

ORIGINAL ARTICLE



The Effects of 12 Weeks Yoga Training on 4-5-Year-Old Preschoolers' Fitness Components

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ABSTRACT

Background. The effect of the long-term yoga program on young children has not been examined in Vietnam, especially the preschoolers who participated in Physical education (PE) courses. **Objectives.** The purpose of the study was to examine the effectiveness of a twelve-week yoga practice program on 4-5-year-old preschoolers' balance, agility, flexibility, and core strength development. Then, an investigation of the randomly selected participants from the experimental group's ideas of the yoga program was explored. **Methods.** Sixty-one children ranging from 4 to 5 years old were conveniently sampled and divided into two groups: an experimental group (17 males and 13 females) and a control group (17 males and 14 females) which received regular physical exercises provided in their PE course. The experimental group practiced twenty-six yogic asanas (postures) and a dynamic exercise (Sun Salutation) three times a week, with each lesson lasting 30 minutes. **Results.** The yoga training significantly improved balance (assessed by one leg balance standing test, $F = 15.562$, $P = 0.000$), flexibility (using shoulder flexibility, $F = 65.952$, $P = 0.000$ and sit and reach tests to measure, $F = 48.937$, $P = 0.000$), and muscular strength (sit-ups test was used, $F = 47.918$, $P = 0.000$ and standing long jump test, $F = 113.792$, $P = 0.000$) when comparing the yoga group (experimental group) with the control group. Nevertheless, the findings reveal that the agility of the two groups was not found to be significantly different (the 4x5m shuttle run test, $F = 2.726$, $P = 0.104$). **Conclusion.** The twelve-week yoga program could be employed as a form of practice that could help improve the physical fitness components of children in their early childhood.

KEYWORDS: Yoga Training, Balance, Agility, Flexibility, Muscular Strength, Preschoolers.

INTRODUCTION

Regular physical activities and a healthy lifestyle can positively affect the human body (1-4). For children, frequent participation in physical activities contributes to their health and growth as early childhood is believed to be a crucial period that needs to be encouraged healthy activity and discourage sedentary behavior (5). Higher levels of physical activity are considered to have both short- and long-term positive effects on children's physical and

mental health (5, 6). It is suggested that increasing physical activity in early childhood will help enhance physical fitness. In addition, increasing exercising time can perform practicing habits throughout the children's whole life (5, 6). In recent years, yoga as an overall system of mind-body exercises for mental and physical health has been investigated to improve physical fitness and health conditions of all ages (7). Yoga has produced mental health benefits for

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children and adults (8-14). Evidence shows that yoga is a potent exercise that helps promote self-regulation among preschool children aged 3–5 (15, 16). It was also revealed that the children who received the intervention of yoga training demonstrated significant improvements in emotion regulation, eye-hand coordination, attention span, concentration level, competitive performance, and relaxation (17). Other research indicates that yoga can improve attention deficit hyperactivity disorder, self-esteem and anxiety, weight loss, and eating disorders in children and adolescents (18-21). The combination of meditation or breath-control exercises, yoga postures (asanas), and deep relaxation practices in yoga are believed to help release stress and reduce anxiety for its practitioners (22, 23). Other research reported that yoga practice helps improve motor abilities (6, 24), physical fitness parameters (25), health-related physical fitness (26, 27), flexibility, balance, strength, and coordination (28-31) in different aged groups.

Some evidence suggests that yoga should be included as excellent physical practice in school programs for students in schools. It has been implemented as a promising school intervention in various countries such as the United States (14, 31-34), Brazil (35), and Israel (36). Studies examined the benefits for children in enhancing motor skills which contribute to the development of children and their healthy growth (24, 35, 37-39). The results of some studies reveal that yoga is an effective classroom intervention for preschoolers. It was examined to improve fine and gross motor performance (35), and motor skills (6, 40) for preschool children. Yoga programs have also shown the effects of yoga training on health-related physical aspects of this young-aged group (26).

