



Yoga versus home exercise program in children with enthesitis related arthritis: A pilot study

Ezgi Yasar^a, Erdogan Kavlak^b, Serkan Turkucar^c, Deniz Bayraktar^{d,*}, Ceyhun Acari^c, Erbil Unsal^c

^a Pamukkale University, Institute of Health Sciences, Department of Physical Therapy and Rehabilitation, Denizli, Turkey

^b Pamukkale University, School of Physical Therapy and Rehabilitation, Denizli, Turkey

^c Dokuz Eylul University, Faculty of Medicine, Department of Pediatrics, Division of Pediatric Rheumatology, Izmir, Turkey

^d Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Turkey

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ABSTRACT

Purpose: The aim was to compare the effects of yoga and home exercise program on lower extremity functional status, pain, and quality of life in children with enthesitis related arthritis (ERA).

Methods: Twenty-one children with ERA were divided into two groups as yoga (n = 11) and home exercise (n = 10). Yoga group performed supervised yoga exercises twice a week for eight weeks. Home exercise group performed video-based exercises for the same period. Pain in rest and activity, lower extremity functional status, and quality of life were evaluated at baseline and following eight weeks.

Results: The groups were similar at baseline (p > 0.05). All the parameters, except parent reported quality of life, significantly improved in yoga group (p < 0.05), where only stair climb test times significantly improved in home exercise group (p < 0.05).

Conclusions: Yoga seems promising for improving lower extremity functional status, pain, and quality of life as an exercise intervention in rehabilitation programs of children with ERA.

1. Introduction

Juvenile idiopathic arthritis (JIA) has seven subgroups with specific disease characteristics. Enthesitis related arthritis (ERA) is a sub-type of JIA, and primarily affects lower extremity joints and entheses points, and subsequently sacroiliac joints and spine.¹ Enthesitis is a common sign in this group and is defined as the local inflammation in the insertion of tendon, ligament, fascia, or capsule to bone.¹ This specific involvement leads to pain and morning stiffness, especially in distal lower extremities, particularly in pressure points such as Achilles tendon.

Exercise is a main component of the JIA management, and recent guidelines recommend exercise for improving functional capacity and activity limitations.²⁻⁴ There are also several studies indicating the benefits in terms of increasing bone mineral density, muscle strength and exercise capacity.^{2,5,6}

Yoga is an exercise method, which not only improves physical status, but also supports mental processes. The primary focus in yoga is stretching exercises that combine with breathing patterns. In clinical

practice, stretching exercises are particularly effective for disease characteristic symptoms such as morning stiffness, which can occur particularly at entheses. Yoga exercises were investigated for many rheumatic diseases in adults.^{7,8} It has benefits on physical characteristics as pain, joint tenderness, joint swelling, morning stiffness, and range of motion as well as on self-esteem and mental status.^{9,10} There is no academic research except a case report for pediatric rheumatic diseases in English literature.¹¹

The aim of this study was to investigate the effects of an 8-week yoga program on primarily functional status, and secondarily pain and quality of life compared to video-based home exercise program.

2. Materials and methods

The present study was conducted in Dokuz Eylul University, Faculty of Medicine, Children's Hospital, Division of Pediatric Rheumatology. Ethical approval (at 04.09.2018, with number: 60116787-020/58569 from Pamukkale University, Non-invasive Research Ethics Board) and

* Corresponding author at: Izmir Katip Celebi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Izmir, Turkey.

E-mail addresses: ezgiyasar4@gmail.com (E. Yasar), kavlake@hotmail.com (E. Kavlak), serkan_turkucar@hotmail.com (S. Turkucar), ptdenislav@yahoo.com (D. Bayraktar), ceyhun_acari@hotmail.com (C. Acari), erbil.unsal@deu.edu.tr (E. Unsal).

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clinical trial registration (clinicaltrials.gov with the number NCT03858504) were obtained prior to the study.

