The Effect of Yoga on Quality of Life in Women with Metabolic Syndrome: An Exploratory Pilot Study

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Background: South Korea is one of the Organization for Economic Cooperation and Development (OECD) countries with the longest working hours. This means that people do not spend a lot of time engaging in health activities. The purpose of this study was to investigate how yoga exercise twice a week affects the quality of life of women with metabolic syndrome in South Korea.

Methods: Participants were assigned to either a yoga exercise group (n=17) or a control group (n=20). The yoga exercise group underwent exercise twice a week for 60 minutes, for a duration of 3 months. The quality of life of both groups was assessed using the EuroQoL-5 Dimension (EQ-5D) and the EuroQoL Visual Analog Scale (EQ-VAS).

Results: EQ-VAS scores tended to increase in the yoga group compared to the control group (yoga group 76.29±13.10, control group 70.50±15.21, P=0.064), but the difference between the groups was not statistically significant. Furthermore, there was no statistically significant difference in EQ-5D scores (yoga group 0.88±0.10, control group 0.91±0.07, P=0.762) between the two groups when we compared quality of life before and after the yoga exercise program.

Conclusion: Short-term intermittent yoga exercises, which lasted 1 hour and were performed twice a week for 3 months, performed in a group of female patients with metabolic syndrome did not lead to statistically significant changes in quality of life indices or metabolic syndrome indicators. Further studies including more frequent yoga exercise over longer periods of time are needed to establish the exact effect of yoga on quality of life in women with metabolic syndrome.

Key Words: Metabolic syndrome, Quality of life, Yoga

INTRODUCTION

Metabolic syndrome describes the comorbid occurrence of abdominal obesity, hyperlipidemia, dysglycemia, and hypertension in one person, thereby increasing his or her risk of cardiac and cerebrovascular disease and type 2 diabetes mellitus [1,2]. According to a recent study conducted using data from the Korean National Health and Nutrition Examination Survey (KNHANES) in 2013, the prevalence of metabolic syndrome in adults over 20 years was 28.9% in South Korea

overall, 30.8% in men, and 26.3% in women [3].

Metabolic syndrome not only increases the incidence of chronic diseases, such as coronary artery disease, cerebrovascular disease, and diabetes mellitus, but is also a major factor in lowering a person's quality of life. According to other studies conducted with data from the 2005 KNHANES, health-related quality of life is lower in patients with metabolic syndrome than in those without metabolic syndrome [4-6].

In a web-based study from 2016, metabolic syndrome patients showed lower levels of role-physical, vitality, and mental

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health than those without metabolic syndrome [7].

In a recent study of patients with type 2 diabetes, exercise was reported to have a positive effect on quality of life [8]. A cross-sectional study of patients with metabolic syndrome in South Korea showed that patients who exercised had a higher quality of life than those who did not exercise, which was observed for all of three assessed types of exercise, that is, resistance, flexibility, and walking [9]. Yoga exercise, which is used for health, fitness, and injury treatment, has been shown to be effective for improving the quality of life of diverse groups in various studies [10].

A study of overweight and obese individuals found that short-term yoga exercise had a positive effect on the quality of life of most participants [11], and regular yoga exercise for type 2 diabetic patients has been reported to decrease the frequency and intensity of depression and increase quality of life [12,13]. In addition, Tew et al. [14] reported that adapted yoga improves physical function and mental health in older adults with no physical activity.

However, few prospective studies have examined the effect of yoga exercise on quality of life in patients with metabolic syndrome. South Korea is one of the OECD countries countries with the longest working hours [15]. This makes it difficult for individuals to spend a lot of time engaging in health activities. The purpose of this study was thus to investigate the practical effect of yoga exercise (twice a week) on the quality of life of women with metabolic syndrome in South Korea.

MATERIALS AND METHODS

1. Participants

The criteria for inclusion in this study were the following: female, married; under 60 years of age; diagnosed with metabolic syndrome; and able to participate in exercise programs. We excluded patients who had uncontrolled hypertension, arrhythmia, chronic obstructive pulmonary disease, mental illness, or had been admitted to hospital within the past 6 months due to coronary artery disease or suspected coronary artery disease (such as chest pain during exercise). We did not include patients who were pregnant or lactating, drug

abusers (including alcohol), or unable to complete a 3-month intervention (due to a move, immigration, etc.). Finally, after excluding 15 women who did not meet the criteria for metabolic syndrome and nine women with uncontrolled hypertension or with current prescriptions for medication to treat mental illness, 37 women were enrolled in this study. The research assistants announced the participants' group assignment, while the investigators and statistician were blinded to the group allocation. The participants were randomly assigned to groups starting the yoga program immediately (yoga exercise group) or 12 weeks after enrollment (wait-listed control group).

