

## Effects of health qigong exercise on sleep and life quality in patients with drug abuse

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### Abstract

**Objective:** The aim of this study was to investigate the effect of Health Qigong (HQ) exercise on the subjective and objective sleep quality and the quality of life in male patients with drug abuse who received treatment at a mandatory drug rehabilitation residential institution. **Methods:** Ninety male patients (mean age, 36.85 ± 8.72 y) were included and randomly divided into the Health Qigong (HQ) group, aerobic exercise (AE) group, or control group. The participants in the HQ and AE groups exercised four times a week for 1 hour per session for 12 weeks, while the control group maintained their original lifestyle. The following parameters were recorded before and after exercise: Pittsburgh Sleep Quality Index (PSQI); SF-36; and total sleep time, sleep efficiency, sleep latency, deep sleep time, deep sleep rate, light sleep time, and light sleep rate using actigraphy. **Results:** Health Qigong improved the subjective sleep quality, objective sleep quality, and quality of life after a 12-week intervention. Considering the subjective sleep quality, Health Qigong helped improve several aspects of the PSQI, including the overall sleep quality ( $p < 0.01$ ), sleep latency ( $p < 0.01$ ), sleep duration ( $p < 0.01$ ), sleep latency ( $p < 0.01$ ), sleep disturbance ( $p < 0.01$ ), and day dysfunction ( $p < 0.01$ ). In relation to the objective sleep quality, Health Qigong improved the total sleep time ( $p < 0.01$ ), sleep efficiency ( $p < 0.01$ ), sleep latency ( $p < 0.01$ ), deep and light sleep rate ( $p < 0.01$ ). Considering the quality of life, Health Qigong helped improve the role-physical ( $p < 0.01$ ), general health ( $p < 0.01$ ), bodily pain ( $p < 0.01$ ), and mental health ( $p < 0.01$ ) aspects of SF-36. **Conclusion:** Health Qigong may be an effective approach to improve the subjective and objective quality of sleep and life quality of patients with drug abuse.

### Keywords

Drug rehabilitation, health qigong, exercise prescription, quality of life, sleep quality, traditional Chinese medicine

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### Introduction

Drug abuse has become a worldwide issue in recent years. Due to the harmful effects of drugs on the nervous system, addicts experience sleep problems, anxiety, depression, and other physiological or psychological issues even after cessation of drug use.

Previous studies have shown that drug use is related to symptoms of insomnia (Navarro-Martínez et al., 2020). There are several causes for poor sleep quality. At present, it is believed that hyperarousal, a combination of predisposing, precipitating and perpetuating factors, and some other physiological factors can cause insomnia (Zhang, 2016). According to traditional Chinese medicine (TCM) theory, the

main cause for insomnia is a disharmony between the organs, especially the heart, kidney, and liver (Zhuang & Wang, 2011). Several approaches, include: psychological treatment, medicine treatment, and physical treatment, are used to reduce insomnia symptoms. However, the side effect may harm

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the body health due to a long-term medicine taking; tools like psychological and physical treatments need professionals to operate so that the cost is high. Exercise was regarded as beneficial to improve sleep quality. It may be a better choice to solve sleep problems with its convenience and safety.

Previous research indicates that exercise is effective in improving sleep quality (Atoui et al., 2021; Garrido et al., 2017; Takemura et al., 2020). According to recent studies, exercise can improve the sleep quality of patients with fibromyalgia, Parkinson's disease, restless legs syndrome, and breast cancer (Cristini et al., 2021; Estévez-López et al., 2021; Garrido et al., 2017; Innes et al., 2020; Kreutz et al., 2019). One investigation showed that both aerobic and mind-body exercises can improve the (PSQI) scores (Chu & Li, 2020). Health Qigong can improve the quality of both sleep and life (Hou, 2017; Xiong et al., 2018); but at the same time, some studies have shown that exercise may not be helpful in improving sleep quality. Therefore, the effect of exercise on sleep quality, especially objective sleep quality, remains controversial. Studies have found that both yoga and aerobic exercise have no significant influence on sleep quality (Buchanan et al., 2017). In contrast, the role of aerobic exercise in improving the total sleep time and times of wakefulness in adults with poor sleep quality has been demonstrated (Tseng et al., 2020). A meta-analysis showed that exercise may decrease sleep efficiency but improve the subjective sleep quality (Banno et al., 2018). Few studies have assessed the role of Health Qigong in improving the quality of life and sleep of drug addicts, and most existing studies on the effect of Health Qigong on sleep quality only investigated subjective sleep quality.

