1994). Based on these observations the imbalance that occurs in obese can be hypothesized as being a dominance of *chandra nāḍi*. Hence we advised practice of *sūrya anuloma viloma* nostril breathing had been included in our study, as part of the yoga intervention for adolescent obesity. This practice is

useful in reducing weight. It increases metabolic rate and hence burns calories and reduces weight.

This can be perceived as dominance of the right nostril breathing. Several studies on uni-nostril breathing prāṇāyāma provide support to this (S. Telles et al., 1994). Nostril dominance as a characteristic of changing every 2-6 hours and illness results when this ultradian rhythm is disturbed. This could be used as a physiological diagnostic measure of health and illness.

d) It appears from these that the cumulative affect of intensive daily practices are more effective even in shorter span of four to five weeks of intervention.

The below tables gives information about the selected pranayama/breathing practices for the study and its significant output

TABLE NO 29

PRANAMAYA KOSHA PRACTICES

Pranamya kosha	Output	Selected Practices	Assessments	Significant Result
2.Breathing kriya	Provides detoxification effect.	Bhastrika,		Revitalisation
(rapid breathing practices)	Breathing in names of animals offers fun for adherence.	Kapalbhati Tiger Breathing		Oxygen consumption is increased due to increased breathing
3.Pranayama (Slow breathing practices)	Economizes the expenditure of vital force -	Nadishuddhi,Bhramari	Body Awreness Questionnaire	Increased Stamina Calming down of mind
	To achieve mastery with awareness over Prana flow.	27 Surya AV,4 times a day	At Residential School ,monitoring was possible	Reduction in Weight BMI

The above table with different methods of breathing (fast/dynamic, slow and cleansing techniques) have resulted in revitalizing the system with better oxygen consumption, improved and increased stamina, reduced weight, fat and BMI.

7.2.3: Psychological – *Manomaya kosha*

An imbalance in *manomaya kośa* is unrest in the state of mind. Mind being a conglomeration of thoughts when not in clarity ends up in vicious circle of pressures, habituated, negative, emotional suppressions and responses. This results in affecting the day to day routine and physiological functioning of the body system.

The scientific literature studies states that the negative emotions are the root causes of ailments resulting in psychological, physiological and biochemical abnormalities and also indicates that the problem of obesity is also, a mind body disease which begins as excessive uncontrolled speed of the mind with lots of thoughts which causes this the disturbance at *Manomaya Kosha*. This is achieved by a systematic process that passes through *prāṇa*, involves the mind, and corrects the intellect by several practices at each level. The *manomaya kośa* practices include practice of meditation i.e., *dharana* (focuss) and *dhyana* (defocuss and expansion). *Dhāraṇa* trains the mind to focus intensely without any distractions on a single spot. This evolves into *dhyāna* wherein the focus becomes effortless with expansion and defocussing thus providing deep rest through slowing down the rate of flow of thoughts in the mind (Telles, S. et al., 1995).

Due to demanding situations, peer pressure, academic pressure, competitions perceived by the school going children appealing to emotional responses builds up stress, speed and repetitiveness that which is generally suppressed or responded with negativity. Studies of yoga in combating the lack of awareness and mastery over emotions, studies on yoga have used the methods of chanting and the aid of counseling session which has resulted in reduction of thought speeding up and removal of mental and emotional blockages (Narasimhan, Nagarathna, 2011).

Management of emotions towards enhancing the right hemisphere was achieved by incorporating the techniques of *bhajans* and *sloka* chantings from *Bhagvadgita* along with patriotic songs. The significance of *pranava mantra. Om* has being extensively studied for its therapeutic value to combat the stress. Due to chanting *OM* it is noted that the Alpha rhythm becomes prominent and synchronized blood pressure and heart rate slows down which might be high in obese. It produces parasympathetic predominance and brings about calmness and peace. Anxiety and hypertension has seen to be reduced and the sleep pattern is improved by the “*OM*”/”*AUM*” recitation regularly (Rangan R1, Nagendra H, 2009). *Om* Meditation results in increased mental alertness, even while being physiologically relaxed (Telles, S. et al., 1995).

Studies on different types of meditation have consistently shown increased mental alertness even while being physiologically relaxed. *Om* meditation and cyclic meditation have shown reduced oxygen consumption suggesting psycho-physiological rest (Telles, S. et al., 1995).

The below tables gives information about the selected practices for *Manomaya Kosha* practices for the study and its significant output.

