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Role of Yoga in Optimising Body Mass Index (BMI): Findings from Scientific Investigations

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ABSTRACT

In adults, overweight is defined as a Body Mass Index (BMI) of 25 kg/m^2 and more, whereas obesity is defined as a BMI of 30 kg/m^2 and more. Obesity is becoming one of the major problems on individuals and health care systems in both developed and developing countries affecting all age groups and economic classes. Yoga is a combination of psychological, physical, and spiritual sciences which gives the holistic development of the human mind and body. Yoga is a traditional practice for achieving self-realisation and spiritual growth, but in recent years, significant attention is being given to the therapeutic effects of yoga. Yoga includes physical postures, breathing techniques, relaxation methods, meditation techniques etc. In present days, yoga is also linked to holistic mental and physical health. Yoga interventions appeared to be effective in optimising BMI and improving quality of life. Yoga practices reduce fat mass, and increase fat-free mass and basal metabolic rate. Yoga appeared to be more effective as compared to physical exercise in optimising BMI which may be because of various aspects of yoga other than the physical one: maintaining the postures, breath regulation, mindfulness, relaxation etc. The objective of this review is to understand the role of various yoga interventions in optimising BMI in human subjects.

Keywords: *BMI; Exercise; Overweight; Obesity; Meditation; Yoga.*

INTRODUCTION

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in metres. A high BMI can indicate health condition called obesity.[1] In adults, overweight is defined as a BMI of 25 kg/ m^2 and more, whereas, obesity is defined as a BMI of 30 kg/ m^2 and more.[2] The prevalence of obesity is growing with very high rate in modern world.[3] Obesity is becoming one of the major problems worldwide affecting all age groups and economic classes.[4] Obesity is a chronic disorder that is strongly correlated with certain types of cancer, cardiovascular disease, disability, diabetes mellitus, hypertension, osteoarthritis, and stroke.[2] Obesity may contribute to many other serious disorders including liver and kidney disease, sleep apnoea, and depression.[5] Further, obesity has very strong effect on quality of life. Diet, physical activity and lifestyle modifications are common methods to deal with obesity, however medical treatment and complex surgery are also being practised these days.[6] The objective of this review is to understand the role of various yoga interventions in optimising BMI in human subjects.

CONCEPT OF YOGA

For many people, yoga only reflects practices that include movement and involvement of the body.[7] In fact, yoga is an art or a science of holistic living but not only a combination of physical postures. Yoga is a combination of psychological, physical, and spiritual sciences which gives the holistic development of the human mind and body.[8] Yoga is traditional practice for achieving self-realisation and spiritual growth, but in recent years, significant attention is being given to the therapeutic effects of yoga.[9] All the systematic practices

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and eight limbs of yoga were described by sage Patanjali in ancient text Patanjali Yoga Sutra. Modern therapeutic yoga generally comprises physical postures, breathing techniques, relaxation methods, meditation techniques etc. In present days, yoga is also linked to holistic mental and physical health. Yoga postures are also practised as physical exercises but yoga postures are something more than physical exercises. Yoga postures have various dimensions such as concentration, awareness, breathing, maintenance, relaxation etc. Yoga postures, known as asanas, may be performed just for health purposes or for attaining higher mental and spiritual goals. The modern objective of yoga including yoga postures is mind-body integration, awareness, positive health and harmony with the life.[10]

EFFECT OF YOGA INTERVENTIONS ON BODY MASS INDEX

Several studies demonstrated the effectiveness of yoga based interventions on obesity and optimization of body mass index. A study saw the effect of 14 weeks integrative approach of yoga therapy (IAYT) program on body composition, sleep quality and quality of life in 80 adult males with obesity. The body weight (P = 0.004), body mass index (P = 0.008), bone mass (P = 0.017), obesity degree (P = 0.005), and mineral mass (P = 0.046), quality of sleep (p = 0.017) were improved significantly after the intervention in yoga group.[11] Another study investigated the effect of 12-week yoga practices on body mass index and flexibility in 30 overweight school boys. The yoga practice group showed significant improvement in body mass index and flexibility after intervention as compared to control group.[12] Similarly, a study try to see the effect of 6-day yoga and diet program on body mass index, waist and hip circumferences, body composition, hand grip strength, postural stability, serum lipid profile and fasting serum leptin levels in 47 individuals suffering from obesity. A significant decrease was found in body mass index, waist and hip circumferences, fat-free mass, total cholesterol, high density lipoprotein cholesterol, fasting serum leptin levels and an significant increase in postural stability and hand grip strength after the intervention. ($p < 0.05$).[13] Another recent study saw the effect of 14-week integrated approach of yoga therapy on body mass index, arm circumferences, waist circumference, hip circumference, waist hip ratio and psychological parameters in 72 obese male subjects. The anthropometric and psychological parameters improved significantly in yoga group after 14 weeks.[14]

