

Health-related benefits and adverse events associated with yoga classes among subjects that are healthy, in poor health, or with chronic diseases.

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Research

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Abstract

Background: Our previous study demonstrated that 42% of yoga class participants in Japan had chronic diseases that required medication. This raises the question as to whether those with chronic diseases could benefit from practicing yoga or if they are at higher risk for specific adverse events compared to healthy individuals receiving the same instruction.

Methods: To address these questions, 328 adults who started practicing yoga for the first time were asked to complete the Profile of Mood States (POMS), Perceived Stress Scale (PSS), and Medical Outcomes Study Short Form 8, standard version (SF-8™) and to record any adverse events on the first day of the yoga class and again three months later. The participants consisted of three groups: a healthy (H) group (n=70), a poor health (PH) group (n=117), and a chronic disease (CD) group (n=141). The severity of subjective symptoms was also compared between the pre- and post-intervention period in the PH and CD groups.

Results: Typically, yoga classes were held once a week for 60-90 min. The programs included asanas, pranayamas, meditation, isometric yoga and sukshma vyayama. In the PH and CD groups, the POMS tension-anxiety and fatigue scores decreased and the vigor score increased significantly after the first class. Furthermore, PSS scores decreased and the SF-8™ scores increased significantly three months later. The severity of subjective symptoms such as easy fatigability, shoulder stiffness, and insomnia also decreased over three months. Individuals in these groups experienced more frequent adverse events than those in the H group. The PH and CD groups also experienced a greater variety of symptoms, including psychological ones, not reported by the H group. Adverse events were not so serious that subjects stopped practicing yoga during the class. About 60% of all participants were highly satisfied with participating in yoga classes.

Conclusions: If yoga classes are conducted with attention to possible adverse events, yoga practice in a studio may have beneficial effects for people with functional somatic symptoms and chronic diseases, as well as healthy subjects. These benefits include reductions in perceived stress and uncomfortable symptoms as well as improved mood and quality of life.

Introduction

Today, yoga is widely practiced to promote health and improve psychological well-being. A considerable number of studies have demonstrated that yoga has health-related benefits in healthy individuals such as reductions of negative affect, perceived stress, and subjective somatic symptoms, as well as improvement in health-related quality of life [1–3]. Furthermore, cumulative studies have suggested that yoga also has beneficial effects for patients with stress-related diseases such as depressive disorders [4, 5] and those with chronic illnesses such as breast cancer [6–8] and myalgic encephalomyelitis/chronic fatigue syndrome [9–13].

In contrast, adverse events during yoga practice have also been highlighted [14, 15]. In 2015, we conducted a nation-wide survey in Japan to understand the current experiences in yoga classes, specifically to understand the population that participated in yoga classes and the presence of any adverse events that may occur while practicing yoga. In this survey, 271 yoga classes and 2508 participants were enrolled. We found that the mean age of yoga class participants was 59 ± 13 years and the oldest participant was 93 years of age [14]. Furthermore, 54% of participants reported having a chronic illness and 42% of them were undergoing outpatient treatment at a clinic. The main reasons cited for practicing yoga were to improve well-being and to reduce stress and subjective symptoms.

In many yoga classes, healthy subjects and those with chronic diseases practice together in the same classes. Furthermore, yoga instructors may teach yoga without any information regarding the participants' diseases or sufficient medical knowledge on these respective diseases. In contrast, in research settings, the effects of yoga have been assessed using programs developed specifically for those with particular diseases and all participants in the classes were patients with the same disease and classes were conducted at a hospital to maximize the benefits and minimize adverse effects.

Considering the current situation in general yoga practice, it is important to elucidate whether individuals who have chronic diseases could experience the same health-related benefits from yoga when practicing the same program as healthy individuals. Conversely, it may also be informative to assess the potential adverse effects on those with chronic disease because there is serious concern that there may be adverse events seen exclusively in unhealthy participants when practicing at the same level as healthy participants. To address these questions, we investigated health-related outcomes and adverse events among healthy subjects, individuals with poor health, and those with chronic illnesses who just started to practice yoga by attending regular yoga classes.

Subjects And Methods

1. Subjects

This study enrolled 407 adults who had not previously practiced yoga and first attended yoga classes taught by certified yoga instructors, i.e. yoga therapists of the Japan Yoga Therapy Society. The participants were asked to complete questionnaires on the first day of the yoga classes and again three months later. Among those enrolled, we were unable to obtain data from 73 individuals (17.9%) because of discontinuation of class attendance over the three months. We also excluded the data of 6 individuals (1.5%) from the final analysis because we could not determine to which group they should belong, as described below. Thus, we ultimately analyzed the data of 328 participants (31 men and 297 women) who regularly attended the classes at least twice a month. This study was conducted in collaboration with 114 yoga instructors and 156 yoga classes of the Japan Yoga Therapy Society.

2. Methods

Written informed consent was obtained from all participants on the first day of attendance at a yoga class. They were asked to fill in forms that included the following questionnaires before the yoga class started on their first and last day (three months later). After the class, they were asked to record any adverse events and to complete some questionnaires again on both days. On the last day, they were also asked to mark their overall satisfaction with the yoga class.

Participants were classified into three groups: a healthy (H) group, a poor health (PH) group, and a chronic disease (CD) group, based on their self-reports. The H group included individuals who had no subjective symptoms and felt healthy. The PH group included individuals who had some somatic or psychological complaints which did not require medication or whose symptoms turned out to be functional, i.e. there were no abnormal findings on medical tests which could account for their symptoms. The CD group included individuals who had chronic diseases and regularly visited clinics seeking medication.