In Vietnam, though yoga has received much attention and becomes a popular exercise among adults, it has not been officially included in the physical fitness program in schools. Unfortunately, the significance of yoga training for preschool

children seems to fit the context of Vietnam which has poor facilities. Thus, yoga was chosen to examine whether it can positively affect preschool children's health-related components of physical fitness, which are necessary for the development of these children. Another aim is to investigate whether the children prefer this form of practice to their regular exercises in their previous PE programs from which to recommend yoga exercises to be replaced or supplemented in other kindergartens across Vietnam.

MATERIALS AND METHODS

Participant. This study is part of a big project aiming to improve the physical fitness of Vietnamese school children run by the Ministry of Training and Education (MoET). First, the kindergarten where the research was conducted decided by the MoET with the support of the kindergarten's principal and the approval of the preschool children's parents. All procedures performed in this study were under the ethical standards of the national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Before conducting the quasi-experiment, the preschoolers' parents had signed an official consent form distributed by the researchers. Next, a sample of 61 preschool children aged four to five from six regular classes at the kindergarten where the quasi-experimental study was conducted randomly recruited and divided into two groups. An experimental group with 17 males and 13 females and a control group with 17 males and 14 females. The average age of the experimental group was 4.24 ± 0.48 years, and the control group was 4.23 ± 0.42 years. They had no health problems and previously participated in physical education (PE) classes. Table 1 below describes the general information of the two groups.

Table 1: General information of the two group participants

| Variable | Yoga group | Control group |
|-------------------------------|------------------|------------------|
| Number | 30 | 31 |
| Gender | | |
| Boys | 17 | 17 |
| Girls | 13 | 14 |
| Age (years) | | |
| Initial | 4.84 ± 0.26 | 4.23 ± 0.28 |
| Final | 5.09 ± 0.26 | 5.06 ± 0.28 |
| Body weight (kg) | 18.3 ± 2.26 | 18.6 ± 2.32 |
| Body height (m) | 1.06 ± 0.05 | 1.055 ± 0.05 |
| BMI (kg/m²) | 16.35 ± 1.87 | 16.71 ± 1.96 |

BMI: body mass index.

Data Collection. To examine the effectiveness of the training program, six tests were selected to measure the improvement of the balance, agility, flexibility, and core strength of preschoolers, such as the one-leg balance standing (s), 4x5m shuttle run (s), shoulder flexibility test (cm), Sit and reach (cm), Standing long jump test (cm) and Sit Ups Test (times) followed the instructions by Mackenzie (41) and Duger T (42). These tests were appropriate to assess the physical fitness of children which were developed and approved by Vietnam Sport Science Institute (43). Measurements were made one week before the training and immediately following the 12-week training program. Balance was evaluated using one-leg balance standing, aiming to keep track of how well the children remain balanced in a static position and retain their equilibrium. The score was recorded as the longest time the kids could maintain a balanced posture by seconds (a stopwatch, Casio HS-80TW-1 was used to score). Agility was measured by a 4x5m shuttle run test assessing the children's ability to accelerate between marked lines and to change direction rapidly. The score was recorded in seconds with the assistance of a stopwatch. Flexibility was assessed by shoulder flexibility and sit and reach to measure the development of the children's shoulder flexibility. Briefly, each kid grasped a one-meter rope and extended both arms in front of the chest, and rotated the arms overhead and behind the neck until the rope touched the back. A measuring tape was used to measure the distance between two thumbs, the shoulder width, and subtracted the shoulder width distance from the thumb distance. The sit and reach test were employed to measure the flexibility of the lower back and hamstring muscles. The kid was asked to sit on the floor with legs stretched out straight ahead with shoes taken off. The sole feet were placed against the box. The kid reached further forward along the measuring line as far as possible. The score was recorded in centimeters by the Takei T.T.K 5403 Flexion-D Meter. Core strength was assessed using the standing long jump test and the sit-up test. The standing long jump evaluated the development of the children's elastic leg strength. The measurement was taken from the takeoff line to the nearest point of contact on the landing. The longest distance jump was recorded in centimeters with a measuring tape. Finally, the sit-up test was used to determine the development of the preschoolers' abdominal

muscles. The kids were guided to lie on the mat with their knees bent, feet flat on the floor, and arms folded across the chest. Then they had to raise themselves to the 90-degree position and return to the floor in 30 seconds. The times they could perform were recorded by a stopwatch.

