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The research data are available from the corresponding author upon reasonable request.

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The authors declare that there are no conflicts of interest.

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Yoga and nutrition in overweight Turkish young women: a 12-week interventional study

Yoga e nutrição em jovens turcas com excesso de peso: um estudo intervencionista de 12 semanas

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ABSTRACT

Objective

This study investigated the effects of a structured 12-week yoga program combined with individualized medical nutrition therapy on body composition, emotional expression, and healthy lifestyle behaviors in overweight and mildly obese women.

Methods

This is a quantitative intervention study. A total of 79 Turkish women aged 20–45 years with a body mass index between 25–34.9 kg/m² were enrolled. Participants attended yoga sessions twice weekly and received personalized dietary counseling. Anthropometric data were collected, and two validated instruments – the Emotional Expressivity Scale and the Healthy Lifestyle Behaviors Scale II – were administered at baseline and after 12 weeks. Data were analyzed quantitatively using paired t-tests and correlation analysis.

Results

Statistically significant improvements were observed in body weight, body mass index, waist circumference, fat percentage, and emotional expression scores ($p < 0.05$). Healthy lifestyle behaviors also improved across all subscales.

Conclusion

The integration of yoga and individualized nutrition counseling appears to be an effective and holistic approach to promoting emotional well-being and improving body composition among overweight and mildly obese adult women.

Keywords: Nutrition. Obesity. Women. Yoga.

RESUMO

Objetivo

Este estudo investigou os efeitos de um programa estruturado de ioga de 12 semanas combinado com terapia nutricional médica individualizada na composição corporal, expressão emocional e comportamentos de estilo de vida saudáveis em mulheres com excesso de peso e ligeiramente obesas.

Métodos

Este é um estudo de intervenção quantitativa. Participaram 79 mulheres turcas entre 20 e 45 anos, com índice de massa corporal entre 25–34,9 kg/m². As participantes realizaram sessões de ioga duas vezes por semana durante 12 semanas e receberam acompanhamento nutricional individualizado. Foram coletadas medidas antropométricas e aplicadas duas escalas validadas: Escala de Expressão de Emoções e Escala de Comportamentos de Estilo de Vida Saudável II, no início e ao final do estudo. Os dados foram analisados quantitativamente através de testes t emparelhados e análise de correlação.

Resultados

Foram observadas melhoras estatisticamente significativas no peso corporal, índice de massa corporal, circunferência da cintura, percentual de gordura corporal e nas pontuações de expressão emocional ($p < 0,05$). Os comportamentos de estilo de vida saudável também melhoraram em todos os domínios avaliados.

Conclusão

A combinação de ioga com aconselhamento nutricional individualizado demonstrou ser uma abordagem eficaz e holística para promover o bem-estar emocional e melhorar a composição corporal em mulheres adultas com sobrepeso e obesidade leve.

Palavras-chave: Nutrição. Obesidade. Mulheres. Yoga.

INTRODUCTION

Sedentary lifestyles have become prevalent due to the pace of school and work, technological advancements, and easier transportation. However, it is important to note that such lifestyles are associated with an increased risk of obesity and various health problems. The sedentary lifestyle is a significant threat to public health in our country, with 87% of women and 77% of men affected. This lifestyle is a crucial factor in the development of obesity, as reported by the Turkish Sports Federation for All and Banerjee [1,2]. The type and intensity of exercise, frequency and duration of interventions, and the method of implementation (e.g., at home, individually, or in a group setting) are all important factors to consider. To manage weight effectively, it is crucial to maintain healthy eating habits and engage in regular physical activity. Weight management strategies depend on a healthy lifestyle, achieved by increasing physical activity and reducing food intake to maintain energy balance [3]. These programs effectively modify individuals' eating and physical activity behaviors, leading to healthier lifestyles. It is worth noting that weight regain is common over time. Complementary and alternative methods for long-term weight loss and fitness maintenance have significantly increased in recent years. While conventional medicine has made notable advances in weight control, it is important to recognize that many individuals prefer non-pharmacological treatment options and complementary and alternative health approaches for weight management [4]. Research has shown that incorporating body movement approaches, such as yoga, with traditional weight management strategies leads to better outcomes [5]. In fact, yoga is one of the most preferred complementary medicine methods used by adults to manage their weight, according to the 2017 United States National Health Statistics report [6].

Yoga effectively regulates energy balance parameters in weight management programs. Its holistic mind-body approach has a healing effect on physical, mental, emotional, and spiritual functions through repetitive physical movements [7]. Lifestyle-based exercise for health and well-being includes physical postures (*asanas*), breathing exercises (*pranayama*), meditation (*dhyana*), stretching, mind-body awareness, and focus of attention. Yoga is classified as a light or moderate physical activity according to the current United States National Physical Activity Guidelines, due to its various styles. Yoga is a versatile exercise that can be classified as both aerobic and strength training, depending on the style and postures utilized. To achieve optimal results, it is recommended

that adults engage in 150–300 minutes of moderate-intensity yoga practice per week. The American College of Sports Medicine evaluates yoga as a neuromotor exercise class and recommends practicing two to three times per week, for 20 to 30 minutes per day, regardless of intensity [8,9].

