Development and Validation of Integrated Yoga Module for Obesity in Adolescents

Abstract

**Background:** Obesity is a growing global epidemic and cause of noncommunicable diseases. Yoga is one of the effective ways to reduce stress which is one of the causes of obesity. Nowadays, children in adolescent age are more prone to get obese due to lack of physical activity making them more sedentary. **Aim:** To identify the design and validation of Integrated Approach of Yoga Therapy Module (IAYTM) for obesity in adolescents. **Materials and Methods:** First phase – IAYTM for obesity was designed based on the literature review of classical texts and recently published research articles. Second phase – Designed IAYTM was validated by 16 subject matter (yoga) experts. Content-validity ratio (CVR) was analyzed using Lawshe’s formula. **Results:** Yoga practices were designed for Integrated Yoga Module for Obesity in Adolescents. Yoga practices with CVR ≥0.5 and which were validated by 16 yoga experts and approved in faculty group discussion were included in final Integrated Yoga Therapy Module. **Conclusion:** The yoga practices were designed and validated for IAYTM for obesity in adolescents.

**Keywords:** Adolescence, integrated approach of yoga therapy, obesity, validation

Introduction

**Obesity**

Obesity (body mass index [BMI] >30 kg/m²) is more common in women than men. The risk of obesity starts at a BMI of 25 kg/m²[1] and it is much lower (23 kg/m²) in southeastern countries that contain genetic predisposition to metabolic disorders. East Asian countries use lower values of BMI.[2] Obesity increases the likelihood of diseases such as heart disease, type 2 diabetes, obstructive sleep apnea, cancer, and osteoarthritis.[3] Researchers consider obesity as one of the most serious public health problems of the 21st century.[4] International organizations such as the WHO, UNICEF, and CARE consider obesity as one of the most neglected public health problems in the society.[5] It is commonly caused by a combination of excessive food intake, lack of physical activity, and genetic susceptibility.[6] Therefore, it can be prevented through a combination of social changes and personal choices.

**Adolescent obesity**

The prevalence of overweight and obesity in children has dramatically increased over the past two decades.[7] In 2010, 43 million children were obese and this number is expected to reach 60 million by 2020. Of the approximately 45 million, 35 million live in the developing countries. Obese children are likely to remain so in adulthood and are at greater risk of developing noncommunicable diseases such as diabetes, hypertension, cardiovascular diseases, and cancers.[8] Two systematic review articles[9] and one clinical review article[10] suggest that yoga has beneficial effects on mental and physical health in children and adolescents.

**Yoga modules to control obesity**

Yoga has emerged as one of the evidence-based practices widely used across the globe. Over 10 million Americans practice yoga for health reasons in 2002 and the number has increased to 13 million in 2007.[12,13] Several schools of yoga have come up different modules of yoga practices that have shown a range of positive benefits on BMI in adults and children. A randomized controlled trial on 72 obese adult males resulted in improvement in BMI, hip circumference, waist circumference, and skin-fold thickness. Fourteen weeks of...
integrated yoga-based lifestyle change included yogic diet, asana, pranayama, relaxation techniques, meditation, and yogic counseling.[14] Yoga/meditation users with normal BMI appeared to be more satisfied with their body weight and shape than nonyoga/meditation users.[15] Studies provide strong evidence that the modified Qigong breathing exercise can significantly reduce or even suppress the sense of hunger on an empty stomach. Qigong practice typically involves moving meditation, coordinating slow flowing movement, deep rhythmic breathing, and calm meditative state of mind. Qigong is now practiced throughout China and worldwide for recreation, exercise and relaxation, preventive medicine and self-healing, alternative medicine, and cultivation. Stomach pH was increased by 3 and intestinal pressure was reduced by 12 mmHg in the experimental group and did not change significantly in the control group. The breathing exercise provides comfort in different circumstances, such as lack of regular meals, limited volume or caloric diet, and even during temporary complete absence of food in therapeutic fasting which is useful in obesity.[16]

In a randomized controlled trial on yoga practice for reducing the male obesity and weight-related psychological difficulties, it has been proved that the yoga practice is effective for obesity control for adult male in an urban setting. Improvement in anthropometric and psychological parameters was observed in that study.[17] The 12-week yoga intervention had positive effects on anthropometric and self-reported variables in women with abdominal obesity. Sixty women with abdominal obesity (waist circumference ≥88 cm; BMI ≥25) were randomly allocated in a 2:1 ratio to either yoga intervention (n = 40) or a waiting list (n = 20). Intergroup significant differences in the waist/hip ratio, body weight, BMI, body fat percentage, body muscle mass percentage, mental and physical well-being, self-esteem, subjective stress, body awareness, and trust in bodily sensations were observed.[18]