In the present study, test-retest reliability was employed to evaluate the reliability of these tests. The result indicates that the reliability coefficient of the test is high $r > 0.85$, $P < 0.05$. The validity coefficient value of the test is beneficial with $r > 0.50$ and $P < 0.05$. It can be concluded that the tests chosen are reliable and appropriate for assessing the two components of the physical fitness of the participants before and after the intervention.

To explore the children's attitudes towards their yoga training, one interview with ten children randomly chosen from the yoga group was conducted with the assistance of their yoga instructor by the end of the program and one week after the intervention for more reliability. The interviews were carried out as informal talks, and the kids were requested to answer two questions seeking their responses about whether they liked the yoga classes they participated in and if they wished to practice yoga in the future. The talks were recorded and calculated for later analysis. The questions were designed as a three-point Likert scale: like, uncertain, and dislike for analysis. The interview questions were designed on this Likert scale as the participants were too young to give complete answers.

Procedures. One week before the intervention, the parents were approached to sign the agreement and described the purpose of this study. All the children were instructed on how to do the six fitness tests. They were provided yoga mattresses and advised to wear comfortable costumes for yoga practice. One week after the program ended, all the participants were examined for the two components of fitness level, and all the testing procedures were conducted by the same researchers for better results.

The yoga training program for the preschoolers lasted twelve weeks and was instructed by an experienced yoga instructor. The experimental group was given yoga lessons instead of regular physical education classes. Each training session lasted 30 minutes and happened three days a week. At the same time, the control group received the same amount of practice and regular instruction in their PE classes. Twenty-six yoga asanas (postures)

and one dynamic exercise/ Salutation to the Sun (Surya Namaskara) were chosen for the yoga group. These asanas include Easy pose (Sukhasana), Staff pose (Dandasana), Be a Butterfly (Baddha Konasana), Half lotus pose (Ardha Padmasana), Head-to-knee (Janu Sirsasana), Diamond (Vajrasana), Seated wide-legged straddle (Upavistha Konasana), Hero pose (Virasana), Cat-Cow Stretch (Marjaryasana-Bitilasana), Cobra pose (Bhujangasana), Plank pose (Phalakasana), Bow pose (Dhanurasana), Bridge pose (Setu Bandhasana), Mountain pose (Tadasana), Raised arms pose (Urdhva Hastasana), Warrior 1 pose (Virabhadrasana 1), Warrior 2 pose (Virabhadrasana 2), Tree pose (Vrikshasana), Awkward Chair Pose (Utkatasana), Happy baby pose (Ananda Balasana), Corpse pose (Savasana), Stretch like a dog (Adho Mukha Svanasana), Child pose (Balasana), Standing half forward bend/ flat back (Ardha Uttanasana), Reclined Hand to Big Toe Pose (Supta Padangusthasana), Garland Pose (Malasana) (44-46). In addition to the poses, chanting Oh, Uh, and Om was guided as a breathing control technique in each session for the children. Yoga classes for these preschoolers were instructed differently from courses for adults. The asanas were simplified for the children and the yoga classes were instructed in a relaxed and comfortable atmosphere. Each lesson included three to four poses/ postures, such as standing, seated, backbend, and balance from either prone or supine asanas and combined with the Salutation to the sun and relaxation techniques. The syllabus structure is summarized and presented in the Appendix.

Data Analysis. The data were collected from the participants at two -time points. The first time was one week right before the experiment process started, and the second time was one week after the experiment process finished. All the data were calculated with the support of SPSS 22.0 and shown as mean and standard deviation values (mean \pm SD). The ANCOVA was employed to determine the differences in the mean scores between the experimental group and the control group. A significant difference was considered to have a p-value of less than 0.05. Data were displayed as mean \pm standard deviation.