2. Procedures

A diagnosis of metabolic syndrome was made using the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) when three or more of the following components were present [1]: abdominal obesity (waist circumference in women ≥ 85 cm); hyperlipidemia (serum triglyceride level > 150 mg/dL or current medication prescription); low HDL cholesterol (serum HDL < 40 mg/dL, men < 50 mg/dL or taking medication); hypertension (blood pressure $\geq 130/85$ mmHg or hypertension medication); or a blood glucose disorder (≥ 100 mg/dL fasting blood glucose or glucose-lowering medication). The definition of abdominal obesity as waist circumference ≥ 85 cm for women was suitable for use in Korean adults based on information presented at the Korean Society for the Study of Obesity in 2005 [16].

Waist circumference was measured in 0.1-cm increments using a tape measure device at the time of expiration, between the twelfth rib and the upper part of the iliac crest, with the patient in an upright state. Blood pressure was obtained once using an automatic blood pressure monitor after the participant had rested to achieve stabilization for 5 minutes. Blood samples were collected from the upper arm vein after the patient had fasted for more than 12 hours. Total cholesterol, triglycerides, HDL cholesterol, and fasting blood glucose levels were measured.

According to the Korean National Health Insurance Service-National Health Screening (NHIS-HEALS) cohort

data including 505,677 participants, 57.49% did not exercise and 23.72% exercised less than three times a week [17]. The yoga exercise program was conducted twice a week for a duration of 3 months to determine the practical effects of exercise. Each session lasted for 60 minutes and consisted of 50 minutes of yoga postures (Asanas) and 10 minutes of rest (Savasana pose). The yoga method used here was based on Hatha Yoga teachings to develop strength, flexibility, and balance of mental and physical energy [18]. The sequence consisted of 14 postures that were held for ≤ 5 minutes each for a total of approximately 50 minutes. Yoga postures (asana) involved the butterfly posture (BaddhaKonasana), bat posture (UpavisthaKonasana), dead posture (Savasana), blowing in firm pose (Kapalbhati), sitting forward bend posture (Paschimottanasana), and cow face posture (Gomukhasana). The butterfly posture (BaddhaKonasana) involves opening the legs and pelvis so that the legs look like butterfly wings. The person should place his or her feet facing each other, hold the toes with both hands, and pull them close to the perineum while bending the upper body so that the forehead touches the floor in a sitting position. In the bat posture (UpavisthaKonasana), each hand is holding one foot while the legs are stretched out to the side as wide as possible while the upper body slowly stretches forward. The dead body pose (Savasana) is achieved by lying on one's back, placing the arms down on the floor on both sides of the body, closing the eyes, and relaxing. For the blowing in firm pose (Kapalbhati), a person should close his or her eyes while sitting on their bend knees with the hands placed on the knees. This is followed by rapid abdominal breathing. In the sitting forward bend posture (Paschimottanasana), participants should squeeze their toes with their hands while in a sitting position with their legs stretched forward and slowly lean their upper body forward. The cow face posture (Gomukhasana) resembles a cow face because the person sits in a folded position with one knee bent over the other. One arm is then lifted up over the shoulder and hands are clasped behind the back.

3. Outcome measures

We used the EuroQoL-5 Dimension (EQ-5D) and the

EuroQoL Visual Analog Scale (EQ-VAS), which are internationally standardized quality of life measurement methods. The EQ-5D assesses quality of life by incorporating the following five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each item is assigned one of three levels: no problems, some problems, and extreme problems. According to this classification, $3^5=243$ health states can be defined, and an EQ-5D index value with a maximum score of 1 is calculated. The Korean EQ-5BD is weighted using the time tradeoff method. EQ-5D index scores range from -0.171 (i.e., severe problems in all five dimensions) to 1.0 (i.e., no problems in any of the five dimensions) on a scale where 0 indicates death and 1.0 indicates perfect health [19]. The validity and reliability of the Korean version of the EQ-5D have been demonstrated in rheumatic patients [20]. In the EQ-VAS, the perceived health state is scored on a scale of 0 to 100 from worst to best possible [21,22].

4. Statistical analysis

Student's t-test or the Mann-Whitney test were used to compare the general characteristics of the participants, while analysis of covariance (ANCOVA) was used to compare the quality of life indices before and after yoga exercise between the groups that performed or did not perform yoga. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 12.0 (SPSS Inc., Chicago, IL, USA), and a significance level of 5% or less was considered statistically significant in all analyses. A power analysis was conducted using a sample size of 20 for each group and a 10% dropout, yielding a statistical power level of 80%.

5. Ethics statement

This study was conducted after all applicants had received a written explanation of the study and provided informed consent to participate. The study was conducted in compliance with the ethical and safety guidelines and the approval of the institutional review board (IRB) of our hospital.