Mindfulness-based interventions may be both physically and psychologically beneficial for adults who are either overweight or obese. Fifteen studies measuring posttreatment outcomes of mindfulness-based interventions in 560 individuals were identified in a review article.[19] Average weight loss was 4.2 kg. Overall effects were large for improving eating behaviors, medium for depression, anxiety, and eating attitudes, and small for BMI and metacognition outcomes. Therapeutic effects for BMI, anxiety, eating attitudes, and eating behaviors remained significant. Another RCT study of a 12-month computerized mindfulness-based intervention for obese patients with binge eating disorder support that mindfulness work as de-automation element and a moderator of motivation to exercise which can lead to the reduction of impulsive eating and also to an increase in levels of physical activity.[20]

Few studies has been conducted on quality of life for the obese people. A short-term yoga-based lifestyle intervention study, including asana, pranayama, relaxation techniques, lectures, group support, nutrition awareness program, and individualized advice, had positive effect on the overall health the obese people.[21]

These studies have designed and used different yoga modules for obesity. However, there is no validated yoga module for obesity in adolescents. Therefore, this study has been designed to propose a validated yoga module for obesity in adolescent with practices of breathing and loosening, asana, pranayama, and relaxation techniques.

Yoga is a voluntary and mindful technique that has positive impact on obesity at physical and psychological levels. Yoga has effect on serum leptin and serum ghrelin; there two hormones have been recognized to harbor major influence on the energy balance mechanism. Leptin is a mediator of long-term regulation of energy balance, suppressing food intake and thereby inducing weight loss.[22] A study states that voluntary exercise leads to the maintenance of a lower body weight and leaner composition, as well as to improved leptin action, independent of fat mass.[23] Moderated meditation analyses showed that higher levels of mindfulness were associated with better-perceived quality of life through lower body shame.[24] Similar effect on serum leptin by yoga is expected as yoga is a voluntary and mindful technique to get control over mind and body.

Yoga in adolescence

Studies suggest that school-based yoga may provide unique benefits beyond participation in physical practice of yoga under expert supervision was helpful in achieving optimum level of self-adjustment in adolescent students.[23,24] However, to the best of our knowledge, there are no studies on the effect of yoga on obesity in adolescence. Hence, this study was designed to provide Integrated Approach of Yoga Therapy module (IAYTM) for obesity in adolescents.

Validation

Validation using content–validity ratio (CVR) developed by Lawson is a tool to check product, service, or system meets requirements and specifications fulfilling its intended purposes.[27] As there are many different modules of yoga for obesity used by different investigators from different parts of the globe, it was felt that there is a need to have a validated common protocol for obesity which we plan to use in a study on yoga for obesity in adolescents. Hence, the present study for validation was planned and implemented.

Materials and Methods

The designing, validation, and feasibility of Integrated Yoga Therapy Module (IYTM) for obesity [Figure 1] were carried out in the following steps:

Step 1: The need of the adolescents with obesity were enlisted [Table 1].
stress corticotrophin-releasing hormone and norepinephrine are released which has impact on hypothalamic–pituitary axis leading to behavioral and peripheral changes. This leads to release of large quantity of glucocorticoids inhibiting action of insulin on skeletal muscles and adipose tissues which is the cause of metabolic disorder such as obesity.[30] This supports that mind and body has strong interaction in pathophysiology of obesity. It proves that along with physical causes, disturbances or problems in mind and emotions are also major contributing factors of obesity pathophysiology.

Attention bias for food could be a cognitive pathway to overeating in obesity. The study results demonstrate that state differences in health versus palatability mind-sets can cause attenuated attention bias for high-calorie food cues in participants with higher eating restraint which can cause bias attention for food.[31]

The concept of how obesity as a mind–body problem occurs was formulated based on the descriptions of five aspects of human existence (Pancha Kosha Viveka)[32] and the downward causation of stress-induced diseases (Adhija Vyadhi). It states that human being exists at five different layers of existence (Annamaya – body, Pranamaya – vital energy, Manomaya –mind, and Vijnanamaya – intellect, and Anandamaya Kosha – soul) which are interconnected and has counterimpact on each other also. Stress at mind disturbs Prana and results in abnormalities at body level called disease. Obesity also has root cause as mental stress along with other physical causes. Hence, treatment of obesity includes working on all Koshas (body, mind, Prana, and intellect). IAYTM for obesity in adolescents also is designed on the basis of Pancha Kosha model.