RESULTS

The mean values of the fitness levels of the preschoolers before and after the experiment are shown in Table 2 below. Specifically, the data from Table 2 indicate the mean difference between

the experimental group and the control group as in one leg balance standing test (Pre-test = 0.04, Post-test = 1.97), 4x5m Shuttle run test (Pre-test = 0.1, Post-test = 0.77), Shoulder flexibility test (Pre-test = 0.01, Post-test = 1.51), Sit and reach test (Pre-test = 0.02, Post-test = 1.69), Standing long jump test (Pre-test = 0.44, Post-test = 6.59), Sit-ups test (EG = 0.05, CG = 1.17). Table 2 also reveals the change in all tests in both groups (EG and CG) such as the *one leg balance standing* test (EG: 57.14 % and CG: 38.98%), 4x5m Shuttle run test (EG: 12.66% and CG: 6.15%), Shoulder flexibility test (EG: 25.17% change and CG: 12.14%), Sit and reach test (EG: 35.73% and CG: 15.88%), Standing long jump test (EG: 17.11% and CG: 9.40%), and Sit-ups test (EG:47.10%, CG: 31.04%).

The results of Levene's Test in the Table 2 showed that all significant values are higher than 0.05 which allow us to analyze the differences of the groups after the training through the Tests of between-Subjects Effect and Pairwise Comparison in the Table 3.

Table 3 below presents the test of the between-subjects effects and pairwise comparison. The results show that all the tests had the Sig. in the source "pre-test" lower than 0.05. It means that the differences in the pre-test have a significant effect on the experimental manipulation (the impact of yoga training on the final score). Specifically, there were significant differences in one leg balance standing test ($F = 15.562$, $P = 0.000$), shoulder flexibility test ($F = 65.952$, $P = 0.000$), sit and reach test ($F = 48.937$, $P = 0.000$), standing long jump test ($F = 113.792$, $P = 0.000$), and in sit-ups test ($F = 47.918$, $P = 0.000$). However, there were no significant differences in the 4x5m shuttle run test ($F = 2.726$, $P = 0.104$) between the experimental group and the control group.

Table 4 presents the results of the two interviews for the purpose of exploring the preschoolers' attitudes towards their training program. Table 4 displays the summary of responses to the quick interviews. The results from the two times of interviews do not show statistical differences (sig.>0.05). In other words, the results from Table 4 show the high preference of the children in the experimental group; the percentage of children who love to practice yoga through the first interview is 86.67% and the second time is 83.33%. It means that the yoga program motivated them to do exercises.

Besides, the data from the informal interviews with the participants also revealed that they wish to practice more yoga in their next physical fitness program.

Table 2. Mean Values of Fitness Level in two Groups before and after the Experiment

| Fitness Tests / Times | Groups | | Mean difference EG-CG | Levene's Test | |
|--------------------------------|-----------------|-----------------|----------------------------|---------------|------|
| | EG Mean ± SD | CG Mean ± SD | | F | Sig. |
| One leg balance standing (s) | | | | | |
| Pre-test | 5.93±1.29 | 5.97±1.12 | 0.04 | .145 | .705 |
| Post-test | 11.0±2.31 | 9.03±1.69 | 1.97 | | |
| % change | 59.14 | 38.98 | 20.16 | | |
| 4x5m Shuttle run (s) | | | | | |
| Pre-test | 11.07±1.59 | 11.17±1.75 | 0.1 | .752 | .389 |
| Post-test | 9.74±1.30 | 10.51±1.60 | 0.77 | | |
| % change | 12.66 | 6.15 | 6.51 | | |
| Shoulder flexibility test (cm) | | | | | |
| Pre-test | 13.40±2.74 | 13.39±2.34 | 0.01 | 1.110 | .296 |
| Post-test | 10.43±2.30 | 11.94±2.29 | 1.51 | | |
| % change | 25.17 | 12.14 | 13.03 | | |
| Sit and reach (cm) | | | | | |
| Pre-test | 8.43±3.07 | 8.45±2.63 | 0.02 | .414 | .522 |
| Post-test | 11.53±2.43 | 9.84±2.90 | 1.69 | | |
| % change | 35.73 | 15.88 | 19.85 | | |
| Standing long jump test (cm) | | | | | |
| Pre-test | 68.73±9.61 | 68.29±13.05 | 0.44 | .422 | .519 |
| Post-test | 81.30±8.79 | 74.71±13.35 | 6.59 | | |
| % change | 17.11 | 9.40 | 7.71 | | |
| Sit-ups Test (times) | | | | | |
| Pre-test | 5.47±2.33 | 5.52±2.64 | 0.05 | 1.458 | .232 |
| Post-test | 8.20±1.87 | 7.03±2.44 | 1.17 | | |
| % change | 47.10 | 31.04 | 16.06 | | |

