

Research Paper



The Effect of Yoga Therapy As a Supplement in the Management of Students With Dyscalculia: A Clinical Trail Study

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ABSTRACT

Purpose: Mathematics is a complex subject that includes language, quantity, and space. Students with dyscalculia have difficulty in learning and memorizing numbers, they cannot remember the basic facts related to numbers, and they are slow and inaccurate in calculating. This research aims to investigate yoga therapy as a supplement in the management of students with dyscalculia in Tabriz city, Iran.

Methods: This study is a randomized clinical trial; a total of 30 male students were initially allocated to either a yoga group (YG, n=15), who underwent a 8-week yoga exercise program, or to a control group (CG, n=15), who did not receive any intervention. The data collection tools are: Visual perception questionnaire, visual and auditory processing questionnaire, spatial visualization questionnaire) and learning disability questionnaire. We performed ANCOVA for data analysis using in level significance 5% by SPSS software, version 25.

Results: The results of ANCOVA showed between-group differences for visual processing ($F_{(1,18)}=19.01, P=0.01$), visual perception, and spatial visualization ($F_{(1,18)}=30.132, P=0.001$), and spatial visualization ($F_{(1,18)}=5202.86, P=0.001$).

Conclusion: It can be concluded that yoga therapy can reduce the amount of math learning disorder in students with dyscalculia.

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Highlights

- The research design was a randomized clinical trial.
- The results showed that yoga exercise plays a significant role in increasing the visual processing, the visual perception and spatial visualization, and spatial visualization.

Plain Language Summary

This research aims to investigate the effectiveness of yoga training on visual processing, visual perception and spatial visualization, and spatial visualization. The research design was quasi-experimental, pre-test and post-test with a control group using a convenience selected method. The result showed that yoga training increased visual processing, visual perception and spatial visualization, and spatial visualization in students.

1. Introduction

According to the fifth diagnostic statistical manual of mental disorders of the [American Psychiatric Association \(APA\)](#) [1], learning disorder is classified as a neuro-development learning disorder. Students suffering from this disorder have problems in understanding numbers, understanding numerical facts, calculation, and problem-solving. The progress of these students in mathematics is significantly lower than expected according to their age, and these problems are not caused by intellectual, neurological, sensory (visual, auditory), or movement disorders. The prevalence of learning disorders has been determined to be 5%-15% of school students [1]. The prevalence of dyscalculia is estimated between 5% and 15% [2]. Mathematics is a complex subject that includes language, quantity, and space. In most studies conducted to improve math skills, it is suggested to help improve basic number learning, such as counting and calculating, but achieving low levels of math skills also requires very complex abilities [3]. Students with dyscalculia have difficulty in learning and memorizing numbers, they cannot remember the basic facts related to numbers, and they are slow and inaccurate in the calculation [4, 5]. Students with learning disorders may experience emotions that interfere with learning; these emotions can occur for several reasons, including failure to face problems, feeling behind academically compared to peers, anger, and doubting one's abilities when there is little academic progress, and also anxiety from focusing on one's learning problems when little importance is given to them. Therefore, if a therapeutic supplement, such as yoga is used in the management program of these students, it may reduce the amount of dyscalculia [6]. Yoga is a movement practice that fosters mindful awareness. It originates from a

traditional Eastern school of philosophical thought that aims to promote self-realization and transcendence [7]. Recently, in Western cultures, yoga is a holistic practice for health and wellness that typically combines physical movement (asana) with breathing exercises (pranayama) and relaxation, in a form known as hatha yoga [8]. Body-based or movement-based mindfulness approaches, such as yoga, often focus on developing bodily awareness before moving on to the awareness of thoughts and feelings, assuming that cognitions are more difficult to access [9]. Therefore, yoga may be a more accessible form of mindfulness practice than sitting exercises and meditation [10, 11]. In parallel, yoga has demonstrated emerging evidence as a management for anxiety [6] and depression [12, 13]. Exercise training, such as balance can strengthen concentration due to its relaxing properties [14]. The philosophy of yoga is to fill the human being with endless energy and vitality. With the limitations we create in our minds, we build walls in the path of these energies, causing illness and disorder in the body and mind. Yoga is a way to reach these inner treasures and increases self-confidence. For this reason, in the new era, this sport can be one of the vital ways to strengthen executive functions, including strengthening concentration and attention. The evidence shows that physical fitness increases attention and concentration and reduces the amount of distraction [15]. Koutsandreou et al. [16] in their research showed that training in motor control improves children's working memory. Arslani et al. [5] in a study showed that motor skills training has improved working memory, attention, and control of motor skills in students with math learning disorders. Van der Fels et al. [15] showed that cognitive motor control training increases executive functions, including attention, and concentration. Schmidt et al. [17] showed that yoga training improves attention and concentration. Rasouli et al. [18] concluded that motor control training was effective