Yoga is highly recommended for individuals with chronic pain, stress, and anxiety due to its focus on low-to-moderate-intensity whole-body movements that activate core muscles, increase functional capacity, and reduce muscle stiffness. This is particularly beneficial for those affected by musculoskeletal and mental health disorders. It is important to note that any subjective evaluations will be clearly marked as such. Contemporary yoga practice is widely regarded as a lifestyle, despite being commonly offered as a form of physical exercise in gyms and recreational centers [10].

Yoga is a highly effective alternative to other forms of physical activity, especially for overweight and obese individuals who struggle to adhere to recommended exercise programs. Yoga practitioners exhibit higher diet quality indices, greater motivation to consume healthy foods, and improved control over emotional and binge-eating behaviors, as demonstrated by numerous studies. Yoga's stress management benefits increase awareness of eating habits, leading to a preference for a "slow food" style of diet over "fast food". These findings have been consistently observed across multiple studies, highlighting the positive impact of yoga on dietary patterns. Yoga's physical and cognitive components have a positive impact on psychological processes related to weight control, such as stress and awareness, as well as maintenance skills like coping strategies, self-monitoring, and physical activity. This is supported by research conducted by Riley et al., Kolimechikov et al., and Verma et al. [11-13].

Mindfulness is a well-established technique that can be used to improve both mental and physical health. It has been shown to decrease psychological symptoms and enhance overall quality of life. Furthermore, extensive research has demonstrated a positive correlation between mindfulness and psychological well-being in individuals with chronic illnesses. Yoga improves the standard of daily living through hormonal balance, toxin removal, breathing techniques, and mindful exercises that soothe the muscles and mind [14]. Yoga effectively addresses physical and mental conditions such as eating disorders, generalized anxiety, and stress. Studies have also shown that it improves the quality of life for patients with breast and prostate cancer and fibromyalgia. Yoga practitioners consistently experience a multitude of positive effects on their physical and psychological well-being. These include increased muscle strength and flexibility, improved body image, relaxation, breath awareness, heightened self-efficacy, mindfulness, self-compassion, and an overall improved quality of life [12,13]. These benefits have been extensively documented in previously conducted studies [11,14,15].

Research on the impact of yoga on weight and healthy lifestyle behaviors has been constrained by inadequate sample sizes of normal-weight individuals, limited randomized trials, and lack of prolonged dietary interventions [14,16]. This study investigated the effects of a structured 12-week yoga program combined with individualized Medical Nutrition Therapy (MNT) on body composition, emotional expression, and healthy lifestyle behaviors in overweight and mildly obese women. The study focused on anthropometric measurements, body composition, physical fitness, and cardiometabolic health-related markers, as well as depression, anxiety, and quality of life.

METHODS

Research location, time, and sample selection

The study was conducted with female volunteers, aged 20–45, who received regular medical nutrition therapy and yoga services twice a week at a private wellness center in Karabük between

June and August 2024. These criteria excluded male individuals, those with malignancies, those who could not adapt to the nutrition program or those who were on a specific diet, those with serious chronic kidney, heart, or endocrine diseases, individuals over the age of 45, and those with a Body Mass Index (BMI) $\leq 24.9 \text{ kg/m}^2$ or $\geq 35 \text{ kg/m}^2$. Furthermore, participants who missed two consecutive yoga sessions or were noncompliant with the nutrition program were also excluded. Participants were fully informed regarding the research and provided their consent by signing the Informed Consent Form. The study was granted ethical approval (Decision No: 96) by the Ankara Medipol University Non-Interventional Clinical Research Ethics Committee on August 24, 2023.

Research design, data collection, and evaluation

A total of 79 female volunteers aged 20–45 participated in the study, attending yoga sessions twice a week for 12 weeks. Anthropometric measurements were taken at the beginning and end of the study. Individualized medical nutrition therapy plans were prepared for each participant by a specialist dietitian, with regular follow-ups conducted throughout the study. The participants were surveyed using a face-to-face interview-based questionnaire, which consisted of three parts and lasted approximately 15 minutes. The first part contained questions regarding the participants' demographic characteristics, including age, educational status, and profession, as well as their general health status and physical activity records. The second part comprised anthropometric measurements. The third and final part included the Emotional Expressivity Scale (EES) and the Healthy Lifestyle Behaviors Scale II (HLBS II). The survey was administered to the participants both at the beginning of the study (pre-test) and at the end of the 12 weeks (post-test) (Figure 1).