RESULTS

1. General characteristics of the participants

Thirty-seven participants were enrolled in this study, 17 in the yoga group and 20 in the control group. There were no statistically significant differences in age, height, weight, body mass index, body fat percentage, waist circumference, systolic and diastolic blood pressure, fasting blood glucose, total cholesterol, triglycerides, high-density lipoprotein cholesterol, total bilirubin, AST, ALT, or creatinine levels between the two groups (Table 1).

2. Metabolic syndrome indicators

We compared metabolic syndrome indicators before and after 3 months of yoga exercise and found that weight, body mass index, body fat percentage, fasting blood glucose, and triglyceride levels tended to decrease, while high-density lipoprotein cholesterol levels tended to increase with yoga exercise. However, there was no statistically significant difference between the two groups (Table 2).

3. Quality of life indices

There was also no statistically significant difference in EQ-VAS or EQ-5D scores between the two groups (Table 3).

DISCUSSION

The purpose of this study was to compare quality of life indices and assess potential changes in metabolic syndrome components in a group of women with metabolic syndrome undergoing yoga exercise. We found that short-term, intermittent yoga exercises for 3 months did not lead to statistically significant changes in quality of life indices or metabolic syndrome components in an exercise group compared with a control group. In an earlier study by Chinnaiyan et al. [23], who assessed quality of life after yoga in 22 patients (19 women, three men) with a history of cardiovascular disease, diabetes, hypertension, and hyperlipidemia, participants completed a 6-month yoga exercise program that consisted of holding postures for 20-30 minutes and pranayama breathing exercises lasting 5-10. This study compared quality of life before and after 6 months of exercise and also compared the

Table 1. Baseline characteristics of the participants

Characteristics	Yoga group (n=17)	Control group (n=20)	P
Age (years)	48.24±7.22	50.30±8.30	0.292**
Height (cm)	158.47±0.05	160.95±0.05	0.143
Weight (kg)	66.29±7.06	65.22±10.30	0.720
BMI (kg/m ²)	26.35±2.32	25.15±4.01	0.285
BFP (%)	33.62±2.87	32.55±4.32	0.391
WC (cm)	91.12±6.60	90.33±8.30	0.753
SBP (mmHg)	118.24±10.74	121.00±11.19	0.762**
DBP (mmHg)	77.65±7.52	79.00±7.88	0.630**
FBS (mg/dL)	115.76±33.54	107.40±15.59	0.511**
T.Chol (mg/dL)	197.88±26.72	195.60±32.59	0.819
TG (mg/dL)	176.06±84.31	193.30±102.07	0.761**
HDL-C (mg/dL)	46.76±10.65	43.90±13.60	0.486
T.bil (mg/dL)	0.54±0.23	0.51±0.15	0.827**
AST (mg/dL)	20.29±6.03	20.15±3.51	0.928
ALT (mg/dL)	22.47±14.37	17.20±6.71	0.264**
Cr (mg/dL)	0.73±0.10	0.73±0.08	0.834**

Values are presented as the mean±standard deviation.

BMI, body mass index; BFP, body fat percentage; WC, waist circumference; SBP, systolic blood pressure; DBP, diastolic blood pressure; FBS, fasting blood sugar; TC, total cholesterol; TG, triglyceride; HDL-C, high-density lipoprotein cholesterol; T.bil, total bilirubin; AST, aspartate transaminase; ALT, alanine transaminase; Cr, creatinine.

*P values were obtained using Student's t-tests.

**P values were obtained using the Mann-Whitney test.

Table 2. Changes in metabolic syndrome components pre and post yoga exercise

	Yoga group (n=17)			Control group (n=20)			ANCOVA
	Pre	Post	P	Pre	Post	P	P*
Weight (kg)	66.29±7.06	64.99±6.74	0.036	65.22±10.30	64.24±10.51	0.022	0.775
BMI (kg/m ²)	26.35±2.32	25.80±2.23	0.025	25.15±4.01	24.77±4.06	0.023	0.129
BFP (%)	33.62±2.87	32.46±2.55	0.003	32.55±4.32	31.21±4.47	0.000	0.078
WC (cm)	91.12±6.60	90.03±5.17	0.166	90.33±8.30	90.53±9.11	0.779	0.517
SBP (mmHg)	118.24±10.74	114.71±8.74	0.303	121.00±11.19	123.00±12.61	0.551	0.374
DBP (mmHg)	77.65±7.52	77.06±5.88	0.750	79.00±7.88	79.00±8.52	1.000	0.220
FBS (mg/dL)	115.76±33.54	99.88±24.55	0.015	107.40±15.59	96.75±15.38	0.000	0.089
T.Chol (mg/dL)	197.88±26.72	215.00±31.01	0.047	195.60±32.59	205.15±21.96	0.194	0.080
TG (mg/dL)	176.06±84.31	129.29±52.95	0.038	193.30±102.07	159.55±86.78	0.143	0.116
HDL-C (mg/dL)	46.76±10.65	54.29±15.26	0.007	43.90±13.60	46.75±13.15	0.263	0.238

Values are presented as the mean±standard deviation.