3. Questionnaires

Participants were asked to complete forms that included the following self-rating questionnaires (Fig. 1).

1) Profile of Mood States (POMS)

To assess changes in mood states, the Japanese version of the POMS [16] was used. Because of their limited time before the yoga classes started, they were only asked to answer items relating to vigor (V), fatigue (F), and tension-anxiety (T-A).

2) Perceived Stress Scale (PSS)

To assess the patient-perceived effects of yoga on stress, the Japanese version of the PSS [17, 18] was administered.

3) Medical Outcomes Study Short Form 8, standard version (SF-8™)

To assess the effects of yoga practice for three months on health-related quality of life (QOL), the SF-8™ was administered [19]. The SF-8™ consists of ten subscales as described in Table 3. The scores were adjusted to compare results with the average Japanese population; the average score for Japanese subjects was set to 50. Therefore, if a score on one of the subscales was less than 50, it would mean that the function assessed by the subscale was below the average for Japanese people.

Table 3
Effects of yoga on health-related quality of life as assessed by the SF-8™.

Group	H		PH		CD				
	First	Last	First	Last	First	Last			
PF	50.6 ± 5.2	50.2 ± 4.4	46.2 ± 8.4	48.9 ± 6.0	☒*	43.3 ± 8.8	45.8 ± 8.5	☒*	
RP	49.7 ± 6.0	49.6 ± 5.3	44.7 ± 8.2	46.8 ± 6.6	☐	43.3 ± 8.4	46.0 ± 8.1	☒*	
BP	51.2 ± 7.5	51.7 ± 6.9	43.6 ± 7.8	47.5 ± 7.2	☒*	43.9 ± 8.3	46.6 ± 8.8	☒*	
GH	50.3 ± 4.9	52.0 ± 6.0	☐	44.4 ± 8.0	47.8 ± 6.9	☒*	43.3 ± 7.6	47.4 ± 7.4	☒*
PCS	50.1 ± 5.6	49.8 ± 5.4	44.3 ± 7.8	47.0 ± 6.5	☒*	42.1 ± 7.8	44.9 ± 8.1	☒*	
VT	49.4 ± 6.0	50.6 ± 5.5	45.4 ± 6.5	48.7 ± 6.0	☒*	45.1 ± 6.1	47.4 ± 6.5	☒*	
SF	49.1 ± 8.2	51.0 ± 6.9	44.4 ± 8.7	46.9 ± 7.9	☒*	44.5 ± 9.6	46.5 ± 8.6	☐	
RE	48.6 ± 5.6	49.7 ± 5.4	45.0 ± 7.0	47.4 ± 6.2	☒*	45.2 ± 8.0	47.4 ± 6.9	☒*	
MH	48.3 ± 6.1	50.4 ± 5.7	☐	43.3 ± 8.4	47.1 ± 7.8	☒*	44.3 ± 8.6	47.4 ± 7.8	☒*
MCS	47.2 ± 6.8	49.5 ± 6.3	☐	43.9 ± 8.8	46.7 ± 7.8	☒*	45.2 ± 9.0	47.4 ± 7.8	☒*
Values are the mean ± standard deviation. H: healthy participants (n = 69); PH: participants in poor health (n = 117); CD: participants with chronic diseases (n = 139). Data from participants that had missing values were excluded from analysis. First: the first yoga class; Last: the last yoga class.									
PF: physical function; RP: role physical; BP: bodily pain; GH: general health perception; VT: vitality; SF: social functioning; RE: role emotional; MH: mental health; PCS: physical component summary; MCS: mental component summary. ** P < 0.01; * P < 0.05 (First vs Last, paired t-test)									

4) Subjective symptoms

Subjects in the PH and CD groups were asked to write down their uncomfortable symptoms and their severities. Severity of the symptom was rated using a numerical rating scale (NRS) from 0 to 10, with 10 being the worst that they could imagine and 0 being nothing.

Table 4.
Common symptoms reported by the PH and CD groups.

PH group

Symptoms	N	%	NRS score		p value	(n)
			First	Last		
Easy fatigability	39	34.2	6.5 ± 2.2	4.5 ± 2.4	0.001	(30)
Shoulder stiffness	35	30.7	7.1 ± 2.3	4.9 ± 2.9	0.001	(26)
Low back pain	30	26.3	6.0 ± 1.8	4.4 ± 2.6	0.006	(23)
Coldness	24	21.1	7.8 ± 1.5	5.5 ± 2.1	< 0.001	(13)
Headache	15	13.2	5.7 ± 2.7	2.5 ± 2.5	0.006	(11)
Insomnia	14	12.3	7.6 ± 1.5	4.7 ± 2.4	< 0.001	(13)

CD group

Symptoms	N	%	NRS score		p value	(n)
			First	Last		
Easy fatigability	32	23.0	6.6 ± 2.3	4.9 ± 1.6	0.010	(23)
Low back pain	26	18.7	5.7 ± 2.4	4.3 ± 2.8	0.001	(23)
Knee joint pain	19	13.7	6.4 ± 2.4	4.6 ± 2.8	0.022	(17)
Shoulder stiffness	19	13.7	7.1 ± 2.1	4.6 ± 2.8	0.003	(16)
Anxiety	18	12.9	7.3 ± 1.7	5.4 ± 2.2	0.002	(14)
Insomnia	14	10.1	7.3 ± 2.2	6.2 ± 2.3	0.040	(10)

Values are the mean ± standard deviation. PH: participants in poor health (n=114); CD: participants with chronic diseases (n=139). First: the first yoga class; Last: the last yoga class.