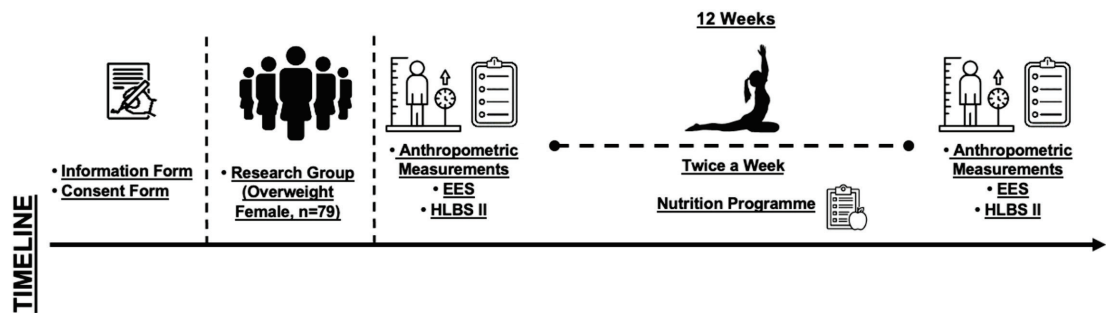


Figure 1 – Timeline.

Note: EES: Emotional Expressivity Scale; HLBS II: Healthy Lifestyle Behaviors Scale II.

Emotional Expressivity Scale

The EES, consisting of 15 items and 3 subscales (positive emotion expression, negative emotion expression, and closeness expression), was originally developed by King and Emmons [17] and later adapted into Turkish by Kuzucu [18]. The scale employs a 7-point Likert rating system, with the 6th and 14th items being reverse-scored. The three subscales explain 35% of the total variance. The scale's inter-item correlations ranged from 0.06 to 0.59, with a mean of 0.18. Each subscale has a high reliability coefficient despite the small number of items. The positive emotion expression subscale had a Cronbach's alpha reliability coefficient of 0.70, the negative emotion expression subscale had a coefficient of 0.64, and the closeness expression subscale had a coefficient of 0.68 [17,18].

Healthy Lifestyle Behaviors Scale II

The HLBS II, which was developed by Walker in 1987 and revised in 1996, consists of 52 items and six subscales: spiritual growth, interpersonal relationships, nutrition, physical activity, health responsibility, and stress management. The scale is scored using a 4-point Likert scale. The overall score of the scale yields the healthy lifestyle behaviors score, which ranges from 52 to 208. The reliability coefficient of the scale, as measured by Cronbach's alpha, is 0.92. The subscales demonstrate strong internal consistency, with Cronbach's alpha values ranging from 0.79 to 0.87. Although the scale was adapted into Turkish by Bahar et al., the Cronbach's alpha value in that study was reported as 0.68, with subscale values ranging from 0.71 to 0.79 [19,20].

Anthropometric measurements

Participant height was measured using a stadiometer. Body composition values, such as body weight, BMI, body fat percentage, and body muscle percentage, were measured with the InBody-120 device, a Bioelectrical Impedance Analysis (BIA) device with kilogram-level sensitivity. Anthropometric measurements were taken at the beginning and end of the study.

Planning the nutrition and diet program

A personalized dietary program was created for each individual, taking into account their body composition results (including body fat, muscle mass, and body water proportions), lifestyle, nutritional habits, and daily energy needs and consumption, which should not fall below the individual's Basal Metabolic Rate (BMR). The basal metabolic rate for each participant was calculated using the Schofield equation, considering age, sex, and body weight. Total Energy Expenditure (TEE) was estimated by multiplying the BMR by an appropriate Physical Activity Level (PAL) factor, based on the individual's lifestyle. Daily energy intake was then planned to include a 15–20% caloric restriction relative to TEE.

The nutrition program's content specifies a planned Carbohydrate (CHO) intake of 55–60%, a protein intake of 15–20% or a protein content of at least 1.5 g/kg per day, a fat intake of 25–35%, and a recommended daily water consumption of 30–35 mL per kg. To monitor dietary adherence, participants were followed up through face-to-face interviews every two weeks. During these sessions, body composition was re-assessed using the BIA device, and nutrition plans were adjusted accordingly by the dietitian based on compliance, feedback, and progress. Dietary adherence was evaluated through a combination of appointment attendance, self-reported compliance, and measured anthropometric changes.

Yoga practice

The basic yoga program consisted of 60-minute sessions. These were held twice a week for 12 weeks. Yoga postures, breathing exercises, deep relaxation/meditation, and traditional yoga teachings were included in each session. Practical exercises and instructions on meditation, positive thinking, and relaxation were also provided. The yoga instructor leading the sessions was trained by a recognized national professional institution. The yoga instructor was responsible for documenting attendance and any adverse events or absences.