BMI, body mass index; BFP, body fat percentage; WC, waist circumference; SBP, systolic blood pressure; DBP, diastolic blood pressure; FBS, fasting blood sugar; TC, total cholesterol; TG, triglyceride; HDL-C, high-density lipoprotein cholesterol.

*P values correspond to differences in post variables between the groups when adjusted for covariates via ANCOVA (analysis of covariance). Covariates: pre variables in Table 2.

Table 3. Changes in quality of life pre and post yoga exercise

	Yoga group (n=17)			Control group (n=20)			ANCOVA
	Pre	Post	P*	Pre	Post	P*	P**
EQ-5D	0.91±0.06	0.88±0.10	0.078	0.91±0.09	0.91±0.07	0.863	0.762
EQ-VAS	70.59±14.78	76.29±13.10	0.157	72.90±14.37	70.50±15.21	0.531	0.114

Values are presented as the mean±standard deviation.

EQ-5D, EuroQoL-5 dimension; EQ-VAS, EuroQoL Visual analog scale.

*P values were obtained using the Wilcoxon signed rank test.

**P values correspond to differences in post EQ-5D/EQ-VAS between the groups when adjusted for covariates via ANCOVA (analysis of covariance). Covariates: pre EQ-5D and pre EQ-VAS, respectively, variables in Table 1.

quality of life of participants who engaged in yoga exercises more than 7 times a week (10, 45.5%) with the quality of life of those who exercised less than 7 times a week (11, 50%). Scores on the Mental Component Scale, Role Emotional Division, and Cohen Perceived Stress Scale (CPSS) of the 36-Item Short Form Health Survey (SF-36) measured had significantly improved after 6 months, and the CPSS demonstrated a greater improvement in participants who exercised more than 7 times a week. Additionally, in Wolff et al. [24]'s study of 191 patients with hypertension (99 women and 92 men, mean age: 64.7 years), participants were randomly assigned to a group undergoing Kundalini yoga twice daily for 3 months (n=96) and a control group (n=95) that were assessed and compared after the yoga exercise. The authors found that the quality of life of participants in the yoga

group, measured with the World Health Organization Quality of Life Assessment (WHOQOL-BREF) tool, was higher than that of participants in the control group. Sivaramakrishnan et al. [25] reported that yoga improves multiple physical functions and health-related quality of life in older adults over the age of 60 who do not have any specific disease or condition.

However, in the present study, quality of life assessed with the EQ-5D and EQ-VAS did not significantly differ between the control and the yoga exercise group. This may be due to the fact that the yoga exercise was performed only twice a week for a relatively short period of 3 months, and that the number of participants was low.

We also compared indicators of metabolic syndrome before and after exercise in the present study, and found that weight, body mass index, body fat percentage, fasting blood

glucose, and triglyceride levels tended to decrease, while high-density lipoprotein cholesterol levels increased after yoga exercise in our patients with metabolic syndrome. However, there was no statistically significant difference between the two groups in metabolic syndrome indicators.

Yadav and Yadav [11]'s study on changes in heart metabolic risk factors after 12 weeks of yoga exercise in pre- or hypertensive patients showed that body weight, BMI, systolic and diastolic blood pressure, waist circumference, total cholesterol, and triglyceride levels were significantly improved in the yoga group compared to the control group. The yoga exercise group of this study underwent a 2-hour daily yoga exercise program including asanas and pranayama for 12 weeks [26]. In a study by Yadav et al. [27] in patients with cardiovascular risk factors, the yoga exercise group demonstrated improved weight, BMI, total cholesterol, triglycerides, fasting glucose, and systolic and diastolic blood pressure compared to the control group. The exercise group in this study underwent a lifestyle intervention program based on 2 hours of yoga every day for 10 days.

Our study has some limitations. First, statistical significance might be low due to the small sample size. Second, because, unlike in many other studies, our yoga program only lasted for a relatively short period of 3 months, and since we compared quality of life measures after doing yoga only twice a week, not daily, the effect of long-term or more intensive yoga exercise in our participants remains unknown. Moreover, there is also a lack of evidence for the low-frequency yoga exercise despite the nationwide survey. The third potential limitation is that we did not assess other factors that might affect quality of life and the status of underlying exercise.

To summarize, short-term intermittent yoga exercises, that is, 1 hour twice a week for 3 months, did not lead to statistically significant changes in quality of life indices or metabolic syndrome indicators in a group of female patients with metabolic syndrome. As other studies show some evidence for more frequent exercise over longer periods leading to improvements, further research is needed to establish the exact effect of yoga in women with metabolic syndrome.

CONFLICTS OF INTEREST

No potential conflicts of interest relevant to this article are reported.

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