The severity of symptoms is shown by a numerical rating scale (NRS) with 10 indicating the worst. N illustrates the number of participants who complained of any symptom. The number in parenthesis is the number of participants who scored their severity of symptoms in both the first and the last periods. As data from participants that had missing values were excluded from analysis, statistical analyses were conducted using the number in the parentheses. Multiple symptoms were included (First vs Last, paired t-test).

5) Adverse events

To document adverse events, we created a list of physical and psychological symptoms based on the Cornell Medical Index. Participants were asked to check symptoms that they experienced during the yoga class, similar to how they were assessed in our previous study [14]. In the present study, adverse events were defined as “undesirable symptoms or responses that occurred during a yoga class”, and participants were encouraged to record them.

6) Overall satisfaction

Overall satisfaction with the yoga classes was assessed by marking one of the following, (1) very good, (2) good, (3) neither good nor bad, (4) bad, or (5) very bad, on the last day of the study after the class.

Among these evaluations, the POMS was delivered both before and after the classes on the 1st and last days (after three months) to determine the short-term effects of yoga on mood and fatigue. The PSS and SF-8™, and the form for recording subjective symptoms were distributed just before the class on the 1st and last days. The forms for recording adverse events were distributed after the class on the 1st and last days. The forms for recording overall satisfaction were only distributed after class on the last day.

7) Details of the yoga classes

The yoga instructors were asked to describe in detail their classes, i.e. length of the class, frequency (times per week), and contents of the programs that participants performed.

4. Statistical Analyses

Results are presented as the mean \pm standard deviation (SD). A paired *t*-test was used to compare scores between the pre- and post-intervention periods. All *p* values of less than 0.05 were considered statistically significant.

5. Ethical Considerations

This study was conducted with the approval of the ethics committee of Kyushu University. Informed consent was obtained from all subjects before the survey was conducted.

Results

1. Participants

This study included 328 total individuals: 70 individuals in the H group, 117 individuals in the PH group, and 141 individuals in the CD group. In all groups, most participants were female (90.5% of the total). Participants were between 21 and 96 years old and the mean age was 54.2 ± 15.0 years (Table 1). In the CD group, any diseases and the number of individuals who suffered from each are indicated in parentheses. Diseases included hypertension (47), low back pain (28), depression (14), autonomic dysfunction (13), climacteric disorder (13), cancer (10), bronchial asthma (9), and type 2 diabetes mellitus (6), among others.

Table 1
Demographic characteristics of yoga class attendees

Group	H	PH	CD	Total
Number	70	117	141	328
Number of females (%)	59 (84.3)	110 (94.0)	128 (91.4)	297 (90.5)
Age range	26 – 85	21 – 83	23 – 96	21 – 96
Mean age	54.7 ± 14.3	48.5 ± 14.8	58.7 ± 13.9	54.2 ± 15.0
Values are the mean ± standard deviation. The numbers in parenthesis represent the percentage of female participants.				
H: healthy participants; PH: participants in poor health; CD: participants with chronic diseases.				

2. Characteristics Of The Typical Yoga Class

Typically, the yoga classes were held once a week and the duration was 60 to 90 min. Most classes included 5 to 20 participants. The programs differed according to the instructor and week. However, most classes included asanas (regular yoga postures), pranayamas (breathing exercises), meditation, and savasana (corpse pose). These are commonly practiced in every type of yoga class [20]. Characteristics of the programs in these classes included isometric yoga and sukshma vyayama. In some classes, these two were practiced longer than ordinary yoga asanas. Isometric yoga poses are practiced with low impact isometric load with long breathing. As isometric load is applied at the point where joints stop naturally, it does not require a high degree of flexibility or significant stretch. However, it is accompanied with post-isometric muscular relaxation [21, 22]. Therefore, isometric yoga enables muscular relaxation with minimal stretch. This characteristic is helpful for avoiding any adverse musculoskeletal events. Sukshma vyayama consists of fine movements of each joint. It does not require strong muscle contraction or any stretch, but does require continuous attention to proprioception induced by slow movements. Therefore, this type of yoga helps enhance mindful bodily awareness. Thus, in general these programs are aimed at inducing relaxation and enhancing self-awareness rather than improving musculoskeletal fitness. On intervening days without class, participants were encouraged to practice yoga if they could.

3. Effects On Vigor, Fatigue, And Tension-anxiety

To assess the short-term effects of yoga on mood and fatigue, we compared the POMS V, F, and T-A scores before and after practicing yoga on both the 1st and last day (Table 2). The F and T-A scores decreased significantly ($P < 0.001$) while the V scores increased significantly ($P < 0.001$) after practicing yoga in both the 1st and last classes in all groups. This suggests that practicing yoga reduced fatigue and tension-anxiety and increased the feeling of energy in all groups even after just one class.

Table 2
Effects of yoga on vigor, fatigue, and tension-anxiety as assessed by the POMS.