Analysis of data

The data underwent statistical evaluation using the IBM®SPSS® (version 27.0) package program. Descriptive statistical measures such as mean, standard deviation, minimum and maximum values, and percentages were employed. Since the data fulfilled the assumptions for parametric tests, one-way ANOVA was used for comparisons between more than two independent groups, and the independent samples *t*-test was used to compare the means of two independent groups. The paired samples *t*-test was also used to analyze continuous variables at weeks 0 and 12. Two-way repeated measures ANOVA was applied to determine the effect of the scale total scores on the variables. Additionally, Pearson correlation analysis was utilized to establish the direction and strength of the relationship between the variables. The error level was set at $p < 0.05$.

RESULTS

The research participants were exclusively female with an average age of 37.2 ± 6.66 years. A significant proportion of the participants, 86.1% ($n=68$), had completed undergraduate degrees. Additionally, most participants did not smoke (84.7%, $n=67$). These findings reflect a highly educated and health-conscious sample, which strengthens the validity of our results. The study found that the majority of participants (91.1%, $n=72$) did not regularly use medication. Most participants had been practicing yoga for 1–2 months (72.2%, $n=57$) and practiced weekly (83.5%, $n=66$). Notably, none of the participants reported any chronic diseases in their family history. Table 1 shows that participants did yoga for 2–3 days per week.

Table 1 – Distribution of women according to sociodemographic characteristics ($n=79$).

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Sociodemographic Characteristics	n	%
Age (years)		
20–30	11	13.3
31–39	45	56.6
≥ 40	23	30.1
Average age (min–max): 37.2 (± 6.7)		
Educational background		
High school	7	8.9
Undergraduate/College	68	86.1
Postgraduate	4	5.1
Marital status		
Married	58	73.4
Single	21	26.6
Working status		
Employed	50	63.3
Unemployed	29	36.7
Alcohol consumption status		
Consumes	5	6.3
Does not consume	74	93.7
Presence of chronic disease		
Present	7	8.9
Absent	72	91.1
Presence of chronic disease in the family		
Yes	12	15.2
No	67	84.8

Table 1 – Distribution of women according to sociodemographic characteristics (n=79).

Sociodemographic Characteristics	n	%
Regular medication use		
Yes	7	8.9
No	72	91.1
How long has she been doing yoga regularly?		
1–2 months	57	72.2
3–4 months	22	27.8
Number of yoga practices (per week)		
2–3 days	66	83.5
4–5 days	13	16.5

When the difference between the anthropometric measurements of women at week 0 and week 12 was evaluated, it was found that there was a significant difference in all values ($p<0.05$) (Table 2).

Table 2 – Averages and comparison of women's anthropometric measurements.

Anthropometric measurements	Week 0	Week 12	t/p*
	M±SD (Min–Max)	M±SD (Min–Max)	
Height (cm)	159.3±4.44 (140–172)	159.3±4.44 (140–172)	–
Body weight (kg)	78.8±10.75 (54.90–92.40)	75.3±12.91 (50.20–85.30)	-0.329/0.743
Body mass index (kg/m ²)	31.0±4.52 (25.40–33.50)	27.2±5.14 (22.90–29.06)	0.261/0.000
Waist circumference (cm)	94.0±10.02 (75.50–118.40)	85.4±10.34 (71.60–104.50)	0.580/0.000
Hip circumference (cm)	92.2±6.41 (76.60–119.0)	85.9±9.85 (75.30–108.00)	0.380/0.000
Waist/hip ratio	0.9±0.12 (0.62–1.34)	0.9±0.12 (0.74–1.14)	0.264/0.005
Waist/height ratio	0.5±0.06 (0.46–0.76)	0.5±0.06 (0.43–0.72)	0.635/0.000
Body fat percentage (%)	43.0±4.18 (35.90–51.00)	33.2±4.74 (24.00–45.00)	0.461/0.000
Body fat mass (kg)	40.5±9.10 (27.30–55.20)	32.9±7.21 (23.30–49.80)	0.246/0.000
Lean body percentage (%)	39.4±4.33 (21.60–47.80)	41.9±4.35 (20.10–46.30)	0.287/0.000
Lean body mass (kg)	48.4±6.51 (30.30–59.60)	49.1±6.30 (31.30–60.60)	0.490/0.000

Note: *Paired samples t-test. M: Mean; SD: Standard Deviation.

Regular yoga practice has a positive effect on women's emotional expression, as evidenced by the significant difference found between the total scores and all sub-dimensions of the Emotional Expressivity Scale at weeks 0 and 12 ($p<0.05$) (Table 3).

The week 0 averages of the HLBS II, used to assess the healthy lifestyle behaviors of the female participants, yielded a total score of 114.5±6.85. By week 12, the average total score of the scale increased significantly to 125.7±5.97, demonstrating a clear improvement in healthy lifestyle behaviors. All variables, including the total and sub-dimensions of the HLBS II, showed a significant difference between the mean scores obtained at weeks 0 and 12 ($p<0.05$), indicating the positive impact of yoga. The study results demonstrate that regular yoga practice is an effective method for increasing mean scores and promoting healthy lifestyle behaviors among women.