tive in the amount of selective attention of students with attention-deficit/hyperactivity disorder. According to the conducted studies, the current research was conducted to answer the question of whether yoga therapy is effective as a supplement in the management of dyscalculia in students with disorders.

This study is a randomized clinical trial. The statistical population included high school teenagers with math learning disabilities in Tabriz City in 2021. The sampling method was a convenience selected method, a sample of 30 people was selected and then 15 participants were placed in the experimental group and 15 participants were placed in the control group. The experimental group underwent intervention (yoga training), but no intervention was performed in the control group. Informed consent was obtained from the participant's parents. The inclusion criteria included high school students, learning disability, obtaining a high score on the disability scale, and willingness to participate in the study. The exclusion criteria included unwillingness to participate in the study, and absence of more than two sessions of the educational program. Evaluation times were done after the sessions. Due to the limited time to conduct the research, the evaluation was performed only once by the researcher after the end of the sessions. Yoga training was conducted by a yoga instructor with a master's degree in physical education

Measurement

Visual perception questionnaire

Sight intervenes in all fields of child development as a coordinating and unifying sense and plays a significant role in understanding other senses. Gardner developed the TVPS-R in 1982 and revised it in the United States in 1996. This series includes seven subtests of visual recognition, visual memory, visual-spatial relations, visual shape stability, visual sequence memory, visual recognition of shape from the visual context, and visual completion. Cronbach's α coefficient for validity and reliability is 0.71 [19].

Visual and auditory processing questionnaire:

This test was prepared by Beck et al. [20]. In the present study, the Persian form of this test prepared by Hadianfard et al. [21] was used. The Persian form, which is executed through the computer, has 150 Persian numbers as stimuli. Of these, 30 stimuli (20 percent) are target stimuli. The interval between the presentation of two stimuli is 500 ms and the presentation time of each stimulus is 150 ms. The retest is in the range of 0.59 to 0.93.

Spatial visualization questionnaire:

The spatial visualization or spatial perception test was prepared in 1930, along with a series of mechanical aptitude tests, at the University of Minnesota, USA. The exam consists of two forms, AA and BB. In this research, the AA form revised in 1934 was used. The whole test has 64 questions and each question is presented as multiple options. Its applications are measuring the ability to draw geometric images, predicting success in mechanical jobs, and predicting success in art and vocational schools, and Cronbach's α coefficients (0.69-0.83) for the overall scale and the factors of the questionnaire show that this instrument has an acceptable internal consistency.

Learning disability questionnaire:

The Colorado learning difficulties questionnaire by Willcutt et al. [22] was used that five basic factors of reading, math, social cognition, social anxiety, and spatial functions cause learning difficulties. This questionnaire contains 20 items that are completed by parents or teachers. The correlation of the Colorado learning questionnaire with reading subscales is 0.81, social cognition, 0.78, social anxiety 0.76, spatial problems 0.76, and mathematical 0.60. In this study, the mathematical component was investigated.

Yoga program

The yoga therapy program was provided under the training of a senior yoga teacher and yoga therapist. This included weekly group sessions and a personalized home workout. The program was introduced to the yoga therapy framework [8] and consensus-based recommendations for yoga interventions targeting anxiety and depression [23]. The group sessions were 60 minutes each and were held weekly for eight weeks with a maximum of 10 participants in each group. They incorporated relaxation, breathing, gentle physical postures, and movements from standing, lying, or sitting positions suitable for all experience levels and using modifications as needed (a description of postures and breathing techniques is mentioned in Table 1). A personalized home practice was created for each participant by a yoga teacher. Routines typically lasted 15 to 30 minutes and included simple movement and breathing techniques, considering each participant's current health and any physical injuries. Participants were advised to complete their home exercises at least three days per week and to detail their adherence in weekly exercise reports.