TABLE NO 30

MANOMAYA KOSHA PRACTICES

<i>Manomaya kosha</i>	Output	Selected Practices	Assessments	Significant Result
1.Practices of <i>Dharana</i> followed by <i>Dhyana</i>	1: Provides mastery over cravings for junk foods and binge eating habits. Increases mindful eating.	Nadanusan dhan	Body Awareness Questionnaire BAQ	Perception Improvement
			Rosenberg Self Esteem Scale RSES	Self Esteem Improved
2. <i>Om</i> meditation	2: Reduces Stress.	<i>OM</i> Meditation	Child Eating Behavior Questionnaire	Satiety Responsiveness & Enjoyment of Food improved
3.Yogic counseling using concepts of pure love to the divine	3. Provides catharsis by cognizing the suppressed emotions.		Child Eating Behavior Questionnaire	Psychological Control. Emotional Eating Control
.	4. Emphasizes the faith in reality.			
	5. Provide guidance in conflictions in mind.			

The above findings through the meditation practices and assessment by different questionnaires support our study by significant output in improving self-esteem, perceptions, and also in terms of Satiety Responsiveness & Enjoyment of Food.

7.2.4 : *Vijnānamaya kośa*

Vijnanamaya kośa is characterized by correct information in the intellectual level that directs the mind and the body towards right actions which replaces wrong notions with right information by correcting cognition. Subjects/participants of this study were exposed to sessions of solving doubts and questions and were also educated regarding causes and effects of obesity. These sessions with the help of the subjects interacting with their therapists were successful in finding the cause for their stress which is believed to be their root cause for their obesity. These sessions included popular concepts like happiness analyses, *karma yoga*, sweet meditation & knowledge of the *panca kośa*.

Obesity especially abdominal is related to academic achievement and cognitive functions in children. Visceral adipose tissue has negative impact on cognitive functions leading to decrease in cognition among children with obesity because of its dangerous metabolic nature (Ontology, 2018). The yoga practices have resulted in better cognitive performances resulting in increased concentration, focus and attention as compared to non-yoga practitioners (Desai Radhika, Tailor, Anisha, 2015).

Below Table gives out the information of practices included at Vijnanamaya Kosha level and their significant outcomes.

TABLE NO 31 VIGNANAMAYA KOSHA PRACTICES

1.Yogic counseling and lectures using concepts of Jnana Yoga –	1: Gives right knowledge to achieve the required targets.	Assessments Cognitive tests DLST Digit Letter Substitution test	Improvement in concentration Within yoga groups significant improvement in DLST
Happiness analysis		SLCT Six Letter Cancellation Test	Focus Yoga group has improved over control group
Sweet meditation	2:Enjoy eating healthy food	CBEQ	CBEQ SR is decreased in Yoga group

The Philosophical lecture sessions followed by meditation have resulted in better focusing ability along with realizing the flaws of a sedentary life style culture. During the feedback of a counseling session, one of the participant reported of about his positive change at his confidence level and also about his improved socialization skills. This definitely marks as a positive psychological health symbol. Feedback of improvements in academic results indicates a positive change in the Intellectual development.

7.2.5 *Ānandamaya kośa*

The layer of happiness is *ānandamaya kośa* comprises of bliss and all activities that individuals do are directed towards achieving happiness. The Right discrimination abilities occupied with positive emotions leads to regulated energy flow within a fit body leads to blissful contented feeling. The Yogic science is a systematic methodology of understanding one`s true nature which is a state of unchanging state of bliss. Meditation trains the mind to search for happiness form inside instead of searching outwardly (Nagendra, 2006).

Participants in the study were taught to incorporate *Ananda* into all yoga techniques in all the previous *kośas* which provide joy during all the sessions. Developing a deep internal awareness and keen observations on the changes occurring into oneself due to the interventions was suggested and emphasized in the study. This has resulted in being aware, that happiness lies within oneself and experiencing it, can be seen as a change in their positive attitude towards their surroundings and also control on the cravings, distractions of a sedentary life style promoting obesity.

Below Table indicates the *Anandamaya Kosha* level practices for aiding the weight loss program.

TABLE NO 32: ANANDAMAYA KOSHA KOSHA PRACTICES

	Selected Practices	Result
<i>Anandamaya kosha</i>	1.Yogic counselling and interactive lectures using concepts of <i>Karma Yoga</i> -	1: Teaches sense of duty in each act.
	2:Enjoy each moment of life by counting blessings	2: Maintain awareness under all circumstances.Enjoy all activites
	3: Work in blissful awareness of self-existence.	3: Prepare to face exams without stress and fear.