We then went on to compile the corrective techniques described in many texts (Patanjali yoga sutra, Hath Yoga Pradipika, Hatharatnavali, Bhagavad Gita) which offer a reversibility model. Thus, a need-based table of practices for long-term holistic change at all the five aspects of personality[33,34] was prepared. Publications (books and published articles) on yoga for obesity were also reviewed to prepare the list of all practices used in all these studies This yielded forty practice items that are tabulated in Table 2.

Step 3: Validation of the module for obesity: Validation of the 40-item module was carried out by arranging a focused group discussion faculty group discussion (FGD) by inviting sixteen subject matter expert (SMEs), that included five Doctor of Medicine in Yoga, eight Doctorates (PhD) in Yoga with minimum experience of 4–5 years in the field of yoga, and three yoga therapists (MSc in yoga) involved continuously for >7 years in teaching the IAYT techniques to obese participants of all ages. These 16 SMEs marked the content validity on a three (0–2)-point scale, viz., not necessary – 0, useful but not essential – 1, and essential – 2. After validation, data were analyzed using Lawshe’s CVR.[35]
Statistical analysis

Sixteen SMEs validated all the 40 practices. Lawshe’s CVR was calculated for all the 40 items using the formula CVR = (n_e – N/2)/(N/2),[36] wherein n_e = number of SME panelists indicating “essential” and N = total number of SME panelists. As per Lawshe’s significance table, the value of CVR for 16 SMEs = 0.5 which means all items with CVR >0.5 are valid and essential for the module.

Results

- Step 1: We presented the list of the needs of adolescents with obesity to FGD; the final comprehensive list of 11 items evolved is tabulated in Table 1
- Step 2: Table 2 shows basis of development of the module with five yogic personality domains and 15 categories of practices; the benefits each component would offer is also tabulated
- Step 3: Table 3 shows the list of 54 items that evolved all groups of practices.

CVR was calculated for physical and breathing practices only. Among them, 33 yoga practices [Table 4] with CVR ≥0.5 were included in designed IYTM. Others practices such as diet, meditation, counseling and lectures on yoga were discussed in faculty group discussion (FGD) meeting and were approved by all participants. Hence, those were also included in IYTM.