Based on a consensus among sleep experts, the indicators of sleep quality improvement include: total sleep time  $\geq 6$  h, sleep efficiency  $\geq 80\%$ – $85\%$ , sleep latency  $\leq 30$  min, awake time  $\leq 30$  min, and improvement in the symptoms of insomnia. Subjective sleep quality can be measured using a sleep diary, sleep questionnaires, or scales like the PSQI. Objective sleep quality can be measured through actigraphy, polysomnography (PSG), and tests like multiple sleep latency test (MSLT) and maintenance wakefulness test (MWT) (Zhang, 2016). This consensus and the relevant research provide a theoretical basis for this study.

This study aimed to evaluate the effect of Health Qigong on objective and subjective sleep quality and quality of life in patients using actigraphy, PSQI, and the SF-36 questionnaire. This therapy may also be useful to improve the sleep quality of the general population.

## Methods

### Sample Size Prediction

The minimum required sample size was determined to be 66 using the G\*Power 3.1 software and the following parameters: effect size, 0.25;  $\alpha$ , 0.05; power (1- $\beta$ ), 0.95;

correlation among REP measures, 0.5; and non-sphericity correction, 1.

### Participants

Male patients with drug abuse admitted to a mandatory drug treatment residential institution were recruited by convenience sampling. Their life routine in the institution was regular. Before initiating the exercise intervention, the PSQI scale was sent to 420 participants. The PSQI scores were ranked from low to high and then divided into four score zones, zone 1 for 0-5 scores, zone 2 for 6-10 scores, zone 3 for 11-15 scores, and zone 4 for 16-20 scores. Ninety patients were chosen from the third and fourth zones and randomly assigned to the Health Qigong exercise (HQ) group, aerobic exercise (AE) group, or control group. All 90 participants completed the SF-36 scale, and their effective sleep over one night was recorded through actigraphy.

### Measurements

PSQI total scores and its components, SF-36 scores in all aspects, the total sleep time, sleep efficiency, sleep latency, deep sleep time, deep sleep rate, light sleep time, and light sleep rate of the patients were compared before and after the exercise intervention.

PSQI is a common tool of objective sleep quality measurement (Lu et al., 2016). It involves eight aspects, a higher score represents a worse sleep quality; SF-36 consists of 36 questions with eight aspects, and a higher score indicates a better quality of life (Lu et al., 2016). All participants sat in the same room with independent desks to fill the PSQI and SF-36 questionnaires. One instructor read questions through the broadcast to guide the participants.

The objective sleep quality was measured through Sleeptek mattress actigraphy (Sleeptek SC-300M, Nanjing Bochuang Healthcare Clouds ET Co. Ltd, China). Before sleeping, the mattress actigraphy should be connected to the monitoring system, and be covered by the sheet. The equipment was placed such that the participants could not feel it while sleeping to avoid interfering with the sleep process as much as possible. After participants left the bed, it would automatically stop recording and upload the data to the system (see Figure 1).

### Interventions

Both HQ and AE groups exercised four times a week, 1 hour per session, for 12 weeks. Each session involved a 5-min warm-up, 45 min of Health Qigong or aerobic exercise, and 10 min of stretching. The control group maintained their original lifestyle without any additional exercise.



**Figure 1.** Sleeptek actigraphy equipment.

The HQ group practiced a special Health Qigong exercise designed for the participants in this study. Among the 10 Health Qigong routines publicized by General Administration of Sport of China, only Mingmu Health Qigong is designed for special health purposes, including improvement of eye health. All other Health Qigong practices are designed for general health and do not target on improving sleep quality. All movements of the exercise in this study were chosen from the 10 aforementioned Health Qigong practice, and the name of each movement was listed in [Table 1](#). The duration of one single practice was 15 min, with 3 consecutive times in a single session of 45 min.

The AE group practiced radio gymnastics which consisted of eight parts: stretch, chest extend, leg kicking, body tilting, body rotating, whole body exercise, jumping, and cool-down. ([Table 1](#)). The gymnastics lasts for 5 min. In this study, three consecutive exercises were practiced as one session, and repeated the session for three times. The participants were allowed to break for 2 min after each session.

### Data Analysis

The variables were assumed to be normally distributed because of the big sample size. And the Levene's test of equality of error variances would be used. If the variance across groups was equal, a repeated measure ANOVA would be used; if the variance was not equal, an ANCOVA would be used and the pre-intervention scores were considered as co-variates, and the post-intervention scores of the groups were compared.

Two main effects, time and exercise intervention, and their interaction was analyzed in this study. The subjective and objective sleep quality were the primary outcomes, and the quality of life was the secondary outcome. The significance level was set at 0.05. All data were analyzed using SPSS 23.