A study investigated the effect of 8 weeks of Iyengar style yoga on prior experience and expectations, health-related quality of life, state anxiety, and functional limitations in 16 youth with paediatric obesity. Almost all domains of quality of life improved significantly ($p < 0.05$), and self-reports of state anxiety decreased significantly ($p < 0.05$) after the intervention.[15] Further, Cremer et al. tried to investigate the effect of 12-week yoga intervention on waist hip ratio, weight, body mass index, blood pressure, health-related quality of life, and self-esteem in 60 women with abdominal obesity. The abdominal circumference was significantly reduced in the yoga group as compared to control at post. Similarly, there was a significant difference between groups in waist hip ratio, body weight, body mass index, blood pressure, health-related quality of life, and self-esteem ($p<0.05$).[16] Hunter et al. saw the impact of 8-week Bikram yoga classes on Glucose tolerance in 14 young lean and 15 older obese individuals. After the intervention, the oral glucose tolerance was significantly reduced as a result of the Bikram yoga in older obese ($P < 0.05$) but not in young lean subjects.[17] Another study investigated the impact of 3-month comprehensive yoga-based lifestyle modification program on obesity and linked disorders. The yoga-based life style modification showed significant decrease in the parameters of obesity in the study group: skin fold thickness ($P < 0.05$), body mass index ($P < 0.05$) and waist hip ratio ($P < 0.05$).[18]

A study saw the effect of 1 year yoga on cardiovascular risk factors in middle-aged and older adults with metabolic syndrome. The cardiovascular risk factors including central obesity and blood pressure were improved significantly after 1 year yoga intervention in the study.[19] Similarly. Another study investigated the effect of 8-week Yogasana training on body weight, body mass index, fat mass, body fat, fat-free mass, lipid profile and basal metabolic rate in 20 volunteers with body mass index greater than the 95th percentile. The body weight, body mass index, fat mass, and body fat were significantly decreased, and fat-free mass and basal metabolic rate were significantly increased in the yoga group after intervention. High-density Lipoprotein (HDL) cholesterol decreased in both groups whereas total cholesterol decreased only in the yoga group.[20] Similarly, a study investigated the impact of 4 years of yoga practice in body mass index and blood pressure levels. A significant decrease in body mass index and systolic blood pressure level was detected in the 1 to 4 year yoga group as compared to the less than 1 year yoga group.[21] Another study saw the association between yoga experience and body mass index and medication score. A significant negative relationship between yoga experience and both body mass index and medication score was found. A long-term yoga practice was associated with little or no obesity in women over 45 years old.[22]