EG: Experimental group, CG: Control group

Table 3. Tests of between-Subjects Effect and Pairwise Comparison

| Fitness Tests / Times | Sum of Squares | df | Mean Square | F | Sig. | Pairwise comparison (Post-test) |
|---------------------------------------|----------------|----|-------------|----------|------|---------------------------------|
| One leg balance standing (s) | | | | | | |
| Pre-test | 24.901 | 1 | 24.901 | 6.446 | .014 | .000 |
| Group | 60.118 | 1 | 60.118 | 15.562 | .000 | |
| 4x5m Shuttle run (s) | | | | | | |
| Pre-test | 102.665 | 1 | 102.665 | 223.447 | .000 | .104 |
| Group | 1.253 | 1 | 1.253 | 2.726 | .104 | |
| Shoulder flexibility test (cm) | | | | | | |
| Pre-test | 290.536 | 1 | 290.536 | 548.871 | .000 | .000 |
| Group | 34.911 | 1 | 34.911 | 65.952 | .000 | |
| Sit and reach (cm) | | | | | | |
| Pre-test | 384.781 | 1 | 384.781 | 422.039 | .000 | .000 |
| Group | 44.617 | 1 | 44.617 | 48.937 | .000 | |
| Standing long jump test (cm) | | | | | | |
| Pre-test | 7549.801 | 1 | 7549.801 | 1484.943 | .000 | .000 |
| Group | 578.545 | 1 | 578.545 | 113.792 | .000 | |
| Sit-ups Test (times) | | | | | | |
| Pre-test | 262.801 | 1 | 262.801 | 565.226 | .000 | .000 |
| Group | 22.279 | 1 | 22.279 | 47.918 | .000 | |

Table 4. The results of the two interviews with the experimental group

| Table 4. The Results of the two interviews with the experimental group | | | | | | | |
|--|-----------|---------------|-------|---------------|-------|----------------|-------|
| Questions | | Results | | | | X ² | Sig |
| | | Time 1 n = 30 | | Time 2 n = 30 | | | |
| | | Agreement | % | Agreement | % | | |
| 1 | Like | 26 | 86.67 | 25 | 83.33 | 0.54 | 0.762 |
| 2 | Uncertain | 03 | 10.00 | 04 | 13.33 | | |
| 3 | Dislike | 01 | 3.33 | 01 | 3.33 | | |

DISCUSSION

To fill a gap in the literature for this specific age group, 5-6 preschoolers, the purpose of this study was to ascertain how yoga affects preschoolers' performance on motor-related tasks such as balance, flexibility, agility, and strength. The findings of this study indicate that yoga may benefit preschoolers' strength, flexibility, and static balance, but agility was not found to be enhanced. Additionally, the findings also show that the children are enthusiastic about engaging in doing the selected and modified asanas in their 12-week yoga training program and the dynamic exercise (Salutation to the Sun).