Group	H		PH		CD				
	Pre	Post	Pre	Post	Pre	Post			
First									
V	49.6 ± 8.2	56.8 ± 10.7	***	45.9 ± 9.5	56.3 ± 10.4	***	45.5 ± 10.2	53.1 ± 11.4	***
F	43.4 ± 8.4	37.7 ± 5.3	***	47.6 ± 9.3	37.5 ± 4.2	***	47.9 ± 11.0	39.6 ± 5.9	***
T-A	43.5 ± 7.4	37.0 ± 4.4	***	46.5 ± 10.0	36.6 ± 4.6	***	49.6 ± 11.5	39.0 ± 6.7	***
Last									
V	49.9 ± 7.7	58.0 ± 9.1	***	48.1 ± 11.4	57.9 ± 10.7	***	47.9 ± 9.4	57.0 ± 10.4	***
F	44.2 ± 9.1	37.4 ± 3.7	***	46.1 ± 9.6	37.3 ± 3.9	***	45.9 ± 10.5	38.4 ± 5.3	***
T-A	43.2 ± 8.4	36.2 ± 4.0	***	43.8 ± 8.4	37.0 ± 4.8	***	45.7 ± 11.1	37.3 ± 5.7	***
Values are the mean ± standard deviation.									
H: healthy participants (n = 62); PH: participants in poor health (n = 108); CD: participants with chronic diseases (n = 135). Data from participants that had missing values were excluded from analysis. Pre: before practicing yoga; Post: after practicing yoga; First: the first class; Last: the last class that was held after three months; V: vigor; F: fatigue, T-A: tension-anxiety. *** $P < 0.001$ (Pre vs Post, paired t-test).									

Table 5
Adverse events experienced by participants during yoga practice

Systems	Group	H		PH		CD	
		First	Last	First	Last	First	Last
Eyes and ears	Blackout	0	0	0	3	2	1
	Pruritus of the eye	2	0	1	1	1	2
	Tinnitus	1	1	2	1	2	2
Respiratory	Coughing	2	1	3	2	6	8
	Congested nose	1	1	2	3	3	2
	Runny nose	1	3	0	3	6	2
	Sputum production	2	0	2	2	0	3
Cardiovascular	Chest pain	0	0	0	0	1	0
	Palpitation	2	0	1	3	3	1
	Breathlessness	0	0	0	1	3	1
Gastrointestinal	Nausea	1	2	0	0	2	0
	Epigastric and abdominal pain	0	0	2	1	2	3
	Diarrhea	0	0	0	0	1	0
Musculoskeletal	Joint pain	2	1	7	3	8	11
	Muscular pain	3	0	5	8	9	17
Skin	Flushing of the face	3	1	2	0	3	3
	Excessive perspiration	0	0	2	1	3	1
	Pruritus of the skin	0	0	0	0	2	2
Neurological	Headache	1	2	5	2	2	4
	Heaviness of the head	0	2	1	3	2	0
	Feeling hot and cold	0	0	4	2	10	2
	Faintness (daze)	4	3	7	4	9	8

H: healthy participants (n = 70); PH: participants in poor health (n = 117); CD: participants with chronic diseases (n = 141). Data from participants that had missing values were excluded from analysis. First: the first yoga class; Last: the last yoga class. Symptoms reported by more than 5.0% of participants in each group are shown in bold (First vs Last, paired t-test).

	Group	H		PH		CD	
	Numbness of a certain body part	0	0	5	2	2	1
	Twitching in a certain body part	1	2	6	2	5	4
	Dizziness	2	4	6	5	14	5
Fatigue	Feeling of exhaustion	1	1	3	2	5	3
	Feeling sick	0	1	0	1	1	0
Psychological	Tension	0	0	0	0	4	3
	Confusion	0	0	1	0	2	2
	Urge to cry	0	0	0	0	1	0
	Anxiety	0	0	2	1	2	0
	Irritation	0	0	0	0	1	0
	Shaking of the body	0	1	0	0	1	0
	Recollection of bad experiences	0	0	1	1	4	2
The number experiencing a symptom		20	16	39	31	58	51
(%)		(28.6)	(22.9)	(33.3)	(26.5)	(41.1)	(36.2)
The number of valid responses		70		117		141	

H: healthy participants (n = 70); PH: participants in poor health (n = 117); CD: participants with chronic diseases (n = 141). Data from participants that had missing values were excluded from analysis. First: the first yoga class; Last: the last yoga class. Symptoms reported by more than 5.0% of participants in each group are shown in bold (First vs Last, paired t-test).

4. Effects On Perceived Stress

To assess the effects of regular yoga practice for three months on perceived stress, we compared the PSS scores before and three months after attending yoga classes (Fig. 2). The PSS score in the H group did not decrease significantly over the three months. However, the PSS scores in the PH and CD groups were reduced significantly ($P < 0.01$) after three months and approached the pre-value of the H group. This suggests that perceived stress levels in the PH and CD groups were reduced by practicing yoga for three months, whereas the H group did not show a significant change.

5. Effects On Health-related Quality Of Life

To assess the effects of regular yoga practice for three months on health-related QOL, we compared the SF-8™ subscale scores before (first) and three months after attending the yoga classes (last; Table 3). In the H group, at baseline, all subscale scores were around 50, an average value for the Japanese population, while three subscale scores, GH (general health perception), MH (mental health), and MCS (mental component summary) scores, had increased significantly ($P < 0.05$, respectively) three months later. In contrast, in the PH and CD groups, all subscale scores were below 50 at baseline. However, all 10 subscale scores increased significantly after three months of yoga practice ($P < 0.01$ or 0.05) and approached 50. This suggests that the health-related quality of life in the H group was similar to the average Japanese population since the beginning. In contrast, the quality of life in the PH and CD groups was lower than the Japanese average before practicing yoga, and improved such that it approached the Japanese average in all dimensions after practicing yoga for three months.