### Ethical Approval

This study has been approved by Sport Science Experiment Ethics Committee of Beijing Sport University (No.2021192H).

## Results

### Baseline and Homogeneity of Variance

One patient left the institution during the exercise intervention; thus, 89 participants were included in the experiment, 30 in the HQ group, 30 in the AE group, and 29 in the control group. At baseline, except for the social functioning and role-emotional aspects of SF-36, other variables were homogenous between different groups ([Table 2](#)). The social functioning and role-emotional aspects of SF-36 were therefore analyzed using ANCOVA.

### Subjective Sleep Quality

After intervention, except for sleep medicine use, all aspects of the PSQI were better in the HQ group ([Table 3](#)); aerobic exercise was effective in improving the overall sleep quality, sleep latency, duration of sleep, sleep efficiency, and PSQI total score ([Table 3](#)). However, Health Qigong had a better effect on sleep latency, sleep disturbance, and day dysfunction improvement than aerobic exercise ([Table 3](#)).

### Objective Sleep Quality

Health Qigong improved participants' total sleep time, sleep efficiency, sleep latency, deep sleep time and rate, and light sleep rate; aerobic exercise improved sleep efficiency, sleep latency, deep sleep time, and light sleep time ([Table 3](#)). The HQ group had a better total sleep time, sleep latency, and deep and light sleep rate than those of the AE group ([Table 3](#)). Although the awake time did not significantly improve in the exercise groups, the change in the control group was significant ([Table 3](#)).

### Quality Life

The effect of Health Qigong exercise in improving the quality of life was most obvious. There were significant differences in role-physical, bodily pain, general health, and mental health factors ([Table 3](#)). The other aspects showed no change after intervention. The AE and control groups had nearly no difference in the pre-and post-intervention scores. The ANCOVA analysis showed significant differences in

**Table 1.** Movements in each intervention.

Intervention	Movement	Time(s)
Health qigong	Ready form	1 times
	Holding sky with hands	1 times
	Shuangyu xuange	3 times
	Longdeng	6 times
	Tiger Pounce	3 times
	Rouji style	3 times
	Deer running	3 times
	Golden rooster dawn	3 times
	Bird flying	3 times
	Returning qi to the source	1 times
	Ending form	1 times
Radio gymnastics	Stretch	2 times
	Chest extend	4 times
	Leg kicking	4 times
	Body tilting	4 times
	Body rotating	4 times
	Whole body exercise	4 times
	Jumping exercise	4 times
	Cool-down	2 times

HQ: Health Qigong; AE: Aerobics.

**Table 2.** Baseline sleep quality and quality of life.

Factor	HQ Group	AE Group	Control Group	p Value of Variance Homogeneity
PSQI total score	10.87 ± 3.04	11.13 ± 3.30	13.72 ± 3.22	0.887
Total sleep time	6.44 ± 0.97	6.84 ± 1.02	6.79 ± 0.97	0.728
Sleep efficiency	0.74 ± 0.08	0.71 ± 0.11	0.80 ± 0.10	0.225
Sleep latency	2.25 ± 0.99	2.15 ± 1.00	1.56 ± 0.79	0.479
Awake time	0.44 ± 0.29	0.56 ± 0.27	0.42 ± 0.24	0.280
Deep sleep time	0.66 ± 0.31	0.77 ± 0.37	0.67 ± 0.30	0.357
Deep sleep rate	0.09 ± 0.04	0.10 ± 0.04	0.10 ± 0.05	0.180
Light sleep time	4.18 ± 0.75	4.49 ± 0.86	4.41 ± 0.73	0.676
Light sleep rate	0.62 ± 0.05	0.58 ± 0.07	0.61 ± 0.05	0.304
Physical functioning	82.00 ± 16.17	80.17 ± 20.02	72.24 ± 17.04	0.594
Role-physical	64.17 ± 39.76	59.17 ± 43.79	42.24 ± 40.70	0.427
Bodily pain	73.03 ± 12.07	76.43 ± 17.10	70.38 ± 15.53	0.246
General health	58.23 ± 18.71	58.67 ± 20.61	41.48 ± 25.19	0.362
Vitality	68.33 ± 12.06	63.33 ± 14.16	44.83 ± 18.92	0.245
Social functioning	79.58 ± 17.21	72.92 ± 16.77	62.50 ± 25.67	0.031
Role-emotional	67.78 ± 33.31	46.67 ± 43.42	37.93 ± 40.56	0.010
Mental health	63.87 ± 11.28	62.27 ± 11.54	54.83 ± 13.86	0.270

Note. values are mean ± standard deviation or as otherwise indicated.