Typically developing toddlers between the ages of three and five were advised by the World Health Organization to engage in physical activity daily for at least three hours to improve their physical fitness (47) and yoga was much researched for its benefits to physical development. Children who participated in the current study's yoga training exhibited significantly improved static balance, flexibility, and strength compared to the control group who did not receive the same training (shown in Table 3 with sig. values in the measures smaller than 0.05). The results of the study supported previous research that found yoga to be beneficial for preschoolers' physical development (5). This study is in line with the study of Bubela & Gaylo who showed that after six weeks of practicing yoga the children samples aged 3-5 years old could improve significantly in strength, flexibility, balance, and coordination (35). Another study by Folleto et al. exposed that a twelve-week yoga program conducted in children aged 6-8 could have a positive effect on the children's balance, strength, and flexibility (24). The results of this study also support the findings of other studies on school-aged children such as the research of Donahoe-Fillmore & Grant which found children aged 10-12 years old to be enhanced in flexibility and balance with the intervention of yoga training (31).

Yoga treatments mentioned in the literature come in a wide variety in length and intensity, with

the majority of programs lasting between six weeks and twelve weeks and consisting of sessions lasting 30 to 90 minutes, three or more times per week. The yoga program of this study also supported the impact of the frequency and intensity (12 weeks and thirty minutes three times a week) of some yoga postures on preschoolers' fitness development.

The current study also found similar positive benefits of some popular postures (asanas) in yoga such as Marjaryasana-Bitilasana, Phalakasana, Adho Mukha Svanasana, Dhanurasana, Virabhadrasana I, Virabhadrasana 2, Vrikshasana in improving the young children's health-related aspects. However, significant modifications to some asanas like Upavistha Konasana, Bhujangasana and Setu Bandhasana to fit young children's abilities made this study different from previous studies. In addition, we observed that some standing yoga exercises such as Tadasana, Ardha Uttanasana, Urdhva Hastasana, Virabhadrasana 1, Virabhadrasana 2, Vrikshasana, Utkatasana could contribute to the improvement of the participants' balance which can be seen from the results of one leg balance standing test after the experiment with a change of 20.16 % in the mean difference between the yoga group and the control group. The data of this study indicated that the shoulder flexibility of the children participating in the research had a good development in the Sit and reach test with an increase of 3.10 cm. Some stretching postures like Urdhva Hastasana, Ardha Uttanasana, Virabhadrasana I, Virabhadrasana 2, Phalakasana, Adho Mukha Svanasana may enhance the flexibility of the preschooler participants that can be seen in the result of the shoulder flexibility test with a 13.03 % change in mean scores between the two groups. The results are also in line with many previous studies which explored that yoga training programs could enhance young adults' flexibility (28). In another study, Grabara indicated that yoga training could increase first-year students' spine flexibility (48). Unfortunately, our study did not prove the improvement of flexibility in the spine as the

participants were too young for the measurements. Moreover, some asanas employed such as Dandasana, Baddha Konasana, Janu Sirsasana, Vajrasana, Virasana, Urdhva Hastasana, Virabhadrasana I, Virabhadrasana 2, Vrikshasana, Urdhva Hastasana, Vrikshasana, Utkatasana showed that they could develop lower limb muscle and other asanas like Ananda Balasana, Savasana, Adho Mukha Svanasana, Supta Padangusthasana, Malasana could enhance stretching ability of back and abdominal muscles (evidence from the significant difference of the sit and reach test). However, due to the young age of the participants, we did not measure the muscle strength using handgrip tests like in the study of Harrison, Manocha & Rubia (18).

Unlike other studies, we found that speed agility (4x5m shuttle run test result) had lower improvement compared to the results of strength, flexibility, and balance levels and had no significant difference (with a sig. value higher than 0.05). It can be explained that the participants of this study belong to the younger age group not as in the study of Bal & Kaur and Sharma whose participants were male students (49). In addition, the asanas and some other yoga exercises in these studies are different from those in this study may bring other impacts.

Furthermore, the improvement of fitness levels of the preschoolers could be accounted for by the inclusion of the variation of Salutation to the sun in the current study, which could support the results of Milind et al., who claimed that daily practice of Sun Salutation could strengthen upper body muscle groups, and increase leg, arm, chest, and back strength (50).