6. Changes in severity of subjective symptoms in the PH and CD groups

To assess the effects of regular yoga practice on physical or psychological symptoms or discomforts in the PH and CD groups, we compared the severity of symptoms before (first) and three months after attending the yoga classes (last) using the NRS (Table 4). In the PH group, symptoms that were noted by 10 or more participants included easy fatigability ($n = 39$, 34.2%), shoulder stiffness ($n = 35$, 30.7%), low back pain ($n = 30$, 26.3%), coldness in the body ($n = 24$, 21.1%), headache ($n = 15$, 13.2%), and insomnia ($n = 14$, 12.3%). The severity of these symptoms was reduced significantly ($P < 0.01$) after three months of yoga practice. In the CD group, symptoms that were noted by 10 or more participants included easy fatigability ($n = 32$, 23.0%), low back pain ($n = 26$, 18.7%), knee joint pain ($n = 19$, 13.7%), shoulder stiffness ($n = 19$, 13.7%), anxiety ($n = 18$, 12.9%), and insomnia ($n = 14$, 10.1%). The severity of these symptoms also decreased significantly ($P < 0.05$ for easy fatigability, knee joint pain and insomnia; $P < 0.01$ for low back pain, shoulder stiffness, and anxiety) after three months of yoga practice.

7. Adverse Events

Adverse events that occurred during the first and last classes were recorded just after each lesson. Generally, adverse events were more frequent in the PH and CD groups than the H group, and the incidence during the last class was less than during the first class. Among participants in the H, the PH, and the CD groups, any adverse events were reported in 28.6%, 33.3%, and 41.1%, respectively, during the first class and 22.9%, 26.5%, and 36.2%, respectively, during the last class. Adverse events included those affecting any system/category. Symptoms experienced by more than 5.0% of participants included faintness ($n = 4$, 5.7%) and dizziness ($n = 4$, 5.7%) in the H group, joint pain ($n = 7$, 6.0%), muscular pain ($n = 8$, 6.8%), faintness ($n = 7$, 6.0%), twitching ($n = 6$, 5.1%), and dizziness ($n = 6$, 5.1%) in the PH group, and coughing ($n = 8$, 5.7%), runny nose ($n = 6$, 5.1%), joint pain ($n = 11$, 7.8%), muscular pain ($n = 17$, 12.1%), feeling hot/cold ($n = 10$, 7.1%), faintness ($n = 9$, 6.4%), and dizziness ($n = 14$, 9.9%) in the CD group. Among symptoms that none of the participants in the H group reported, the PH group experienced 7 symptoms, such as numbness ($n = 5$, 4.2%), epigastric and abdominal pain, excessive perspiration, anxiety ($n = 2$, 1.7%, respectively), breathlessness, confusion, and recollection of bad experiences ($n = 1$,

0.9%, respectively). Among symptoms that none of the participants in the H group reported, the CD group experienced 13 symptoms, such as tension, recollection of bad experiences (n = 4, 2.8%, respectively), breathlessness, epigastric and abdominal pain, excessive perspiration (n = 3, 2.1%, respectively), pruritus, numbness, confusion, anxiety (n = 2, 1.4%, respectively), chest pain, diarrhea, urge to cry, and irritation (n = 1, 0.7%, respectively). These adverse events were mild and there were no serious adverse events that caused a participant to quit practicing yoga or that required medical treatment.

8. Overall Satisfaction And Benefits Of Yoga

To assess overall satisfaction, we asked participants whether yoga was helpful for maintaining and improving their health or not by giving a score from 1 to 5: (1) very good, (2) good, (3) neither good nor bad, (4) bad, or (5) very bad. In all groups, more than 60% of participants answered “very good” and more than 90% of those answered “good or very good”. In the H group, 1.4% of participants answered “bad”. However, no one answered “very bad” in any group (Fig. 2).

Discussion

The aim of this study was to investigate if individuals with poor health or chronic diseases could benefit from yoga similar to healthy individuals, and to assess any specific adverse events unhealthy subjects might experience when they practice the same yoga program alongside healthy participants.

Benefits

First, this study suggests that yoga reduces negative affects and perceived stress while improving health-related QOL in individuals with poor health and chronic diseases. Practicing yoga for three months decreased the POMS T-A and F scores and increased V scores in all groups, suggesting that yoga reduced tension, anxiety, and fatigue and increased energy in all participants. This beneficial effect was obtained even after the first class. Yoga also reduced PSS scores in the PH and CD groups, suggesting that yoga can reduce perceived stress levels among individuals with poor health and with chronic diseases. In contrast, the PSS score did not decrease significantly in the H group after three months. This does not necessarily mean that yoga does not have any effect on perceived stress in healthy individuals; rather, it may be due to lower stress levels in the H group from the outset, as the PSS score of the H group (20.8 ± 7.5) before practicing yoga was lower than that for average Japanese adults (25.4 ± 8.6) [18].

Furthermore, yoga improved health-related QOL in all groups. Among the ten SF-8™ subscale scores, yoga improved all subscale scores in the PH and CD groups, whereas it improved three subscale scores in the H group. This also does not necessarily mean that yoga had little effect on health-related QOL in healthy subjects, and instead may be due to a ceiling effect because every SF-8™ subscale score of the H group was around 50, an average value for Japanese people. On the other hand, in the PH and CD groups, all subscale scores were below 50, suggesting that their QOL was worse than the average for Japanese people. Given that after three months of yoga, all of the subscale scores approached the pre-values of the H group, this suggests that yoga may improve their QOL near to that of healthy subjects. It is noteworthy

that yoga improved all subscale scores in these groups because it suggests that yoga has beneficial effects both physically and mentally in individuals with poor health or chronic diseases.