A significant difference was found between the mean scores of the closeness sub-dimension at week 0 and the weekly frequency of yoga practice, as well as between the mean scores of the positive expression sub-dimension at week 0 and working status, when comparing them with sociodemographic characteristics.

Table 3 – Comparison of the Emotional Expressivity Scale and the Healthy Lifestyle Behaviors Scale II total and subscale scores.

Scales	Week 0	Week 12	<i>t/p*</i>
	M±SD	M±SD	
Emotional Expressivity Scale (Total)	61.5±4.24	65.7±4.97	-11.561/0.000
Proximity	23.4±2.35	25.9±2.78	-11.052/0.000
Positive	20.1±2.61	21.3±2.67	-6.154/0.000
Negative	17.9±2.22	18.4±2.45	-2.193/0.031
Healthy Lifestyle Behaviors Scale II (Total)	114.5±6.85	125.7±5.97	-20.889/0.000
Health responsibility	19.0±1.92	20.1±1.89	-8.782/0.000
Physical activity	16.2±2.45	18.5 ±2.26	-13.263/0.000
Nutrition	20.5±2.44	21.8±2.15	-7.012/0.000
Spiritual development	20.9±2.29	23.7±2.55	-11.491/0.000
Interpersonal relationships	19.7±1.59	21.4 ±1.75	-11.265/0.000
Stress management	18.0±2.06	20.0±2.50	-9.241/0.000

Note: *Paired samples t-test. M: Mean; SD: Standard Deviation.

These findings demonstrate the impact of sociodemographic factors on the total and sub-dimensions of the Emotional Expressivity Scale. Significant differences were found between the positive expression sub-dimension mean score at week 12 and the presence of chronic diseases, as well as between the negative expression subscale mean score at week 12 and the duration of regular yoga practice, and also between the scale total score mean at week 0 and the presence of chronic diseases, as well as between the scale total score mean at week 0 and the number of yoga practices ($p<0.05$). In contrast, there were no significant differences found among the remaining sociodemographic characteristics in the analysis of the scores obtained from the total and sub-dimensions of the scale at weeks 0 and 12 ($p>0.05$). Furthermore, regular yoga practice was found to be a primary factor influencing emotional expression, comparable to other sociodemographic variables (Table 4).

Table 4 – Distribution and comparison of the total scores of the Emotional Expressivity Scale and Healthy Lifestyle Behaviors Scale II according to the sociodemographic characteristics of women.

Features	Emotional Expressivity Scale Total Score		Healthy Lifestyle Behaviors Scale II Total Score	
	Week 0	Week 12	Week 0	Week 12
	M±SD	M±SD	M±SD	M±SD
Age (years)				
20–30	113.1±6.70	124.4±5.83	60.5±3.88	64.5 ±4.63
31–39	114.6±7.06	126.0±6.47	61.7±4.03	66.1±5.01
≥ 40	114.8±6.71	125.8±5.13	62.8±4.70	65.5±5.12
<i>F/p*</i>	0.249/0.780	0.301/0.741	1.392/0.254	0.528/0.592
ANOVA	0.178/0.950***		2.297/0.061***	
Educational background				
High school	111.7±7.75	122.2±9.49	62.2±5.31	66.4±5.98
Undergraduate/College	114.5±6.39	126.0±5.26	61.2±4.14	65.5±5.05
Postgraduate	118.1±9.82	127.3±6.56	64.1±3.18	67.5±1.04
<i>F/p*</i>	1.593/0.210	1.933/0.151	1.417/0.236	0.519/0.597
ANOVA	1.357/0.251***		0.772/0.545***	
Marital status				
Married	114.4±6.74	125.5±6.24	61.2±3.94	65.5±4.95
Single	114.8±7.28	126.2±5.30	62.4±4.94	66.3±5.08
<i>t/p**</i>	-0.278/0.782	-0.431/0.668	-1.188/0.238	-0.701/0.485
ANOVA	0.093/0.912***		0.736/0.482***	

Table 4 – Distribution and comparison of the total scores of the Emotional Expressivity Scale and Healthy Lifestyle Behaviors Scale II according to the sociodemographic characteristics of women.