Finally, the interviews with randomly selected yoga participants could enhance the effectiveness of the yoga training and yoga training can be considered or added to the regular physical curriculum in kindergartens in Vietnam or in other countries with similar contexts.

In general, our study findings could support previous studies which believed that yoga programs could develop some physical fitness components in children, helping their balance, flexibility, and core strength during their PE courses. The findings from the review paper of Khalsa & Butzer revealed that most yoga interventions included in school curricula were beneficial for primary students' health characteristics. However, it is hard for us to make a direct comparison with previous studies which

explored that yoga training could enhance the agility of participants (51). The explanation may be due to the difference in characteristics of the participants, genders, age, level of physical fitness, types of asanas or yoga postures, types of fitness assessment tests, frequency and intensity of training program, training physical conditions, and even cultural differences. According to Zeng et al., the early years are a crucial period for fostering the motor abilities and skills of children (6). Some studies explored the efficiency of physical activity programs (52) or game-based training on physical fitness in preschool children (53); however, our study attempted to another form of exercising which has never been used in Vietnam to foster some fitness components of preschoolers age ranging from 4 -5 years old. The overall results confirmed not only the efficiency of the yoga training on the preschoolers in their fitness aspects, including balance, flexibility, and core strength, but also their positive attitudes towards the yoga program. Yoga training can be an advantageous physical activity form for the physical fitness development of children in PE courses.

CONCLUSION

The study employed twenty-six yoga asanas and one dynamic exercise (Sun Salutation) and found that the training could bring benefits to the participants' balance, flexibility, and core strength. However, the agility of the participants was found not to be significantly different. Besides, the study also discovered that almost all the 4-5-year-old preschoolers who took the experiment preferred this new physical form of exercising to their regular PE classes and expected to have more similar classes. Through the training program and interviews, we found that the selected asanas can be popularized in Vietnam as a recommended form of physical activity that would help young children practice in their PE programs for the objective of improving physical fitness and health.

In summary, the results of this study indicate that 12 weeks of yoga training can significantly improve some fitness components in the 4-5-year-old preschooler subjects. More specifically, yoga training can enhance balance, flexibility, and core strength. However, the yoga training in our study did not have a significant effect on agility.

Though the study has reached its research objectives, some limitations should be concerned. A small sample that included a conveniently chosen

group of children may affect the results of the study. Another limitation is that some components used only one or two tests to assess. For instance, flexibility, one of the important factors of health-related components of fitness, was not measured by other tests such as ankle flexibility, trunk extension, or trunk flexion like in other studies which may bring other results. In addition, our study did not investigate the influence of yoga on preschoolers' coordination, which may have good results in the yoga program. Future research could be conducted on a bigger size of samples and even on other 3-4-year-old or 6-7-year-old preschoolers' motor abilities which would provide additional information for a yoga-school-based program to the physical development of children. In another study, it would be more investigation of the impact of yoga training on other health-related fitness components such as coordination and muscular endurance.

APPLICABLE REMARKS

- Preschoolers are often seen as active and prefer exciting activities; however, the yoga training program appealed to them as they expressed their positive attitudes towards the yoga training and wished to have further practice in the future.
- The training could improve some fitness components which meet the requirements of the basic physical education programs for preschoolers.

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- The findings of this study may allow educators and trainers to popularize yoga in physical education classes to improve preschoolers' fitness and fit the poor facility conditions in Vietnam.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Vinh Quang Nguyen. Acquisition of data: Vinh Quang Nguyen. Analysis and interpretation of data: Dung Xuan Phung. Drafting the manuscript: Dai Quang Tran. Critical revision of the manuscript for important intellectual content: Truong Ngoc Duong. Statistical analysis: Dung Xuan Phung. Administrative, technical, and material support: Dai Quang Tran. Study supervision: Vinh Quang Nguyen.

CONFLICT OF INTEREST

The authors declare that no conflicts of interest could be perceived as interfering with the publication of this study.

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