

Sun Salutation yoga in patients with subacute low back pain: a feasibility study

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Novita Intan Arovah ^{ID}, Wara Kushartanti ^{ID}, Rachmah Laksmi Ambardini ^{ID}

Department of Sport Science, Faculty of Sport Science, Yogyakarta State University, Yogyakarta, Indonesia

Abstract

Introduction. The roles of yoga in improving symptoms in chronic low back pain (LBP) have been established. However, evidence of Sun Salutation yoga feasibility in subacute LBP is lacking. This feasibility study examined the adherence, safety, and potential effect size of Sun Salutation yoga in improving pain, functional disability, and quality of life among patients with subacute LBP.

Methods. Overall, 20 patients with subacute LBP (65% females, age: 35 ± 10 years) were enrolled in a 6-week Sun Salutation program. The protocol adherence and safety were self-reported by participants during weekly monitoring. Pain was assessed with visual analogue scale (VAS) and numeric rating scale (NRS), functional disability with Oswestry Disability Index (ODI) and Roland-Morris Questionnaire (RMQ), while quality of life with the Short Form Health Survey (SF-12). Pre- and post-intervention data were analysed by using the paired t-test or Wilcoxon signed-rank test per data distribution. Effect size was evaluated.

Results. All patients adhered to the study protocol and no adverse effects were reported. Pain, functional disability, and quality of life improved significantly after the intervention. Effect sizes were very large for pain (3.87 and 3.97 for VAS and NRS), functional disability (1.94 and 3.24 for ODI and RMQ), and quality of life (2.34 and 4.62 for SF-12 physical and mental composite score).

Conclusions. The adherence and safety of Sun Salutation yoga in subacute LBP patients were demonstrated, with large effect sizes for improving pain, functional disability, and quality of life. Randomized controlled trials are recommended to confirm the findings.

Key words: pain, functional disability, quality of life, subacute low back pain

Introduction

Low back pain (LBP), one of the most common musculo-skeletal disorders, is experienced by an estimated 80% of the population during their lifetime [1]. LBP has caused a significant disabling health condition and socioeconomic problem worldwide [2, 3], including Indonesia [4]. LBP is defined as pain that is localized below the costal margin and above inferior gluteal folds, with or without the presence of foot pain [5]. Up to 90% of cases are not attributable to a known specific pathology (i.e., non-specific) [6] and most acute LBP resolves within 4–6 weeks. However, it may progress into a subacute form or become chronic LBP, lasting more than 12 weeks [7, 8]. Current guidelines recommend non-pharmacological management that includes patient education and exercise therapy for non-specific LBP [6, 8]. Immobility and bed rest are discouraged in LBP to prevent progression to a chronic stage [9]. Thus, although exercise therapy is the first-line therapy for chronic LBP, it should be initiated in the earlier stage [6].

Systematic reviews show that yoga improves flexibility, pain, and functional disabilities among patients with chronic LBP [10–12]. Further exploration, however, is needed to assess the style, frequency, and duration of yoga that best suit patients with subacute LBP. One of the recommended yoga styles is hatha yoga, which combines several elements, such as postural positioning, breathing, and concentration, as it is intended to improve both mental and physical health [13, 14]. One hatha yoga session usually is group-led and held for 60–90 minutes [11]. The effectiveness of hatha yoga for managing chronic LBP has been reported in many studies [11, 15]. Nevertheless, the attendance to a typical hatha yoga class

and the amount of time required may deter LBP patients from participating in the sessions. A simpler hatha yoga, the Sun Salutation or Surya Namaskar, can be practised independently after a brief training [16], which may increase participation and adherence. Sun Salutation consists of a series of postures (*asanas*) that are synchronized with specific breathing patterns for obtaining optimum benefits, which include physical fitness and physiological, mental, and emotional advantages [17]. Sun Salutation also plays a role in the prophylaxis of several diseases [17]. However, Sun Salutation in managing subacute LBP, particularly in improving pain, functional disability, and quality of life (QoL), the 3 most important self-reported outcomes, has not been studied.