Features	Emotional Expressivity Scale Total Score		Healthy Lifestyle Behaviors Scale II Total Score	
	Week 0	Week 12	Week 0	Week 12
	M±SD	M±SD	M±SD	M±SD
Working status				
Working	114.8±7.34	125.9±6.51	62.1±4.62	66.2±4.79
Not working	114.0±6.04	125.3±5.00	60.6±3.39	65.0±5.25
t/p**	0.475/0.636	0.436/0.664	1.551/0.125	1.092/0.278
ANOVA	0.121/0.886***		1.193/0.309***	
Smoking status				
Smoker	114.9±6.45	125.3±5.96	61.6±4.13	65.7±4.89
Non-smoker	114.2±7.21	126.1±6.02	61.4±4.38	65.7±5.09
t/p**	0.461/0.646	-0.629/0.531	0.204/0.839	0.021/0.984
ANOVA	1.064/0.350***		0.040/0.961***	
Alcohol consumption status				
Consumes	116.6±4.72	130.0±3.67	62.4±4.61	67.2±7.39
Does not consume	114.4±6.97	125.4±6.00	61.4±4.25	65.6±4.83
t/p**	0.694/0.490	1.655/0.102	0.463/0.644	0.660/0.511
ANOVA	1.599/0.209***		0.216/0.806***	
Presence of chronic disease				
Present	120.5±7.72	129.8±5.14	65.1±5.55	69.0±3.87
Absent	113.9±6.55	125.3±5.93	61.2±3.99	65.4±4.97
t/p**	2.514/0.014	1.928/0.057	2.411/0.018	1.820/0.072
ANOVA	3.148/0.048***		2.872/0.062	
Presence of chronic disease in the family				
Yes	117.0±6.71	128.8 ± 3.30	61.4±2.53	66.2±4.24
No	114.0±6.82	125.1 ± 6.20	61.5±4.53	65.6±5.13
t/p**	1.489/0.140	3.222/0.003	-0.157/0.876	0.364/0.717
ANOVA	2.342/0.103***		0.231/0.795***	
Regular medication use				
Yes	120.1±7.25	129.5±4.87	63.5±6.92	67.3±5.82
No	113.9±6.58	125.3±5.96	61.3±3.87	65.6±4.88
t/p**	2.505/0.014	1.893/0.062	1.378/0.172	0.959/0.340
ANOVA	3.116/0.049***		0.944/0.393***	
How long has she been doing yoga regularly?				
1-2 months	114.6±7.20	126.3±5.79	61.8±4.76	66.2±4.99
3-4 months	114.2±6.03	124.2±6.26	60.7±2.51	64.7±4.86
t/p**	0.271/0.787	1.479/0.143	1.311/0.194	1.246/0.216
ANOVA	1.733/0.183***		0.777/0.463***	
Number of yoga practices (per week)				
2-3 days	114.9±6.02	126.3±5.70	61.0±4.26	65.3±4.98
4-5 days	112.8±9.91	123.2±6.71	63.7±3.55	67.8±4.50
t/p**	0.763/0.456	1.810/0.074	-2.261/0.026	-1.828/0.071
ANOVA	1.682/0.193***		2.553/0.084***	

Note: *One-way ANOVA test, **Independent Sample t-test, ***Two-way ANOVA analysis of variance in repeated measurements. M: Mean; SD: Standard Deviation.

Upon evaluating the relationship between the scores obtained from the scales at week 0, it is evident that as closeness increases, the total score for the EES and stress management increase, while interpersonal relationships decrease. Furthermore, an increase in positive emotions leads to an increase in the total score for the EES and nutritional behaviors, but a decrease in physical activity behavior. Lastly, an increase in negative emotions results in a decrease in the scores for the EES.

Table 5 – The relationship between the total and sub-dimensions of the Emotional Expressivity Scale and the Healthy Lifestyle Behaviors Scale II between weeks 0 and 12.