Table 1. Important Studies on Yoga and Body Mass Index

S. N.	Authors & Year	Title of the Study	Sample	Variables	Intervention	Control	Results	Conclusion
1	Rshikesan et al., 2017	Sleep quality and body composition variations in obese male adults after 14 weeks of yoga intervention: A randomized controlled trial	Eighty adult males with obesity were randomly divided into two groups: yoga group and control group.	Body composition, Sleep quality, Quality of life	Integrative approach of yoga therapy (IAYT) program, half hour per day, 5 days in a week for 14 weeks	The control group continued their regular activities as usual.	Body weight (P = 0.004), body mass index (P = 0.008), bone mass (P = 0.017), obesity degree (P = 0.005), and mineral mass (P = 0.046), quality of sleep (p = 0.017) were improved significantly only in yoga group.	The yoga practice reduces obesity with the improvement in sleep quality and quality of life.[11]
2	Yokesh & Chandr-asekaran, 2011	Effect of Yogic Practice on Selected Physical Fitness among Over-weighted School Boys	Thirty overweight school boys were divided into two groups of 15 each: yogic practice group and control group.	Body mass index, Flexibility	Yogic practices for 12 weeks, five days a week	Control group maintained their daily routine activities and no special training was given.	The yogic practice group showed significant improvement in body mass index and flexibility as compared to the control group.	Yoga practice is effective in improving in body mass index & flexibility among overweight school boys.[12]
3	Telles et al., 2010)	Short term health impact of yoga & diet change program on obesity	47 individuals suffering from obesity	Body mass index, Waist and hip circum-ferences, Body composition, Hand grip strength, Postural stability, Serum lipid profile and Fasting serum leptin levels	A 6-day residential program comprising yoga practice for 5 hours every day, and a low fat, high fibre, vegetarian diet	No control group	Significant decrease in BMI, waist and hip circum-ferences, fat-free mass, total cholesterol, high density lipoprotein cholesterol, fasting serum leptin levels and an significant increase in postural stability and hand grip strength (p < 0.05)	A 6-day yoga and diet change program can reduce the body mass index and the fat-free mass.[13]
4	Rshikesan & Subramanya, 2016	Effect of integrated approach of yoga therapy on male obesity and psychological parameters – A randomized controlled trial	72 obese male subjects were randomized into two groups (Yoga n=37, Control n=35).	Body mass index, Arm circum-ferences, Waist circum-ference, Hip circum-ference, Waist hip ratio and psychological parameters	Integrated approach of yoga therapy was given to THE yoga group for one and half hours for 5 days in a week for 14 weeks.	Control group continued regular physical activities and no specific physical activity was given.	The anthro-pometric and psychological parameters improved significantly in the yoga group.	Integrated approach of yoga therapy is effective for obesity treatment and for reducing the obesity related problems.[14]

S. N.	Authors & Year	Title of the Study	Sample	Variables	Intervention	Control	Results	Conclusion
5	Hainsworth et al., 2012	A pilot investigation of alignment based yoga for paediatric obesity	Sixteen youth with paediatric obesity (11-17 years)	Prior experience and expectations, Health-related Quality of life, State anxiety, and Functional limitations	60 minute Iyengar style yoga classes, biweekly for 8 weeks	No control group	Almost all domains of quality of life improved significantly ($p < .05$). Self-reports of state-anxiety also decreased significantly ($p < .05$).	The alignment-based yoga may be a safe and effective intervention for the management of paediatric obesity.[15]
6	Cramer et al., 2016	Yoga in Women with Abdominal Obesity— a Randomized Controlled Trial	60 women with abdominal obesity	Waist hip ratio, Weight, Body mass index, Blood pressure, Health-related quality of life, & Self-esteem	12-week yoga intervention	No inter-vention for waiting list control group	Abdominal circumference was significantly reduced in the yoga group as compared to control. There was a significant difference between groups in waist hip ratio, body weight, body mass index, blood pressure, health-related quality of life, and self-esteem ($p<0.05$).	Yoga is safe and can be recommended as a technique for combating abdominal obesity in women.[16]
7	Hunter et al., 2013	Improvements in glucose tolerance with Bikram yoga in older obese adults: A pilot study	Fourteen young lean and fifteen older obese subjects	Glucose tolerance	90-min Bikram yoga classes, 3 times per week for 8 weeks	No control group	The oral glucose tolerance was significantly reduced as a result of the Bikram yoga in older obese ($P < 0.05$) but not in young lean subjects.	Bikram yoga Improves glucose tolerance in older obese but not in young lean adults.[17]
8	Choudhary & Budholia, 2015	Impact of comprehensive yoga based lifestyle modification program on obesity and linked disorders	62 females with obesity age between 25 to 45 years	Skin fold thickness, Body mass index and Waist hip ratio	Yoga routine and diet program for 3 months	No control group	The yoga based lifestyle modification showed significant decrease in the parameters of obesity in the study group, skin fold thickness ($P < 0.05$), Body mass index ($P < 0.05$) and Waist hip ratio ($P < 0.05$).	Yoga based life style modification (selected asanas and diet program) helps in decreasing body weight.[18]