Participants were really happy to report in feedback interactive session. Along with reduction in weight, BMI, abdominal obesity. Reported yoga practices helped for overall personality development. Resulted into improvement in socialisation. They were feeling confident and energetic. Overall positive attitude was built up.

Summary:

Yoga practices offer techniques of mastering the gross to reach the subtle layers of one's existence by introspective slowing down of thoughts. By controlling the gross physical body one is able to bring about changes in the physiology as well as the mind. The reverse is also true where the subtle controls the gross. If one masters his breathing, Prāna, he can manipulate the functions of physical body; the subtler one, the mind can manipulate Prāna and vijnāna, in turn can master the mind. The goal of this is to establish in a state of complete mastery and happiness by remaining in a state of *Ānandamaya kośa* which in turn influences *Vijñāna*. This is a state of complete contentment and freedom from all distress and disease (Nagarathna & Nagendra, 2014).

Yoga appears promising as a complementary therapy for obesity in adolescents because it offers gentle and subtle mind management techniques. It helps in bringing about normalcy, balance and stability through effortless discipline. It restores body weight through lifestyle change. Yoga reduces perceived stress, anxiety, and depression which are the major reasons for overeating. Yoga appears to be promising to assist with the behavioral change, weight loss, and maintenance (Balasubramaniam, Telles, & Doraiswamy, 2013).

7.3 REVERSAL OF OBESITY THROUGH IAYT

Yoga as therapy brings a reversal to the prasava pathway by shifting the awareness from the physical body level Figure i.e. *annamaya kośa* (through the practice of *āsanas*) through the astral sheath i.e. *prāṇamaya kośa* (through the practice of *prāṇayama* and *kriya*); through the emotional realm i.e. *manomaya kośa* (through the practice of *dhāraṇa* and *dhyāna*) through the intellectual level i.e. *vijnānamaya kośa* (with the help of knowledge counseling sessions, query solving and notional correction) to finally reach bliss i.e. *anandamaya kośa*. In this state, a positive and a complete healthy state beyond the sickness zone is accomplished. This, applied to the problems of OBESITY, is known as the *pratiprasava* or the mechanism to reduce fat resulted in reduction of obesity

KOSHA ATTRIBUTES = Yoga shifts awareness from physical level to the *Ānanda* with the real “Self” (*pratiprasava* of obesity)

Thus reaching *ānandamaya kośa* with increased awareness is the secret that unfolds the healing potential within. The fig below depicts the model of *pratiprasava* as described in yogic texts to return from illness state to harmonious healthy state through IAYT

Yoga Module developed for adolescent obesity brings about a reversal of *prasava* pathway by shifting the awareness from the physical body (*annamaya kośa*) to finally reach bliss (*ānandamaya kośa*)

YOGA SHIFTS AWARENESS FROM PHYSICAL LEVEL TO THE *ĀNANDA* WITH THE REAL “SELF”: FIGURE 8: *PRATIPRASAVA* OF OBESITY

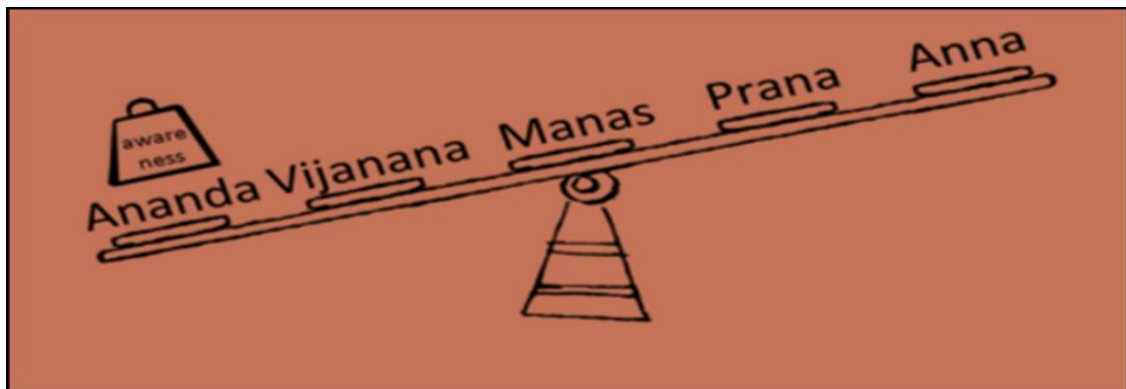


FIGURE 9: REVERSAL OF OBESITY PRATIPRASA



REVERSAL OBESITY THROUGH IAYT