Scales		Week 0										
		Proximity	Positive	Negative	EES Total	Health Responsibility	Physical Activity	Nutrition	Spiritual Growth	Interpersonal Relationships	Stress Management	HLBS II Total
Proximity	<i>r</i>	1	0.184	-0.152	0.589	0.179	0.172	0.005	0.004	-0.222	0.235	0.134
	<i>p</i>		0.097	0.171	0.000	0.106	0.119	0.962	0.975	0.044	0.032	0.228
Positive	<i>r</i>		1	0.004	0.719	-0.141	-0.224	0.354	-0.135	-0.104	0.031	-0.053
	<i>p</i>			0.970	0.000	0.203	0.042	0.001	0.222	0.352	0.779	0.632
Negative	<i>r</i>			1	0.442	0.020	-0.013	0.151	-0.092	0.201	0.140	0.113
	<i>p</i>				0.000	0.856	0.910	0.172	0.408	0.069	0.208	0.309
EES Total	<i>r</i>				1	0.023	-0.048	0.300	-0.129	-0.082	0.223	0.101
	<i>p</i>					0.836	0.664	0.006	0.244	0.462	0.043	0.366
Health Responsibility	<i>r</i>					1	0.339	0.207	0.086	0.021	0.381	0.623
	<i>p</i>						0.000	0.061	0.440	0.852	0.000	0.000
Physical Activity	<i>r</i>						1	0.164	0.076	-0.029	0.330	0.628
	<i>p</i>							0.138	0.497	0.797	0.002	0.000
Nutrition	<i>r</i>							1	0.110	0.114	0.199	0.596
	<i>p</i>								0.324	0.303	0.071	0.000
Spiritual Growth	<i>r</i>								1	0.113	0.076	0.475
	<i>p</i>									0.310	0.493	0.000
Interpersonal Relationships	<i>r</i>									1	-0.204	0.246
	<i>p</i>										0.064	0.025
Stress Management	<i>r</i>										1	0.574
	<i>p</i>											0.000
HLBS II Total	<i>r</i>											1
	<i>p</i>											
Scales		Week 12										
		Proximity	Positive	Negative	EES Total	Health Responsibility	Physical Activity	Nutrition	Spiritual Growth	Interpersonal Relationships	Stress Management	HLBS II Total
Proximity	<i>r</i>	1	0.142	0.100	0.685	0.213	0.064	-0.123	0.088	-0.137	0.291	0.167
	<i>p</i>		0.199	0.370	0.000	0.053	0.565	0.267	0.427	0.215	0.008	0.131
Positive	<i>r</i>		1	0.028	0.631	-0.138	-0.275	-0.003	0.117	-0.070	-0.218	-0.210
	<i>p</i>			0.804	0.000	0.215	0.012	0.978	0.291	0.531	0.048	0.056
Negative	<i>r</i>			1	0.564	-0.192	0.017	0.120	0.142	0.199	0.027	0.119
	<i>p</i>				0.000	0.081	0.878	0.280	0.098	0.072	0.809	0.283
EES Total	<i>r</i>				1	-0.050	-0.103	-0.011	0.183	-0.016	0.059	0.039
	<i>p</i>					0.655	0.352	0.919	0.098	0.884	0.595	0.725
Health Responsibility	<i>r</i>					1	0.217	0.034	-0.024	0.097	0.126	0.484
	<i>p</i>						0.048	0.763	0.833	0.382	0.255	0.000
Physical Activity	<i>r</i>						1	0.292	0.043	0.176	-0.099	0.581
	<i>p</i>							0.007	0.703	0.112	0.372	0.000
Nutrition	<i>r</i>							1	0.004	0.327	-0.120	0.530
	<i>p</i>								0.970	0.003	0.282	0.000
Spiritual Growth	<i>r</i>								1	-0.112	-0.041	0.388
	<i>p</i>									0.314	0.712	0.000
Interpersonal Relationships	<i>r</i>									1	-0.069	0.432
	<i>p</i>										0.534	0.000
Stress Management	<i>r</i>										1	0.341
	<i>p</i>											0.002
HLBS II Total	<i>r</i>											1
	<i>p</i>											

Note: Pearson correlation analysis was used. Correlation coefficients (*r*) and *p*-values (*p*) are presented. EES: Emotional Expressivity Scale; HLBS II: Healthy Lifestyle Behaviors Scale II.

Furthermore, physical activity is positively associated with stress management and HLBS II total scores. The study confirms that an increase in the total score of nutrition, spiritual growth, interpersonal relationships, and stress management leads to a corresponding increase in the total score of the Healthy Lifestyle Behaviors Scale II. However, Table 5 indicates a predominantly weak, positive, and non-significant correlation between the total and sub-dimensions of the scales at week 0 (Table 5).

The nine predictive variables have a significant relationship ($R^2=0.287$) with women's expression of emotions, as measured by the EES scores at week 0 ($F = 2.593$; $p<0.05$). They account for 28.7% of the variance in emotional expression. The order of importance of these variables for the dependent variable was evaluated, and it was found that regular medication use ($\beta=8.830$) had the highest importance, while the presence of chronic disease ($\beta=-13.399$) had the most negative contribution. Chronic disease, regular medication use, and weekly frequency of yoga practice were found to be significant predictors of emotional expression at week 0 ($p<0.05$), based on the significance tests of the regression coefficients (Table 6). At week 12, it was found that regular medication use had the highest standardized regression coefficient ($\beta=9.898$), indicating its strong positive significance in the study. On the other hand, the presence of chronic disease had the most negative standardized regression coefficient ($\beta=-14.108$), suggesting its strong negative impact. The chronic disease variable was found to significantly predict emotional expression at week 12 ($p<0.05$), as demonstrated in Table 6.

Table 6 – Emotional Expressivity Scale total score regression analysis at weeks 0 and 12.