S. N.	Authors & Year	Title of the Study	Sample	Variables	Intervention	Control	Results	Conclusion
9	Siu et al., 2015	Effects of 1 year yoga on cardiovascular risk factors in middle-aged and older adults with metabolic syndrome: a randomized trial	182 Adults with Metabolic syndrome were randomly assigned to yoga intervention group or control group.	Cardio-vascular risk factors (Body mass index, Blood pressure levels, lipid profile & Blood sugar levels)	One year of yoga practices	No inter-vention for control group	Cardio-vascular risk factors including central obesity and blood pressure were improved significantly after 1 year yoga intervention.	Yoga improves the cardiovascular risk factors including central obesity in middle-aged and older adults with metabolic syndrome.[19]
10	Seo et al., 2012	Yoga training improves metabolic parameters in obese boys	Twenty volunteers with body mass index greater than the 95th percentile were randomly assigned to the yoga group and control group.	Body weight, Body mass index, Fat mass, Body fat fat-free mass, Basal metabolic rate, & Lipid profile	Yoga asana training, three times per week for eight weeks	No inter-vention for control group	The body weight, body mass index, fat mass, and body fat were significantly decreased, and fat-free mass and basal metabolic rate were significantly increased in the yoga group. Total cholesterol decreased in the yoga group, & HDL-cholesterol decreased in both groups ($p< 0.05$).	An 8-week of yoga training improves body composition and total cholesterol levels in obese adolescent individuals.[20]
11	Guarracino et al., 2006	Yoga participation is beneficial to obesity prevention, hypertension control, and positive quality of life	Seventy women and men aged 18 years or older	Body mass index, Blood pressure levels	Hatha & relaxation yoga for 1 to 4 years	Hatha & relaxation yoga for less than 1 year	A significant decrease in body mass index and systolic blood pressure level was detected in the 1- to 4-year yoga group as compared to the less than 1 year yoga group.	Hatha and relaxation yoga has an important role in optimising body mass index, hypertension, and mood.[21]
12	Moliver et al., 2011	Increased Hatha yoga experience predicts lower body mass index and reduced medication use in women over 45 years	211 female yoga practitioners aged 45 to 80 years	Body Mass Index and Medication use	Participants practised yoga for as long as 50 years and for up to 28 hours per week.	No control group	There were significant negative relationships between yoga experience and both body mass index and medication score.	A long-term yoga practice is associated with little or no obesity in women over 45 years old.[22]

S. N.	Authors & Year	Title of the Study	Sample	Variables	Intervention	Control	Results	Conclusion
13	Sarvottam et al., 2013	Adiponectin, Interleukin-6, and Cardiovascular Disease Risk Factors Are Modified by a Short-Term Yoga-Based Lifestyle Intervention in Overweight and Obese Men	51 overweight and obese men	Body mass index, cardiovascular disease (CVD) risk, levels of interleukin-6 (IL-6), adiponectin, and endothelin-1	Yoga (Asana, pranayama, group discussion, yoga based lifestyle) for 10 days	No control group	There was a significant reduction in weight ($p<0.001$), body mass index ($p<0.001$), and systolic blood pressure ($p=0.042$). There was also a significant reduction in plasma IL-6, and significant increase in the plasma adiponectin.	Yoga intervention may be effective to reduce the risk for CVD as indicated by weight loss, reduction in systolic blood pressure, an increase in adiponectin, and decrease in IL-6.[23]

DISCUSSION

Obesity is becoming one of the major problems on individuals and health care systems in both developing and developed countries affecting all age groups and economic classes.[4] Yoga interventions appeared to be effective in optimising body mass index, arm circumferences, waist circumference, hip circumference, waist hip ratio, and improving psychological well-being. Yoga practices reduce fat mass, and increase fat-free mass and basal metabolic rate.[20]

The components such as mindfulness and relaxation in yoga may bring the human mind and body to a natural state through down-regulation of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis[24] that may contribute to optimising body mass index. Breath regulation, on the other hand, also has potential to bring the mind to the present moment and to reduce the level of stress[25] that may further assist the autonomic nervous system in maintaining vital parameters and optimising body mass. Yogic postures also improve muscular strength and flexibility, and promote respiratory and cardiovascular functions[26] which ultimately help to attain the natural state of the human body.

The physical and mechanical aspects of the yogic postures are quite similar to physical exercises in terms of reducing body weight. Hence, physical exercise is also considered to be a widely accepted method for improving and maintaining a healthy body.[24] However, yoga appeared to be more effective than physical exercise in optimising body mass index which may be because of various aspects of yoga other than the physical one. Hence, maintaining the postures, breath regulation, mindfulness, relaxation etc. are the major components which separated yoga from exercises.[27]

WAY FORWARD

Yoga interventions appeared to be effective in optimising body mass index and improving quality of life. Yoga practices reduce fat mass, and increase fat-free mass and basal metabolic rate. Yoga appeared to be more effective as compared to physical exercise in optimising body mass index which may be because of various aspects of yoga other than the physical one; maintaining the postures, breath regulation, present moment awareness, relaxation etc.

CONFLICT OF INTEREST

None

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