2.1. Patients

Children (13–18 years) diagnosed with ERA according to International League of Associations for Rheumatology criteria participated in the study. Inclusion criteria were having ERA related symptoms for at least six months and being able to understand exercise commands. Exclusion criteria included a contraindication to exercise (neurologic, cardiovascular etc.), an ongoing physiotherapy program, unwillingness to participate in the study, no approval from the family, and medication changes during the study. The medication of the children was adjusted at least one month prior to the study. Thirty-three children were invited to study. The flow chart of the study provided in Fig. 1. The children and their families were informed verbally, and both signed informed consent forms prior to the participation.

Children were divided into two groups according to their availability for participating in the supervised yoga exercise sessions. Dokuz Eylul University pediatric rheumatology clinic is providing care for children with rheumatic diseases in a large area (the biggest center in the west part of the country). Many children live in distances such as 300 km; therefore, these children could not participate in yoga exercise sessions. Thus, a true randomization could not be performed primarily due to this fact. The children who could not participate in the yoga exercise sessions composed the home exercise group.

2.2. Interventions

2.2.1. Yoga group

Yoga sessions were performed in groups with five children at maximum and supervised by a certified physiotherapist. The yoga program lasted for eight weeks (two times/week), and each session was 50 min. The yoga program composed of three sections as breathing and postural awareness exercises (5–10 min), various asanas which are positions/postures focusing on stretching, strengthening, balance (20–25 min), and meditation (10–15 min) (Fig. 2).¹² The program progressed by increasing the repeats and the duration of the movements

in every two weeks.

2.2.2. Home exercise group

A part of effective home exercise program reported by Sandstedt et al., which focus on trunk and hip muscles was used in this group. This modified program included two exercises as bridge and sit-ups (Fig. 3).¹³ The program was delivered as video recordings and was asked to be performed 10 × 3 repeats for two times a week for eight weeks. The adherence was tracked by using an exercise diary. The children recorded the days which they performed the exercises. Also, the children were called weekly to remind them off the exercise program.

2.3. Outcome measures

All the children were assessed at baseline and at 8th week. Physical characteristics including age, height, weight, body-mass index [body-mass index (BMI), weight divided by height squared (kg/m²)] and disease-related features as disease duration, and medications were recorded at baseline.

2.3.1. Primary outcomes

2.3.1.1. Lower extremity functional status

2.3.1.1.1. Six-minute walking distance. The general functional status of lower extremities was assessed by measuring six-minute walking distance.¹⁴ The assessment was performed in a 15-meter tracked hallway, and the children were asked to walk as fast as possible without running. Standard encouragement orders were used as ‘keep-going’ or ‘you are doing well’. Children could stop and rest during the test, but the countdown was not stopped in such occasions. The distance covered for six minutes was recorded.

2.3.1.1.2. Timed up and down stairs test. Another important lower extremity function, stair climbing, was assessed by using timed up and down stairs test. Children were asked to go up and down 13 steps as quickly as possible. The time was recorded in seconds.¹⁵