Pain intensity, which reflects the magnitude of the pain, ranks the highest compared with other pain domains (e.g., quality, temporal, type, and interference) among LBP patients [18]. Thus, although the multidimensional pain scale is essential, unidimensional pain measures such as the visual analogue scale (VAS) and the numeric rating scale (NRS) are most commonly used for pain assessment in LBP, both in clinical settings and in trials [19]. These instruments are highly feasible and provide health professionals, researchers, and patients with very little burden to complete [18].

Assessment of the functional disability among patients with subacute LBP is important, both in clinical practice and in treatment-outcome research. Two specific functional measures for conditions associated with spinal disorders are the Oswestry Disability Index (ODI) and the Roland-Morris Questionnaire (RMQ) [20]. These tools have been widely used in various settings. Good psychometric properties of the instruments have been reported [20].

Correspondence address: Novita Intan Arovah, Department of Sport Science, Faculty of Sport Science, Yogyakarta State University, Colombo Street No 1, Karang Malang, Yogyakarta 55281, Indonesia, e-mail: novita@uny.ac.id, <https://orcid.org/0000-0002-0779-3344>

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QoL is also significantly impaired among patients with LBP [21]. Studies suggest that LBP was associated with lower scores on both physical and mental composite scales of the 36-item Short Form Health Survey (SF-36) [11, 21], controlling for other comorbid medical conditions [21]. In this regard, the 12-item Short Form Health Survey (SF-12) is less burdensome for patients as it has fewer items, and could be used as an alternative to the more commonly applied instrument for measuring QoL, SF-36. The study aimed to examine the adherence, safety, and potential effect size of Sun Salutation yoga in improving pain, functional disability, and QoL in patients with subacute LBP, in a view for developing a suitable protocol for a larger trial.

Subjects and methods

Study design and participants

This study employed a one-group pre- and post-test design. The inclusion criteria involved subacute non-specific LBP, defined as LBP lasting for 4–12 weeks without a known underlying cause, and age of > 18 years. The exclusion criteria comprised using painkillers or other pharmacological treatments within 24 hours before the pre- and post-test assessment; specific LBP; LBP red flag signs indicating underlying illnesses, such as chest pain, fever, unexplained weight loss, bladder or bowel dysfunction; history of malignancy; history of injury or orthopaedic procedures; as well as acute LBP manifestation (i.e., clear inflammation sign indicating acute exacerbation). With the use of these criteria, 20 individuals with non-specific subacute LBP were recruited from a physiotherapy clinic in Yogyakarta, Indonesia, from May to October 2019.

Treatment

The patients were invited to participate in a Sun Salutation yoga program, 3 times per week for 6 weeks. The Sun Salutation was applied as a cyclical posture (*asana*) synchronized with a specific breathing pattern (*pranayama*) [16]. Within each cycle, 12 steps were performed consecutively, as illustrated in Figure 1. The cycle started with the 1st asana (*Pranamasana*). The 2nd asana (*Hasta Uttanasana*) was conducted with inhalation, followed by exhalation at the beginning of the 3rd asana (*Padahasthasana*). Next, inhalation was conducted while rising from the 3rd asana and moving to the 4th asana (*Ashwa Sanchalanasana*). It was followed with

exhalation at the 5th asana (*Parvatasana*) and the 6th asana (*Ashtanga Namsakara*). The 7th asana (*Bhujangasana*) was conducted with inhalation and the 8th asana (*Parvatasana*) was conducted with exhalation. The 9th asana (*Ashwa Sanchalanasana*) was performed with inhalation, followed by exhalation while rising from the 10th asana (*Padahasthasana*) to return to the 11th asana (*Hasta Uttanasana*) and 12th asana (*Pranamasana*) [17].