Week 0	β	SE	p	95%CI	
				Lower	Upper
Age				-0.016	0.245
Educational background	0.114	0.065	0.086	-2.020	2.219
Marital status	0.100	1.063	0.926	-1.469	2.546
Working status	0.538	1.007	0.595	-2.315	2.592
Smoking status	0.138	1.230	0.911	-1.648	1.867
Presence of chronic disease	0.109	0.881	0.901	-21.948	-4.849
Regular medication use	-13.399	4.288	0.003	0.835	16.825
How long has she been practicing yoga regularly?	8.830	4.010	0.031	-2.683	1.216
Number of yoga practices (per week)	-0.734	0.978	0.456	0.238	4.802
	<i>2,520</i>	<i>1,144</i>	<i>0.031</i>		
$R^2 = 0.287$ $F = 2.593$ $p=0.008$					
Week 12	β	SE	p	95%CI	
				Lower	Upper
Age	-0.017	0.082	0.839	-0.181	0.147
Educational background	-0.367	1.335	0.784	-3.029	2.295
Marital status	-0.009	1.265	0.994	-2.531	2.512
Working status	-0.432	1.545	0.781	-3.513	2.649
Smoking status	0.192	1.107	0.863	-2.015	2.399
Presence of chronic disease	-14.108	5.385	<i>0.011</i>	-24.845	-3.371
Regular medication use	9.898	5.035	0.053	-0.143	19.938
How long has she been practicing yoga regularly?	-1.142	1.228	0.356	-3.590	1.307
Number of yoga practices (per week)	2.490	1.437	0.087	-0.375	5.356
$R^2 = 0.179$ $F = 1.405$ $p=0.190$					

Note: Multiple linear regression analysis was used. EES: Emotional Expressivity Scale; CI: Confidence Interval; SE: Standard Error.

Values written in italics indicate statistical significance at the $p<0.05$ level. Multiple linear regression analysis was used. EES: Emotional Expressivity Scale; CI: Confidence Interval; SE: Standard Error.

DISCUSSION

Yoga has been shown to have positive effects on body composition, physical and mental health, cardiovascular risk factors, and chronic pain in various populations, including individuals with obesity. This is supported by recent studies conducted worldwide [20-26]. This study investigated the effects of a structured 12-week yoga program combined with individualized medical nutrition therapy on body composition, emotional expression, and healthy lifestyle behaviors in overweight and mildly obese women.

Anthropometric and body composition variables are frequently studied in the literature on yoga-based training for overweight or obese individuals. Research has shown that the addition of diet and nutrition recommendations to yoga practice can significantly impact daily energy balance and anthropometric measurements. Incorporating yoga into a weight management program can help to reduce the amount of energy consumed and improve eating habits. It is important to note that while yoga interventions alone may not be sufficient to increase energy expenditure, they can still be a valuable addition to a comprehensive weight management plan [23,25]. Yoga and mindful eating interventions have been clinically proven to effectively control weight and improve body composition. Batrakoulis et al. [27,28] and Henninger et al. [29] have demonstrated that these interventions can lead to significant reductions in body weight, fat percentage, and BMI, while also improving muscle strength and endurance. A controlled study conducted in India found significant improvements in anthropometric measurements after 12 weeks of yoga combined with medical nutrition intervention [30]. Body weight, BMI, waist circumference, hip circumference, body fat percentage, and body fat mass all decreased significantly, while lean body mass percentage and lean body mass increased. These results demonstrate the effectiveness of these interventions in improving body composition. Yoga increases self-awareness and self-compassion and interacts positively with other weight control behaviors. Practicing mindfulness through yoga reduces non-homeostatic eating by increasing awareness of hunger signals. It also helps individuals cope with distressing thoughts or feelings that may result from intense cravings or urges to eat.

Research on the effects of yoga-based exercise interventions on psychophysiological markers is limited. However, Henninger et al. [30] demonstrated that mindful eating and yoga not only improved body composition but also enhanced mental quality of life scores. In their study, Omelan et al. [31] analyzed the body composition of 94 women who regularly practiced yoga and investigated the effect of yoga on their psychophysiological health. The vast majority of participants (89%) reported a positive impact on their mental health, while 86% reported improvements in their physical health. Practicing yoga has been shown to improve quality of life and well-being, as demonstrated by several studies using different scales to assess healthy lifestyles [32-34]. The present study demonstrates that regular yoga practice is effective in the improvement of emotional expression and the development of healthy lifestyle behaviors in women. The results of the study showed a significant increase in the mean scores of women who practiced yoga. These findings provide evidence for the benefits of yoga in promoting overall well-being. Notably, individuals with chronic diseases and those using regular medication experienced a significantly greater change in their healthy lifestyle behaviors ($p < 0.05$).

These findings are consistent with prior studies showing the effectiveness of yoga combined with dietary interventions in improving physical and psychological health indicators [35,36]. However, the absence of a validated measure of eating behavior limits the scope of interpretation regarding psychological eating patterns. Future studies should incorporate tools to assess emotional or mindful eating and explore their mediating roles in lifestyle-based interventions. Additionally, including male participants or participants from broader age groups could enhance generalizability of the findings.

CONCLUSION

This study demonstrated that a 12-week yoga program combined with personalized medical nutrition therapy led to significant improvements in anthropometric measurements (including body weight, BMI, waist circumference, and body fat percentage) and enhanced healthy lifestyle behaviors and emotional expression in overweight and mildly obese women. These findings support the use of integrative, lifestyle-based interventions for physical and emotional health improvement. Future studies should include longer follow-up periods and more diverse populations to assess long-term effectiveness and generalizability of these findings.

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