Discussion

This study developed a validated module of integrated yoga as a prelude to an RCT for obese adolescents. The content validity was assessed in four steps. After enlisting the needs of obese adolescents at their physical, mental, emotional, spiritual, and behavioral levels, 15 categories of yoga practices under five domains with yogic scriptural basis (Annamaya – physical, Pranamaya – vital energy, Manomaya – mental and emotional, Vijnanamaya – intellectual, and Anandamaya – spiritual and behavioral) was tabulated. As a next step, 54 items of actual
| Domain | Type of practice | Name of practice | CVR |
|--------|------------------|------------------|-----|
| A. Annamaya Kosha: Raja yoga | Diet | Yogic diet | Approved in FGD |
| | Kriya | Fasting | 0.34 |
| | | Jala neti | 0.26 |
| | | Sutra neti | 0.6 |
| | | Vaman dhauti | 0.73 |
| | | Laghu Shankhaprakshalana | Trataka | 0.43 |
| | | Kapalabhati | 0.875 |
| | Shithilekarana vyayamas and Surya Namaskar (loosening practices) | Jogging with jumping: Backward, forward, and side with Mukha dhauti | 0.875 |
| | | Backward and forward bending (Pashchaata Purstaata namana) | 0.625 |
| | | Side bending (Parshva Namana/Parshva Karshana) | 0.75 |
| | | Backswing (Prushthha Andolana) | 0.75 |
| | | Hip twist (Nitamba Vyavartana) | –0.75 |
| | | Hip rotation (Nitamba Chankramana) | 0.5 |
| | | Spinal stretch with folded legs (Baddha pada merudanda prasarana) | 0.875 |
| | | Bhunaman | 0.75 |
| | | Chakki Chalana stretch | 0.5 |
| | | Butterfly | 0.75 |
| | | Tiger stretch (Vyaghra Prasaarana) | 0.625 |
| | | Dhanurasana and Dhanurasana Swing | 1 |
| | | Surya Namaskar (5 dynamic and 1 slow) | 0.875 |
| | Asanas in standing, prone, supine and sitting positions | Ardha Kati Chakrasana | 0.625 |
| | | Padottanasana | 0.25 |
| | | Trikonasana | 0.875 |
| | | Parivritta Trikonasana | 0.5 |
| | | Vajarasana | 0.75 |
| | | Ushtrasana | 1 |
| | | Sasankasana | 0.75 |
| | | Vakrasana | 1 |
| | | Bhujangasana | 0.75 |
| | | Naukasana | 0.75 |
| | | Deep relaxation | QRT (Sheeghra shaithilya tantra) | 0.75 |
| B. Pranamaya kosha | Breathing exercises | Hands in and out breathing (Antar bahya Hastha chalana Shvasana) | 0.375 |
| | | Hands stretch breathing (Hasta Prasaarana Shvasana) | 0.625 |
| | | Ankle stretch breathing (Gulf Prasaarana Shvasana) | 0.75 |
| | | Alternate leg raise breathing (Vyatysa paadottana Shvasana) | 0.625 |
| | | Both leg raise breathing (Dwayam Padottanasana shvasana) | 0.625 |
| | | Side leg raising breathing (Paarshva Padottanasana shvasana) | 0.25 |
| | | Breathing Kriya (rapid breathing practices) | Dog breathing | 0.40 |
| | | Pranayama (slow breathing practices) | Rabbit breathing | 0.75 |
| | | Nadi shuddhi | 0.5 |
| | | Bhastrika | 0.375 |
| | | Surya AV 27 rounds 4 times a day | 0.75 |
| | | Bhramari 9 round | 0.375 |
| | | Seetali/Seetkari/Sadanta | –0.875 |
| C1. Manomaya Kosha: Raja yoga | Practices of Dharana followed by Dhyana | Nadanu Shandhan | Approved in FGD |
| C2. Manomaya Kosha: Bhakti yoga | Meditation | OM meditation (Omkar Dhyana) |
| | Yogic counseling using concepts of pure love to the divine | Lecture on Bhakti yoga |
| | Singing devotional songs | Bhajan session |

Contd...
| Domain                              | Type of practice                                      | Name of practice                                      | CVR  |
|------------------------------------|-------------------------------------------------------|-------------------------------------------------------|------|
| D. Vijnanamaya Kosha               | Yogic counseling and lectures                          | Lecture on Jnana yoga                                  |      |
|                                    |                                                       | Counseling                                             |      |
| E. Anandamaya Kosha                | 14. Yogic counseling and interactive lectures          | Yogic counseling                                       |      |
|                                    | 15. Work in blissful awareness of self-existence       | Karma yoga activity                                    |      |

FGD=Focused group discussion, CVR=Content-validity ratio, QRT=Quick relaxation technique