The participants were supervised for 1 session per week in a group setting and were required to independently practise 2 times per week using a Sun Salutation guideline in a written format. The guideline described the procedure, schedule, target, and progression of yoga practices. It defined a 'cycle' as the completion of 12 asanas, while a 'round' consisted of 2 cycles, of which one was conducted with one leg in front for the *Ashwa Sanchalanasana* asana, while the other cycle was conducted with the opposite leg. The patients were required to perform a session of 3 rounds of yoga practice daily in the 1st week, which was gradually increased to 6 rounds per session in weeks 4–6. Each round was targeted to be completed within 4 minutes, including the interval time between the cycles. Thus, the session was aimed to last for up to 12 minutes in the 1st week and up to 24 minutes starting with the 4th week. Within each cycle, each asana was assumed as dynamic stretching. The subjects, however, were allowed to progress with the speed once they had been accustomed to the asanas. They were also allowed to modify some asanas if they were unable to implement them, as well as to breath in between the inhalations required in the breathing pattern if needed.

Data collection

The patients were asked to report their progress each week during the group yoga class. The adherence to the study protocols and any adverse effects of the treatment were also recorded in this weekly follow-up. Patients with complete sessions were included in the study analysis.

Outcome measures

Pain perception, functional disability, and QoL were assessed before and after the 6-week yoga program. They were measured by using adapted instruments which could be completed by the participants within 10 minutes.

Pain

Pain was evaluated with 2 scales: VAS and NRS, for the triangulation purpose. For both scales, the participants were asked to rate the most intense pain they experienced during the previous 24 hours. VAS was presented to patients as a straight horizontal line of 10 cm, which they were required to put a mark on. The ends of the line represented extreme limits of pain orientated from no pain to the highest level of pain [19]. The distance from the 'no pain' anchor to the mark made by the patients was measured to identify their level of pain. The measurement was taken in millimetres; thus, the scores ranged 0–100, with higher results indicating higher pain intensity [19]. NRS was self-administered; the patients were provided with a series of discreet values from 0 to 10, in which 0 indicated a painless condition and 10 stood for the worst, unimaginable pain [19]. The scores thus ranged 0–10 points, with higher results indicating higher pain intensity.

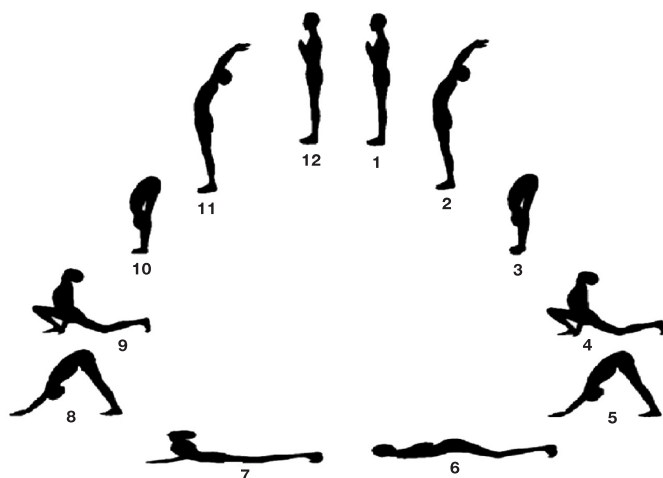


Figure 1. The Sun Salutation yoga routine

Functional disability

The functional disability was also measured with 2 instruments: ODI and RMQ, for triangulation purposes. ODI includes 10 items regarding (i) pain intensity, (ii) lifting, (iii) self-care ability, (iv) ability to walk, (v) ability to sit, (vi) sexual function, (vii) ability to stand, (viii) social life, (ix) quality of sleep, and (x) ability to travel [22]. For each item, 6 response options from 0 to 5 are available which describe different potential scenarios (0 indicates the least disability and 5 stands for the most severe disability). The scores for all items are summed and then multiplied by 2 to provide the index that ranges 0–100, with higher scores indicating higher disability [22]. In this study, we used the modified version 2.0 of ODI, as suggested by the instrument developer [22]. RMQ requires patients to report their perceived level of disability by responding to 24 items referring to various disability conditions [23]. The participants were instructed to put a mark next to each statement describing the disability that they experienced; the score ranges 0–24, with higher values indicating higher disability [23].