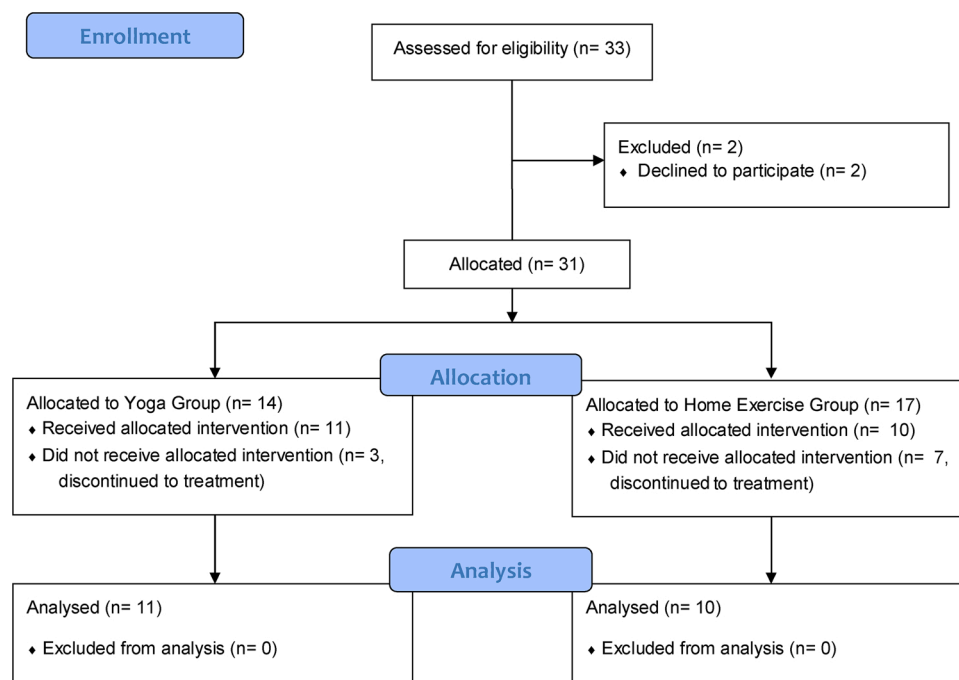


Fig. 1. Flow Diagram.

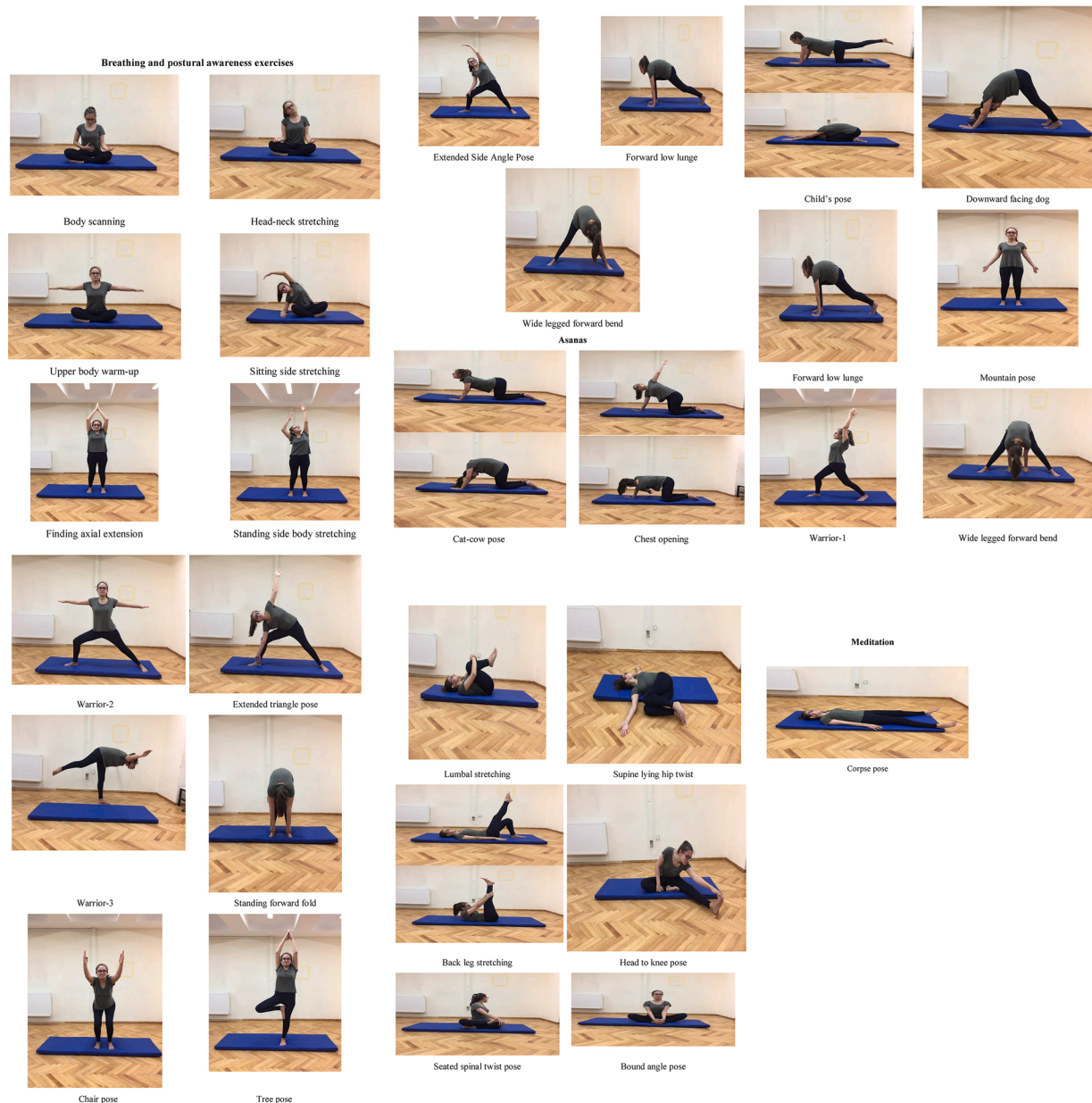


Fig. 2. Yoga Program.