| Table 4: IYTM practices with content validity ratio ≥0.5 and focused group discussion approved practices |
|--------------------------------------------------------|--------------------------------------------------------|
| Serial number | Name of practice                                      | CVR          |
|---------------|--------------------------------------------------------|--------------|
| 1             | Yogic diet                                             | Approved in FGD |
| 2             | Fasting                                                |              |
| 3             | Vaman dhouti                                            | 0.6          |
| 4             | Laghu Shankhaprakshalana                                | 0.73         |
| 5             | Kapalabhati                                             | 0.875        |
| 6             | Jogging with jumping: Backward, forward and side with Mukha dhauti | 0.875    |
| 7             | Backward and forward bending (Paschhaata Purstaata namana) | 0.625      |
| 8             | Side bending (Parshva Namana/Parshva Karshana)           | 0.75         |
| 9             | Backswing (Prushtha Andolana)                           | 0.75         |
| 10            | Hip rotation (Nitamba Chankramana)                      | 0.5          |
| 11            | Spinal stretch with folded legs (Baddha paada merudanda prasaarana) | 0.875 | |
| 12            | Bhunaman                                                | 0.75         |
| 13            | Chakki Chalana stretch                                  | 0.5          |
| 14            | Butterfly                                               | 0.75         |
| 15            | Tiger stretch (Vyaghra prasarana)                       | 0.625        |
| 16            | Dhanurasana and Dhanurasana swing                       | 1            |
| 17            | Surya Namaskar (5 dynamic and 1 slow)                    | 0.875        |
| 18            | Ardha Kati Chakrasana                                   | 0.625        |
| 19            | Trikonasana                                             | 0.875        |
| 20            | Parivritta Trikonasana                                  | 0.5          |
| 21            | Vajarasana                                              | 0.75         |
| 22            | Ushtrasana                                              | 1            |
| 23            | Sasankasana                                             | 0.75         |
| 24            | Vakrasana                                               | 0.5          |
| 25            | Bhujangasana                                            | 1            |
| 26            | Shalabhasana                                            | 0.875        |
| 27            | Naukasana                                               | 0.75         |
| 28            | QRT (Sheeghra shaithilya tantra)                         | 0.75         |
| 29            | Hands stretch breathing (Hasta Prasaarana Shvasana)      | 0.625        |
| 30            | Ankle stretch breathing (Gulf Prasaarana Shvasana)       | 0.75         |
| 31            | Alternate leg raise breathing (Vyatasya padottana shvasana) | 0.625        |
| 32            | Both leg raise breathing (Dwayam Padottanasana shvasana) | 0.625       |
| 33            | Rabbit breathing                                        | 0.75         |
| 34            | Nadi shuddhi                                            | 0.5          |
| 35            | Surya AV 27 rounds 4 times a day                         | 0.75         |
| 36            | Nadamu Shandhan                                         | Approved in FGD |
| 37            | OM meditation (Omkar Dhyana)                            |              |
| 38            | Lecture on Bhaktiyoga                                   |              |
| 39            | Bhajan session                                          |              |
| 40            | Lecture on Jnana yoga                                   |              |
| 41            | Counseling                                              |              |
| 42            | Yogic counseling                                        |              |
| 43            | Karma yoga activity                                     |              |

FGD=Focused group discussion, CVR=Content-validity ratio, QRT=Quick relaxation technique
yoga practices were selected and subjected to assessment by 16 subject experts in a focused group discussion meeting. Then, the CVR was calculated to develop the final list by retaining all those items with CVR >0.5.

Advances in technology has resulted in children spending their leisure time in television, mobiles, and ipads resulting in sedentary lifestyle and childhood obesity since last two decades.[37,38] Low levels of physical activity are definitely promoted by an automated and automobile-oriented environment that is conducive to sedentary lifestyle.[39] 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.[40,41] Urbanization 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 form inside instead of searching outwardly. It also make the mind to enjoy eating healthy food. The control over mind decreases the cravings toward junk and fast food resulting in proper intake of high-fiber and less-fat diet.

Yoga practices with CVR <0.5 was removed from IAYTM [Table 5]. The reason for their CVR <0.5 could be these practices are not focused and not having direct impact on adolescent obesity. The principle of selection of yoga practices is physical exercise along with relaxation of mind. However, few texts on Hatha yoga lay more emphasis on improving health through different yogic practices.[42] This module for obesity in adolescents reduces weight as it provides exercise effect to different parts of body, especially arms, abdomen, hip, and thigh region. Muscle work out in body region reduces adipose tissues leading to weight loss. It offers enough work out to burn excessive calories that results in proper balance of calorie intake and energy expenditure. Yoga practices provide deep relaxation to internal body systems which is essential to regain normal functioning of the system. Yoga also strengthens the mind determination to adhere to healthy lifestyle.

Practices of Manomaya Kosha such as Bhajans (devotional music) and lecture on Bhaktiyoga releases stress in mind with relaxation. Practices of Vijnanamaya Kosha such as lecture on Jnana yoga and counseling help to motivate children in right direction towards success and their goal of life by clearing the intellectual complexes and conflicts. Activity like Karmayoga trains their mind to do work with the sense of duty and not as the burden of life which leads to relaxed mind.

These yoga practices makes IAYTM unique from other yoga modules.

**Conclusion**

- The yoga practices for IAYTM were designed as per yoga texts and the experience of yoga experts
- The designed IAYTM was validated by 16 yoga experts by using Lawshe’s content validity formula.

**Strength and limitations**

This study provides a validated yoga module for obesity in adolescents. We did not conduct other validity and reliability tests for obesity in adolescents. Furthermore, all the panelists of SMEs were from the same school of Yoga (S-VYASA, Bangalore, Karnataka, India). Further study can be planned with reliability test on yoga module for obesity in adolescents.

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**Conflicts of interest**

There are no conflicts of interest.

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