Quality of life

QoL was measured by using the SF-12 version 1. The survey consists of 12 items. Six of them are used to generate the Physical Component Summary (PCS-12), involving subscales measuring general health perception, physical functioning, role limitation owing to physical health, and bodily pain. Another 6 items are used to create the Mental Component Summary (MCS-12), involving subscales measuring role limitations owing to emotional problems, vitality, mental health, and social functioning [24]. Reverse scoring of 4 items was conducted so that a higher value indicated better health. Raw scores were then transformed to provide results ranging from 0 (the worst) to 100 (the best) and, in accordance with the approach used in the SF-36 scoring, the 6 corresponding items were averaged to provide the composite score [24]. In this study, the validated Indonesian translated version of SF-12 was used [25].

Statistical analysis

Descriptive analysis of the variables was carried out with central trend (mean), dispersion data (standard deviation), and range. Next, the Shapiro-Wilk test was conducted to assess data distribution normality. Differences between pre-

and post-intervention pain assessment with VAS, functional disability, and QoL were determined by using the paired *t*-test, while other ones were evaluated with the Wilcoxon signed-rank test, depending on their normality status. The crude effect size was calculated by averaging the difference between paired data, while the standardized effect size took into account the mean difference, pooled standard deviation, and correlation between the paired data. The criteria for evaluating standardized effect size were based on those by Cohen: < 0.20 for very small, 0.20–0.49 for small, 0.50–0.79 for medium, and ≥ 0.80 for large [26]. Data were analysed with the SPSS® software version 25 (IBM Corporation, Armonk, NY, USA). The significance level for all studied variables was fixed at *p* < 0.05.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Review Board of Human Ethics Committee of Gadjah Mada University (approval number: KE/0499/05/2019).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

Patients' characteristics, adherence to the protocol, and safety concerns

The mean ± standard deviation of the patients' age was 35 ± 10 years (range: 25–58 years). Most of the subjects were female (65%), married (65%), with tertiary education (85%). All were employed and did not smoke. The LBP duration at recruitment equalled 5.4 ± 1.5 months. All patients adhered to the study protocol and did not report any adverse effects of the treatment, which supported the feasibility of the protocol. No missing data were found; all participants were thus included in the analysis.

Pain, functional disability, and quality of life

Table 1 summarizes the statistics of all measures before and after the 6-week yoga practice.

Table 1. Effect sizes of Sun Salutation intervention for pain, functional disability, and quality of life

Variable	Tools	Time	Mean	SD	<i>p</i>	Crude ES	Standardized ES
Pain	VAS	Pre-test	4.94	1.28	< 0.001	2.80	3.97
		Post-test	2.15	0.89			
	NRS	Pre-test	4.95	1.32	< 0.001	2.90	3.87
		Post-test	2.05	0.89			
Functional disability	ODI	Pre-test	13.66	7.18	< 0.001	6.64	1.94
		Post-test	7.02	4.76			
	RMQ	Pre-test	10.10	3.04	< 0.001	5.80	3.24
		Post-test	4.30	1.84			
Quality of life	PCS-12	Pre-test	42.08	7.83	< 0.001	17.52	2.34
		Post-test	59.61	7.42			
	MCS-12	Pre-test	54.68	8.92	< 0.001	21.32	4.62
		Post-test	76.00	8.41			

VAS – visual analogue scale, NRS – numeric rating scale, ODI – Oswestry Disability Index, RMQ – Roland-Morris Questionnaire, PCS – Physical Component Summary, MCS – Mental Component Summary