2.3.2. Secondary outcomes

2.3.2.1. Pain level. Pain level was measured by using Numeric Rating Pain Scale (0–10) where 0 represents no pain and 10 represents extreme pain.¹⁶

2.3.2.2. Quality of life. Turkish form of Pediatric Quality of Life Inventory (PedsQL) 3.0 Arthritis (Rheumatology) Module was used for evaluating quality of life.¹⁷ PedsQL 3.0 Arthritis Module includes 22 questions in five different regions as pain and hurt (4 items), daily activities (5 items), treatment (7 items), worry (3 items), and communication (3 items). The questionnaire has two forms as patient form and family form. Both children and one of their parents completed PedsQL 3.0 Arthritis Module.

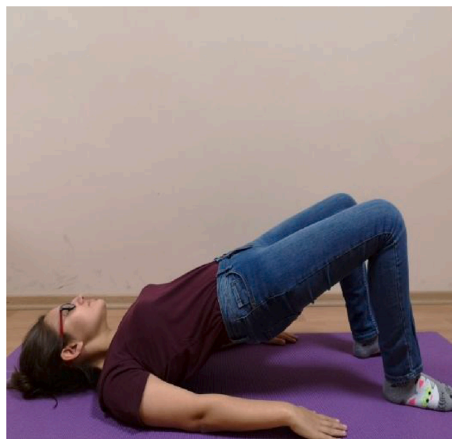
2.4. Statistical analysis

Statistical analysis was performed using Statistical Package for Social

Science for Windows version 25.0. The normal distribution of the data was assessed with Shapiro–Wilk Test. Non-parametric tests were deemed more suitable for interpretation of the results due to relatively small sample size and heterogeneous distribution of the data. Therefore, medians and interquartile ranges 25/75 (IQR 25/75) were used for the descriptive data. Mann–Whitney U test was employed for between group comparisons and Wilcoxon Signed Rank test was used for in-group comparisons. $p < 0.05$ was accepted as statistically significant.

3. Results

The study was completed with 11 children (9 males and 2 females) in yoga group and 10 children in home exercise group (8 males and 2 females). Groups were similar at baseline in terms of physical characteristics, diseases related characteristics, pain level, lower extremity functional status, and quality of life ($p > 0.05$, Table 1). Five children in yoga group, and four children in home exercise group were using non-steroidal anti-inflammatory drugs. Eight children in yoga group and



Bridge



Sit-ups

Fig. 3. Home Exercise Program.

Table 1
Comparison of the groups at baseline.

	Yoga Group (n:11) Median (IQR 25/75)	Home Exercise Group (n:10) Median (IQR 25/ 75)	p*
Physical Characteristics			
Age (year)	15.0 (13.0/15.5)	16.0 (14.0/17.0)	0.099
Body-Mass Index (kg/ m ²)	20.7 (18.3/23.1)	21.2 (19.9/22.0)	0.756
Disease Related Characteristics			
Time since symptom onset (months)	34.0 (11.5/66.0)	54.0 (34.0/72.0)	0.468
Time since diagnosis (months)	12.0 (4.5/61.0)	36.0 (24.0/67.0)	0.349
Lower Extremity Functional Status			
Six-minute walking distance (m)	600.0 (552.5/664.5)	626.0 (556.0/ 650.0)	1.000
Timed up and down stairs test (sec)	7.6 (6.8/8.3)	7.4 (7.0/8.0)	1.000
Pain Level			
Rest pain (score)	0 (0/5.0)	1.0 (0/3.0)	0.705
Activity pain (score)	4.0 (1.0/6.5)	2.0 (0/7.0)	0.387
Quality of Life			
PedsQL Children (score)	13.0 (10.0/23.5)	12.5 (6.0/ 20.0)	0.654
PedsQL Parent (score)	21.0 (8.5/31.5)	26.0 (15.0/ 39.0)	0.387

* Mann-Whitney U test; IQR 25/75: Interquartile Range 25/75, PedsQL: Pediatric Quality of Life Inventory, p < 0.05.

four children in home exercise group were using sulfasalazine, and four children in yoga group and five children in home exercise group were using anti-TNF agents (adalimumab).