\* $p < 0.05$ ; \*\* $p < 0.01$ .

HQ: Health Qigong; AE: Aerobics; PSQI: Pittsburgh Sleep Quality Index.

the post-intervention role-emotional dimension score between the three groups (Table 4).

## Discussion

The aim of the Health Qigong practice in this study was to improve both sleep quality and general health in male participants

with drug abuse. Our findings indicate that exercise can improve the sleep quality of patients with drug abuse. Exercise could improve sleep quality by changing sleep efficiency, latency, and structure. The findings may also be attributable to exercise relieving nervous emotion. Dopamine and endorphin, which are secreted during exercise, make people feel pleasant and alleviate hyperarousal by reducing sympathetic excitability.

**Table 3.** Results of repeated measure ANOVA on sleep and quality of life.

	HQ Group (n = 30)		AE Group (n = 30)		Control Group (n = 29)		Interaction	
	Pre	Post	Pre	Post	Pre	Post	p	
Overall sleep quality	1.80 ± 0.71	0.63 ± 0.49**	1.87 ± 0.73	1.37 ± 0.67**	1.95 ± 0.74	1.83 ± 0.89*	0.001**	
Sleep latency	2.80 ± 0.41	1.69 ± 0.87**	2.67 ± 0.55	2.37 ± 0.72*	2.76 ± 0.49	2.14 ± 0.91**	0.000**	
Duration of sleep	0.93 ± 0.87	0.43 ± 0.68**	1.23 ± 1.14	0.73 ± 0.87**	1.56 ± 0.95	1.24 ± 0.83	0.677	
Sleep efficiency	1.80 ± 0.85	1.03 ± 1.03**	2.00 ± 0.91	1.47 ± 1.07**	2.34 ± 0.67	2.10 ± 0.86	0.155	
Sleep disturbance	1.60 ± 0.56	1.03 ± 0.41**	1.67 ± 0.61	1.43 ± 0.68	2.10 ± 0.56	2.03 ± 0.78	0.067	
Need medicine to sleep	0.33 ± 0.76	0.13 ± 0.35	0.17 ± 0.53	0.17 ± 0.38	0.52 ± 0.95	0.83 ± 1.14	0.120	
Day dysfunction	1.60 ± 0.86	0.77 ± 0.73**	1.53 ± 0.90	1.27 ± 0.83	2.24 ± 0.83	1.72 ± 1.07*	0.124	
PSQI total score	10.87 ± 3.04	5.63 ± 2.85**	11.13 ± 3.30	8.8 ± 3.12**	13.72 ± 3.22	11.90 ± 4.26*	0.002**	
Total sleep time	6.44 ± 0.97	7.43 ± 0.75**	6.84 ± 1.02	6.61 ± 0.91	6.78 ± 0.97	6.55 ± 1.05	0.000**	
Sleep efficiency	0.74 ± 0.08	0.82 ± 0.10**	0.71 ± 0.11	0.79 ± 0.10**	0.80 ± 0.10	0.78 ± 0.11	0.002**	
Sleep latency	2.25 ± 0.99	1.52 ± 0.82**	2.15 ± 1.00	1.73 ± 0.90*	1.56 ± 0.89	1.75 ± 0.75	0.002**	
Awake time	0.56 ± 0.27	0.56 ± 0.34	0.44 ± 0.29	0.44 ± 0.25	0.42 ± 0.24	0.90 ± 0.50**	0.000**	
Deep sleep time	0.66 ± 0.31	0.85 ± 0.37*	0.77 ± 0.37	0.90 ± 0.39*	0.67 ± 0.30	0.91 ± 0.37	0.683	
Deep sleep rate	0.09 ± 0.04	0.13 ± 0.05**	0.10 ± 0.04	0.11 ± 0.06	0.10 ± 0.05	0.12 ± 0.04	0.328	
Light sleep time	4.18 ± 0.75	4.05 ± 0.77	4.49 ± 0.86	4.10 ± 0.61*	4.41 ± 0.73	4.08 ± 0.61	0.518	
Light sleep rate	0.62 ± 0.07	0.57 ± 0.05**	0.57 ± 0.07	0.56 ± 0.06	0.61 ± 0.05	0.60 ± 0.07	0.037*	
Physical functioning	82.00 ± 16.17	80.00 ± 12.48	80.17 ± 20.02	85.83 ± 16.51	72.24 ± 17.04	73.10 ± 22.18	0.558	
Role-physical	64.17 ± 39.76	86.68 ± 22.47**	59.17 ± 43.79	68.33 ± 38.80	42.24 ± 40.70	57.76 ± 38.44	0.519	
Bodily pain	73.03 ± 12.07	87.47 ± 7.88**	76.43 ± 17.10	76.67 ± 15.93	70.38 ± 15.53	70.00 ± 21.76	0.004**	
General health	58.23 ± 18.71	69.73 ± 14.61**	58.67 ± 20.61	63.87 ± 23.23	41.48 ± 25.19	50.90 ± 21.26*	0.542	
Vitality	68.33 ± 12.06	78.00 ± 18.13	63.33 ± 14.16	61.83 ± 16.48	44.83 ± 18.92	51.90 ± 18.25	0.115	
Mental health	63.87 ± 11.28	73.87 ± 16.05**	62.27 ± 11.54	65.73 ± 14.04	54.83 ± 13.86	58.82 ± 16.42	0.168	