Second, yoga reduced the severity of uncomfortable symptoms in the PH and CD groups. Common symptoms in both groups included easy fatigability, shoulder stiffness, low back pain, and insomnia. After three months, the severity of these symptoms decreased from 6.0-7.6 to 4.4–4.9 in the PH group and from 5.7–7.4 to 4.3–6.2 in the CD group. The severity of other symptoms also decreased and no symptoms worsened.

Taken together, this study suggests that practicing yoga has psychological and physical benefits in individuals with poor health and in those with chronic diseases.

Adverse events

This study also indicated that the potential for adverse events should be taken into consideration. We demonstrated that the incidence of adverse events on the day of the first class was 28.6% in the H group and that it was more prevalent in the PH group (33.3%) and the CD group (41.1%). In all groups, the percentage of subjects experiencing any particular incidence had decreased on the last day. On neither day did anyone have to discontinue the class due to adverse events. While the incidence of adverse events may seem rather high to some, these rates were comparable to those found in our previous nationwide survey on adverse events associated with yoga classes [14]. In a previous study, we investigated the incidence of adverse events during yoga practice among 2508 yoga class participants throughout Japan and found that 27.8% of participants experienced some adverse events after participating in a class. In that study, among participants who had uncomfortable symptoms, 1.9% of them had to discontinue the class [14]. Therefore, the incidence of adverse events in the healthy participants in the present study was almost the same as that of our previous study.

The present study addressed several important points to be considered when yoga instructors teach classes with participants in poor health or those with chronic diseases alongside healthy subjects. First, the incidence of adverse events is likely to be more frequent among these individuals. Second, these subjects may experience more varied symptoms than healthy subjects because subjects of these groups reported numerous symptoms that healthy individuals did not report. For some, it may be difficult to take into consideration the characteristics of yoga, such as changing from a sympathetic-dominant state to being parasympathetic-dominant [23] [24]. Although this effect is beneficial for reducing stress [25], it is possible that it may cause or exacerbate coughing and runny noses in patients with bronchial asthma and allergic/vasomotor rhinitis, abdominal pain and diarrhea in patients with irritable bowel syndrome, and faintness or dizziness in patients with hypotension, especially orthostatic hypotension because these symptoms are induced or exacerbated by parasympathetic activation. Therefore, it is important to keep in mind that, although this characteristic of yoga is beneficial for reducing stress in healthy subjects, it is possible that it may cause or exacerbate symptoms in patients with diseases in which the parasympathetic nerve is involved in the pathophysiology. Third, yoga may have mixed effects on symptoms of the musculoskeletal system. This study demonstrated that yoga reduced low back pain as

a long-term effect. However, as a short-term effect, practicing yoga induced arthralgia and myalgia in more than 5% of participants in the PH and CD groups. Lastly, it is important to remember that these subjects may also have psychological symptoms. Generally, yoga is known to induce relaxation and thereby decrease negative affects such as anxiety [3]. However, this study demonstrated that yoga induced negative affects such as tension, confusion and anxiety in some individuals in these groups. This might be due to “relaxation-induced anxiety” [26, 27]. This contradictory effect can be observed even in healthy individuals. However, this study demonstrated that it could be observed more frequently in subjects with health concerns. Another explanation for this might be due to recalling negative experiences from the past during yoga practice. This phenomenon is not uncommon, either, especially in individuals with psychologically traumatic experiences in their past. Therefore, when instructing yoga to these types of participants together with healthy individuals, yoga instructors should be aware of the potential for these adverse events and prepare to minimize them.

Overall satisfaction

In spite of these adverse events, more than 60% of subjects of poor health and those with chronic diseases reported high satisfaction, which is comparable to healthy individuals. These high rates of satisfaction may be due to the long-term beneficial effects, including reduction of negative affect and perceived stress, improvement of health-related QOL, and decrease in severity of uncomfortable symptoms in these individuals, even though they experience some undesirable symptoms especially in the beginning as a short-term effect. Furthermore, a considerable number of participants reported that it was nice to have an opportunity to learn practical methods to deal with stress, such as relaxation techniques, breathing methods, or meditation, by attending the yoga class. It is possible that most, if not all, subjective symptoms in the PH group are stress-related and that participants in the CD group feel stress due to the burden of their chronic diseases. It is understandable that this could explain their high satisfaction because medical treatment, especially medication alone, does not necessarily teach them how to cope with their stress, even though it could alleviate their symptoms.

Limitations

This study has several limitations to note. First, it is difficult to generalize these findings to other styles of yoga classes because there are many kinds of yoga, and yoga instructors are constantly developing new types of yoga to generate interest in their classes. From the viewpoint of psychosomatic medicine, the characteristics of yoga classes that aligned with the current study were the inclusion of isometric yoga and sukshma vyayama as well as common practices in other yoga classes such as asanas, pranayamas, and meditation. As described earlier, these types of yoga programs would enable participants to obtain post-isometric relaxation and to enhance self-awareness, which may help them find methods for coping with their stress. Furthermore, this style enables [28] people with debilitating diseases to participate in and reap the benefits of yoga [9–13]. Due to these characteristics, the classes in the present study were more therapeutic rather than being designed to improve physical fitness or personal appearance. Second, 17.9% of participants dropped out during the study. Although the reasons are unclear, it is possible that

this caused some bias to the results. In particular, it is possible that beneficial effects and high satisfaction were obtained because the participants were highly motivated. Furthermore, most participants were female (around 90%). Therefore, it is not clear if male subjects and those who were less motivated would have similar benefits from yoga. Third, the CD group included a limited number of common chronic diseases, such as hypertension or low back pain. Therefore, future studies are warranted to determine if this finding is also applicable to those with other chronic diseases such as hyperthyroidism, multiple sclerosis, or schizophrenia.