Significant improvements were detected in all parameters (except PedsQL Parent form) in the yoga group at the end of the study (p < 0.05, Table 2), where only timed up and down stairs test was found improved in the home exercise group (p < 0.05, Table 2). When the changes between baseline and at the end of study were compared, yoga group had better results; however, only the changes related to activity pain reached to statistically significant level (Table 3).

Table 2
Changes in the Groups.

	Before Median (IQR 25/75)	After Median (IQR 25/75)	p*
Yoga Group			
Lower Extremity Functional Status			
Six-minute walking distance (m)	600.0 (552.5/664.5)	692.0 (595.0/ 705.5)	0.011
Timed up and down stairs test (sec)	7.6 (6.8/8.3)	6.2 (6.0/7.0)	0.008
Pain Level			
Rest pain (score)	0 (0/5.0)	0 (0/2.5)	0.039
Activity pain (score)	4.0 (1.0/6.5)	0 (0/1.5)	0.012
Quality of Life			
PedsQL Children (score)	13.0 (10.0/23.5)	9.0 (4.0/17.0)	0.021
PedsQL Parent (score)	21.0 (8.5/31.5)	18.0 (8.0/22.0)	0.169
Home Exercise Group			
Lower Extremity Functional Status			
Six-minute walking distance (m)	626.0 (556.0/650.0)	601.5 (585.0/ 707.0)	0.093
Timed up and down stairs test (sec)	7.4 (7.0/8.0)	7.0 (6.5/7.8)	0.028
Pain Level			
Rest pain (score)	1.0 (0/3.0)	0 (0/3.0)	0.715
Activity pain (score)	2.0 (0/7.0)	2.0 (0/7.0)	0.892
Quality of Life			
PedsQL Children (score)	12.5 (6.0/20.0)	8,5 (7,0/18,0)	0.475
PedsQL Parent (score)	26.0 (15.0/39.0)	22.5 (14.0/30.0)	0.192

* Wilcoxon Signed Rank Test, IQR 25/75: Interquartile Range 25/75, PedsQL: Pediatric Quality of Life Inventory, p < 0.05.

4. Discussion

Yoga is a holistic physical/mental practice which can be implemented in chronic disease management. Positive effects of yoga program on physical and psychological parameters were previously demonstrated in adult patients with rheumatic diseases.^{9,10} The only evidence related to yoga in pediatric patients with rheumatic diseases is a case report by Feinstein et al., which demonstrates yoga as beneficial for improving pain level and morning stiffness in a 17-year-old girl with RF (+) JIA.¹¹

The results of the present study showed that an 8-week yoga exercise program could improve lower extremity functional status, pain level and quality of life in children with ERA. Our results are in accordance with the case report by Feinstein et al., and yoga resulted in significant improvements regarding pain level. However, in the study of Feinstein et al. the case attended only three supervised yoga sessions and practiced yoga between those sessions at home by watching a DVD for a total of 40

Table 3
Comparison of the differences between groups.

	Yoga Group (n:11) Median (IQR 25/75)	Home Exercise Group (n:10) Median (IQR 25/ 75)	p*
Lower Extremity Functional Status			
ΔSix-minute walking distance (m)	35.0 (7.5/74.3)	26.0 (4.5/57.0)	0.468
ΔTimed up and down stairs test (sec)	-0.9 (-1.4/-0.7)	-0.5 (-0.6/-0.5)	0.132
Pain Level			
ΔRest pain (score)	0 (-4.0/0)	0 (-1.0/0)	0.251
ΔActivity pain (score)	-3.0 (-4.5/-0.5)	0 (0/1.0)	0.008
Quality of Life			
ΔPedsQL Children (score)	-3.0 (-9.0/-1.0)	-3.5 (-6.0/1.0)	0.512
ΔPedsQL Parent (score)	-4.0 (-11.5/1.0)	-4.5 (-12.0/0)	0.918

* Mann-Whitney U test; Δ: Difference between baseline and 8 weeks later. IQR 25/75: Interquartile Range 25/75, PedsQL: Pediatric Quality of Life Inventory, p < 0.05.

days. Even though, we have differences between our methods, more evidence was provided related to the effect of yoga in a more systematic research.