Note. values are mean ± standard deviation or as otherwise indicated.

\*p < 0.05; \*\*p < 0.01.

HQ: Health Qigong; AE: Aerobics; PSQI: Pittsburgh Sleep Quality Index.

**Table 4.** ANCOVA of social functioning and role-emotional in SF-36.

	HQ Group (n = 30)		AE Group (n = 30)		Control Group (n = 29)		F	p
	Pre	Post	Pre	Post	Pre	Post		
Social functioning	79.58 ± 17.21	82.50 ± 22.65	72.92 ± 16.77	73.33 ± 15.30	62.50 ± 25.67	68.97 ± 20.49	2.72	0.071
Role-emotional	67.78 ± 33.31	73.33 ± 29.56	46.67 ± 43.42	48.89 ± 37.89	37.93 ± 40.56	50.57 ± 34.06	4.13	0.019*

Note. values are mean ± standard deviation or as otherwise indicated.

\*p < 0.05; \*\*p < 0.01.

HQ: Health Qigong; AE: Aerobics.

Health Qigong seems to induce greater sleep quality improvement than does radio-gymnastics. This might be due to the reason that the Health Qigong practice was designed based on TCM, and that insomnia is caused by a disharmony between the internal organs, especially the liver and the kidney. Health Qigong could stimulate the liver and kidney meridians through body movement to enhance the function of both organs. The liver meridian originates in the big toe, and passes through the legs, abdomen, and chest. During the movements of the HQ group such as the Tiger Pounce, the chest is fully squeezed and stretched to stimulate the liver meridian, improving the function of the liver

and sleep quality; the Rouji Style movement also stimulates the liver meridian through twisting of the legs. Similarly, movements like Deer Running and Golden Rooster Dawn are designed to stimulate the kidney meridian. Other movements are designed to stimulate the spleen and lung meridians. These meridians are important because the spleen and lung are closely related to the kidney and liver.

According to the preliminary experiment, the intensity of this Health Qigong routine is 45%–55% of heart rate reserve (HRR), which is a moderate intensity. Movements like the Golden Rooster Dawn and Deer Running require supporting the body with a single leg. They are more intensive than

other movements. An alternating intensity of exercises stimulates the body better and helps induce better sleep.

Previous studies have shown that exercise improves drug addicts' quality of life (Lu et al., 2013). The findings of the present study suggest that Health Qigong exercise is effective in improving life quality. The improvements in life quality occur in multiple dimensions and may have various reasons. It may be related to the effect of Health Qigong on the regulation of both body and mind. Concentration is required when performing movements like the Returning Qi to the Source and Ending Form, which may help the individual develop peace of mind. Exercise could change the mesolimbic pathway to reduce drug-seeking behavior (Robison et al., 2018), which may also help alleviate anxiety, thereby improving the quality of life. The quality of life may also relate to sleep quality improvement. The improvement in body pain according to SF-36 by participants' general health condition is better. Health Qigong practice may improve their fitness and thereby the quality of life.

This study had several limitations. This study measured the sleep and life quality of only male patients, and the sample size was limited. These findings may not be therefore applicable to female patients. In addition, this research did not distinguish the type, time, and way of drug using. In the future, a more detailed research could be performed to develop a more effective and targeted exercise plan.

## Conclusion

This study concluded that Health Qigong is effective in improving the objective and subjective sleep quality and quality of life in male participants with drug abuse. Health Qigong is an easy, safe, and feasible approach for patients with drug abuse to improve sleep and life quality during rehabilitation.

Future studies may consider using Health Qigong for patients with mild neurological disease to improve their sleep quality and health.

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## Declaration of conflicting interests

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## Research interest

Practice and theories of health maintenance through traditional Chinese exercise; health promotion mechanism of traditional Chinese exercise.

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