Conclusions

This study investigated if individuals with poor health or chronic diseases could benefit from yoga, similar to healthy individuals, and if they might be prone to experiencing specific adverse events when practicing the same program as healthy participants. The findings suggested that all patients received benefit from yoga in terms of reducing negative affects, perceived stress and improvement of health-related QOL. It also suggested that special attention to those in poor health is necessary because their incidence of adverse events will be higher than in healthy subjects, especially at the beginning, and they may have a greater variety of adverse symptoms including psychological ones. However, considering the high satisfaction rates of participants, practicing yoga in classes that include isometric yoga and sukshma vyayama as well as asanas, pranayamas, and meditation, may have potential benefits for individuals with poor health or common chronic illnesses as well as healthy subjects if the instruction is conducted with attention to the prevention of adverse events.

Abbreviations

BP: bodily pain; CD: chronic disease; F: fatigue; GH: general health perception; H: healthy; MCS: mental component summary; MH: mental health; NRS: numerical rating scale; PCS: physical component summary; PF: physical functioning; PH: poor health; POMS: Profile of mood States; PSS: Perceived Stress Scale; RE: role emotional; RP: role physical; QOL: quality of life; SF: social functioning; SF-8TM: Medical Outcomes Study Short Form 8, standard version; T-A: tension-anxiety; V: vigor; VT: vitality.

Declarations

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Author contributions

TO designed the survey, analyzed the data and drafted the manuscript. The author read and approved the final manuscript.

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Availability of data and materials

Data sharing is not applicable.

Ethics approval and consent to participate

The study was approved by the ethics committee of Kyushu University (approval number 28-261). Written informed consent was obtained from all study participants.

Consent for publication

Not applicable.

Competing interests

The author declares that he has no competing interests in relation to this article.

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Figures

	1 st visit			...	Last visit	
	Pre	Post			Pre	Post
POMS	•	•			•	•
PSS	•				•	
SF-8™	•				•	
Subjective symptoms	• (PH, CD)				• (PH, CD)	
Adverse events		•				•
Overall satisfaction						•

Figure 1

Schematic representation of the study design. Each dot represents a questionnaire that participants were asked to complete. Pre: before practicing yoga; Post: after practicing yoga; PH: participants in poor health; CD: participants with chronic diseases. POMS: Profile of Mood States; PSS: Perceived Stress Scale; SF-8™: Medical Outcomes Study Short Form 8, standard version.