Yoga was also found to be superior to the home exercise program in the present study. This might be attributed to difference between performed exercises. Yoga focuses on core region and includes many stretching poses primarily affects entheses. In addition, breathing exercises by activating parasympathetic system and the meditation part by relaxing muscles might help to ease the pain. On the other hand, the modified home exercise program by Sandstedt et al. focused on trunk and hip muscles.¹³ They showed that performing the original home exercise program (including bridge, sit-ups, rope skipping, shoulder flexion strengthening, and shoulder abduction strengthening) for 12 weeks resulted in improvements in bone health, muscle strength, physical fitness, and overall health. We preferred providing an evidence-based home exercise program for the control group instead of comparing yoga program versus no-intervention. However, as our study did not evaluate upper extremity related assessments and bone health, we did not include exercises related to shoulder strengthening and rope-skipping in the modified home exercise program. Also, as yoga focuses mainly on core region and lower extremities, we preferred to include the exercises with same objective, for comparison purpose. Thus, only two exercises were employed (bridge and sit-ups) in the present study.

Besides, the attendance rates in the home exercise program were poor in the present study, and seven children could not complete the program, while this number was three in the yoga group. This might be attributed to the social interaction between children in the yoga group as the yoga sessions were held as group sessions and supervised by a physiotherapist.

Lielieveld et al. reported that six-minute walking distance is suitable for measuring lower extremity functional status in children with JIA.¹⁴ Yoga helped to improve six-minute walking distance in the present study, while home exercise program did not lead to any increase. Pain improvement in the yoga group might have positive effects in this regard. However, the certain effect of yoga on other lower extremity functions such as muscle strength, explosive power; on disease related characteristics such as morning stiffness; and on psychological aspects yet to be discovered in children with ERA.

5. Strengths and limitations of the study

The present study was the first one which includes children from only one type of JIA subtypes. Also, the effect of yoga exercises was investigated for the first time in a pragmatic study. On the other hand, relatively small number of patients in each group and higher drop-out rates in the control group might limit the results. Besides, one can deliberate that the study design was actually testing whether professionally lead exercise program has better outcomes than a self-exercise program. In addition, recruiting a true control group which was not interfered with any form of exercise might help to understand the effects of yoga better. However, one cannot be sure that the children in home exercise group really performed their exercises even though exercise diaries were kept by the participants. Thus, home exercise group might have served as a true control group in the present study. Lack of a true randomization and follow-up periods were other limitations of the study. In addition, the physical activity levels were not questioned during the study and possible differences in physical activity patterns between groups might influence our results.

6. Conclusions

The present study was the first study which investigates the effect of yoga exercise program compared to home exercise program on lower extremity functional status, pain level and quality of life in children with ERA. The yoga program was determined as a useful method and superior to the home exercise program. However, the drop-out rates were rather high in the home exercise group, therefore, future studies may draw different conclusions. In addition, the effects of yoga program on muscle strength, morning stiffness, and psychological parameters yet to be investigated in future studies. As this is the first study which report the effects of yoga in a systematic way in children with JIA, the study may be used as a baseline upon which to build higher quality studies with larger numbers of subjects.

CRedit authorship contribution statement

Ezgi Yasar: Conceptualization, Methodology, Investigation, Writing - original draft, Visualization. **Erdogan Kavlak:** Supervision, Writing - review & editing. **Serkan Turkucar:** Resources. **Deniz Bayraktar:** Conceptualization, Methodology, Formal analysis, Writing - review & editing, Project administration. **Ceyhun Acari:** Resources. **Erbil Unsal:** Resources, Writing - review & editing, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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