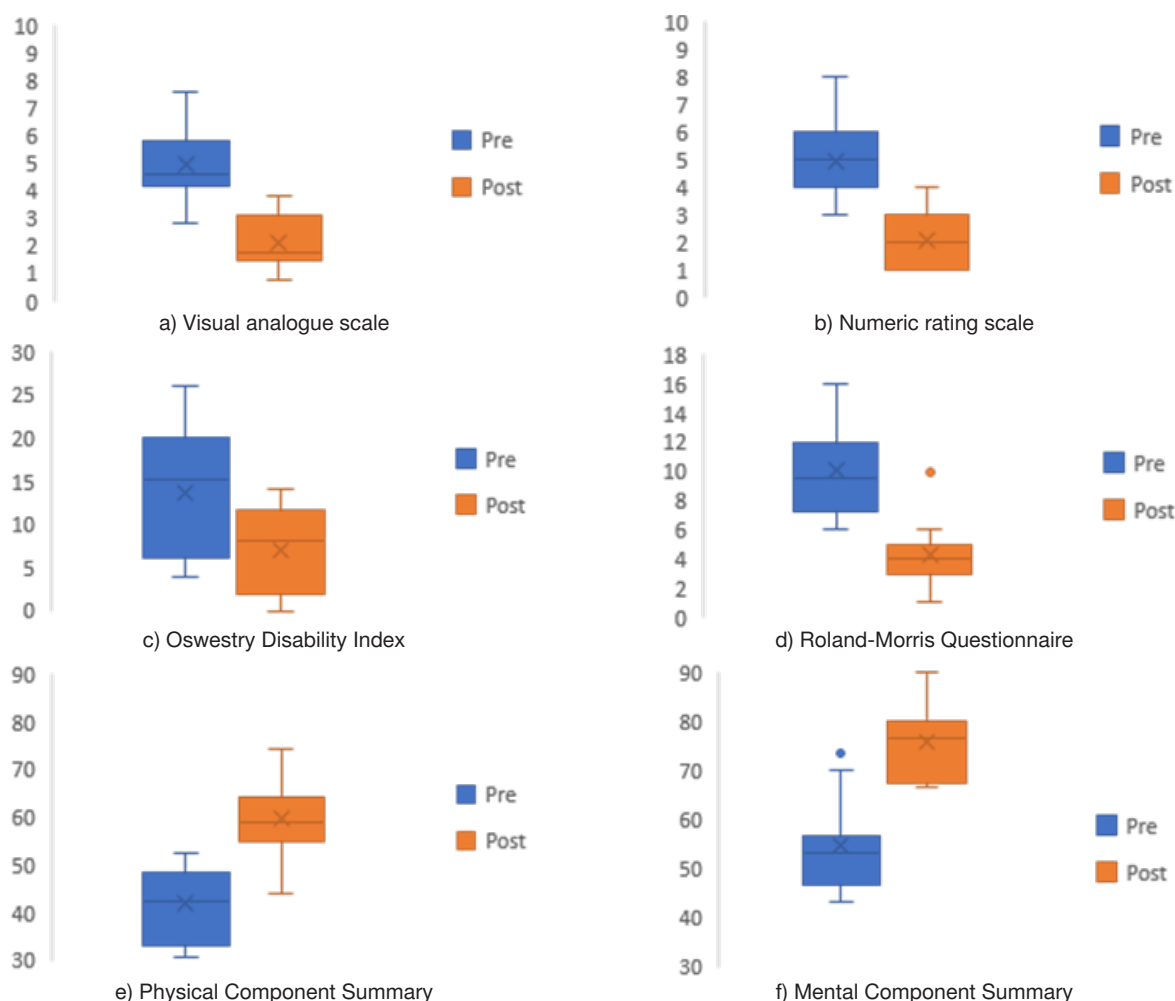


Figure 2. Pain, functional disability, and quality of life before and after Sun Salutation program

As shown in Table 1, pain, functional disability, and QoL scores consistently improved after the yoga practice. The differences were all significant ($p < 0.001$) and the effect sizes were very large. Figure 2 further illustrates the dispersion of the pre- and post-intervention data.