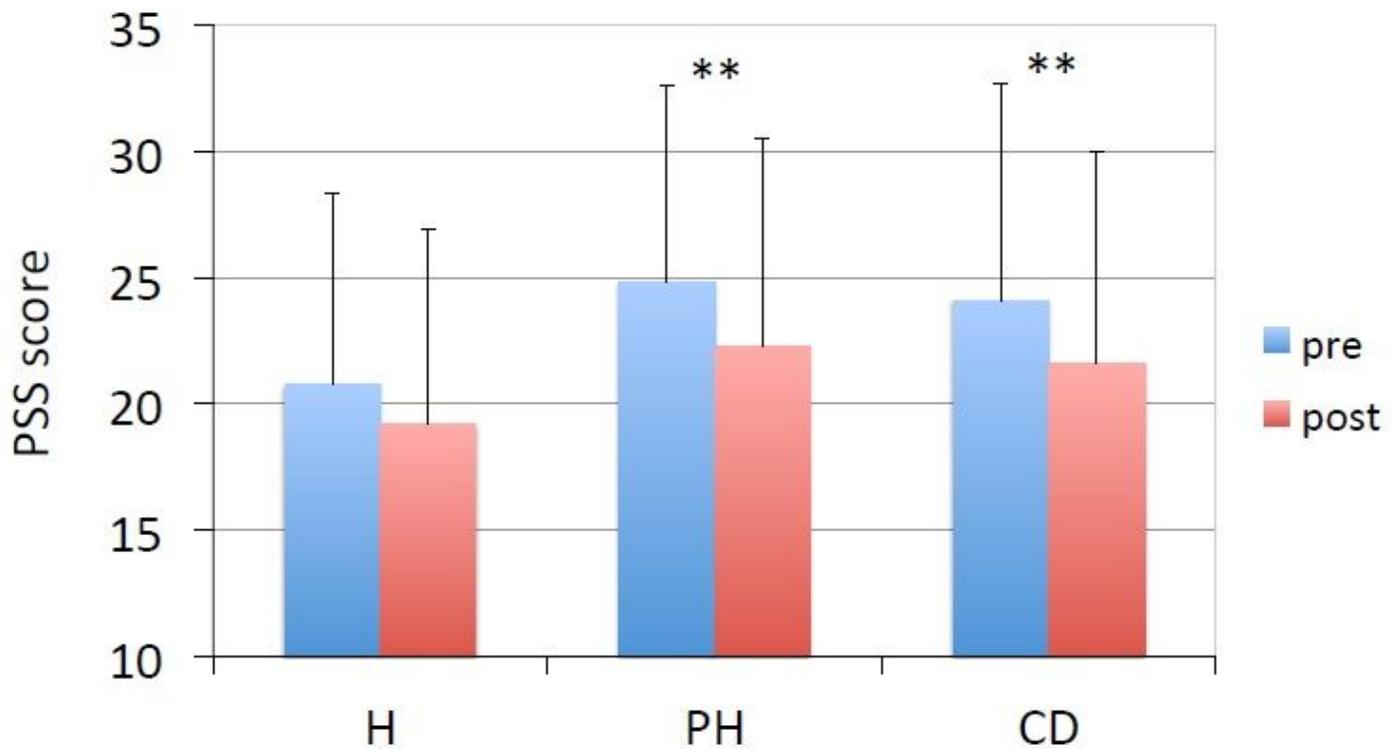


Figure 2

Effects of yoga on perceived stress as assessed by the PSS. The PSS scores were compared before (pre) and after (post) practicing yoga for three months in a healthy group (H, n=64), a poor health group (PH, n=111), and a chronic disease group (CD, n=130). Data from participants that had missing values were excluded from analysis. ** P<0.01 (pre vs post, paired t-test). PSS: Perceived Stress Scale; H: healthy participants; PH: participants in poor health; CD: participants with chronic diseases.

Group

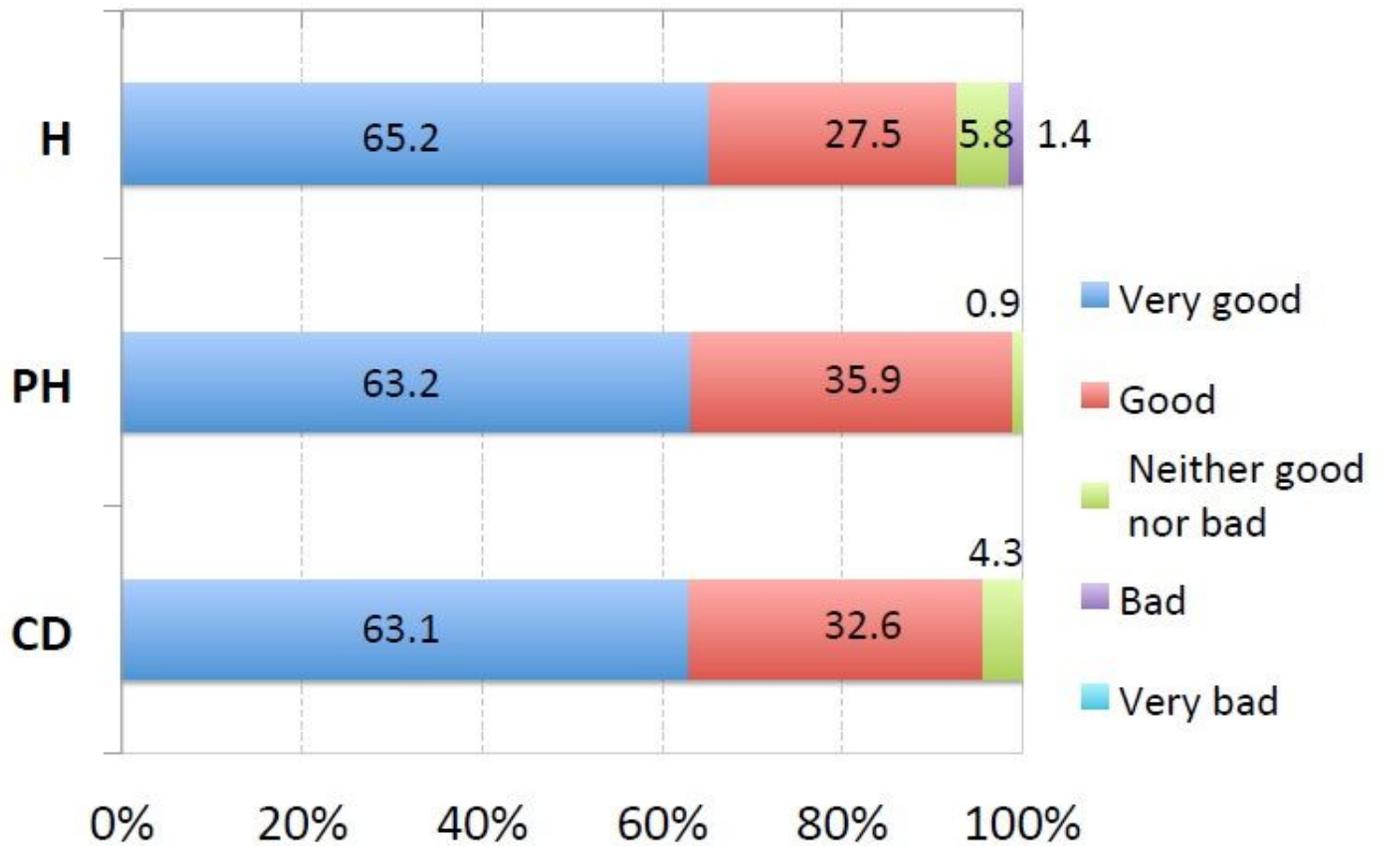


Figure 3

Overall satisfaction in attending yoga classes. The numbers in the figure indicate percentage (%). H: healthy participants; PH: participants in poor health; CD: participants with chronic diseases.