Discussion

While the positive roles of physiotherapy modalities [27, 28] and yoga [29–31] in improving chronic LBP have been established, this study is the first to investigate the feasibility (i.e., adherence and safety) and the potential effect size of the Sun Salutation in improving pain, functional disability, and QoL among patients with subacute LBP. While a higher intensity exercise is more appropriate for chronic conditions [32], we utilized Sun Salutation because of its low intensity, which may best suit subacute conditions. We also adjusted the progression of the program to allow patients to adapt to the routine for minimizing injuries and other adverse events. The program was well-received by the participants and the study resulted in full adherence to the program, without any reports of adverse effects, which highlights the protocol feasibility and safety.

We found a very large positive effect size for all measures, as opposed to smaller effect sizes reported in a systematic review of studies conducted in patients with chronic LBP [33]. However, to be noted, we did not assign a control group, so we could not distinguish whether the improvements were largely due to the natural course of the disease

or to the treatment. Moreover, unlike in chronic LBP, where symptoms tend to persist, there was a high probability that our patients in the subacute stage would fully recover. Also, the participants suffered from only moderate LBP symptoms at baseline; thus, our findings could not be fully applied in higher or lower severity levels. Nevertheless, the effect sizes obtained in the study could be potentially used for determining sample sizes for future trials in this population.

The large effect size found in this study is possibly due to the following reasons. First, the asanas in Sun Salutation potentially improve back and abdominal muscle strength and flexibility, thus improving posture and mobility [16]. The asanas may also stimulate the blood flow, potentially accelerating back recovery [34]. The improvements in posture, mobility, and vascularization further decrease pain perceptions. Finally, Sun Salutation is found to improve relaxation [35], which can also affect pain perception. As pain is an important aspect of the functional ability assessment (ODI and RMQ) and the QoL measurements (PCS-12), large sample sizes were demonstrated for all outcomes.

Attempts to compare our findings with other similar studies are limited by the lack of research exploring Sun Salutation and LBP. Although Sun Salutation yoga has been studied for improving physical [16, 36] and mental [37] health in the general population, no study has reported the effectiveness of Sun Salutation for improving LBP symptoms. Likewise, while overall physical therapy in improving chronic LBP has been widely investigated, studies in subacute LBP are scarce [38, 39]. Thus, our study extends the evidence in the literature

that simple, low-intensity yoga practice, such as Sun Salutation, is feasible, safe, and potentially effective in improving LBP symptoms among patients with subacute LBP. Further research with a longitudinal design and larger sample sizes is recommended to confirm these findings.

Limitations

Overall, we have demonstrated adequate evidence of the participants’ adherence and the protocol safety, as well as the large potential effect size of Sun Salutation in improving pain, functional disability, and QoL. Using the effect size, future studies may only need a modest sample size for examining the effect of Sun Salutation in LBP symptoms. However, our findings must be interpreted in the context of certain limitations. First, we did not assess the effect size difference between the treatment and control groups. Second, our study recruited more women, younger adults, and patients with moderate symptoms. Although it was likely to reflect the epidemiology of LBP in the population, it may limit the generalizability of our findings to other demographic groups (i.e., older adults with more severe symptoms).

Conclusions

This study demonstrates subacute LBP patients’ adherence to the Sun Salutation yoga and highlights the safety of the protocol, indicated by no adverse events reported. The study also resulted in large effect sizes of the treatment in improving pain, functional disability, and QoL in patients with subacute LBP, which implies a potential efficacy of the treatment. Future trials, however, are recommended to confirm the findings of this study.

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Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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