Table 1. Yoga postures and pranayama used during group classes

Postures	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Savasana (corpse pose)	*	*	*	*	*	*	*	*
Ardho Mukha Svanasana (downward facing dog)				*		*	*	*
Cakravakasana (sunbird)	*	*	*	*	*	*	*	*
Tadasana (standing balance)				*		*		*
Urdhva Prasrta Padasana (lying leg raise)		*	*				*	*
Uttanasana (standing forward bend)	*	*	*	*	*	*	*	*
Ardha Uttanasana (standing half forward bend)	*	*		*		*		
Virabhdhasana 1 (warrior)	*		*	*		*	*	
Virabhdhasana 2 (warrior twist)	*			*		*		
Apanasana (lying knees to chest)	*	*	*	*	*	*	*	
Dvipadapitham (bridge)	*	*			*	*		*
Trikonasana Parsva (standing triangle)		*		*	*			*
Parsva Uttanasana (lateral forward bend)			*				*	
Jathara Paravrtti (modified lying twist)		*		*	*	*	*	
Supta Baddha Konasana (lying butterfly)		*						
Janursirasana (asymmetrical seated forward bend)			*					
Jathara Paravrtti Parsva (lying asymmetrical twist)	*							
Sukhasana (crossed legs seated)	*	*	*	*	*	*	*	*
Sukhasana (plus twist) (crossed legs seated twist)		*		*			*	
Vajrasana (lightning bolt/diamond)								*
Bhujanghasana (Cobra)						*	*	
Utkatasana (squat)						*		
Dandasana (stick pose)							*	
Prasrita Pada Uttanasana (wide leg forward bend)								*
Ardha Matsyendrasana (D) (lateral seated twist)							*	
Viparita Karani (lying supported inversion)					*		*	*
Utthita Parsva Konasana (standing lateral angle)					*			
Pranayama techniques								
Palming (hands to eyes)		*						
Recaka Pranayama (long exhalation focus)	*				*	*		*
Ujjayi (ocean breath)			*	*	*	*	*	*
Karanyasam (finger movement linked to breath)				*	*	*		*
Anuloma Ujjayi (inhale-ujjayi, exhale-alternate nostril)							*	*

Table 2. Mean±SD of the studied variables

Variables	Groups	Mean±SD	
		Pre-test	Post-test
Visual perception	Control	6±1.60	6.01±1.81
	Examination	5.6±1.40	6.87±2.06
Visual and auditory processing	Control	3.27±1.90	3.30±0.97
	Examination	3.40±1.40	4.02±1.19
Spatial visualization	Control	3.00±1.06	2.93±1.48
	Examination	3.30±0.97	3.67±1.03

PHYSICAL TREATMENTS

Data analysis

Research data were analyzed at two levels of descriptive and inferential statistics. First, the data were described using descriptive statistical methods, such as frequency calculation, Mean±SD. To observe the normality of the normal distribution of scores in the population, the Shapiro-Wilk test was used, and also to determine the homogeneity or equality of variances, Levin test, and regression slope homogeneity were used as well as analysis of covariance (ANCOVA) was used to test hypotheses using SPSS software, version 25 at the significance level of 5%.

3. Results

The results of Table 2 show that the studied variables have increased after the intervention compared to pre-test and control.

Examining the research hypotheses indicates the normality of the data ($P>0.05$) and the homogeneity of the variance matrix for the post-test conditions of the dependent

variables as well as the homogeneity of the error variance ($P>0.05$). The results of Table 3 show that there is a significant difference in the mean of perception, visual and auditory processing, and spatial visualization in the experimental and control groups in the post-test phase ($P<0.001$). Therefore, yoga movements have been effective in perception, visual and auditory processing, and spatial visualization, and the amount of this effect was 0.71, 0.76, and 0.69, respectively.

4. Discussion

The results showed that yoga as a therapeutic supplement is significant in reducing the number of math disorders among adolescents by increasing the level of cognition at the probability level of 1%. These results are consistent with the research results of Mousavi-Sadati and Jirsarai-Bazargard [24], Parajuli et al. [25]. Mousavi-Sadati and Jirsarai-Bazargard [24] in the study of the effect of super brain yoga on increasing intelligence, visual-spatial perception and academic progress and static balance of children with down syndrome concluded that yoga practice

Table 3. The results of ANCOVA of the studied variables

Variables	Source	Sum of Squares	df	Mean of Squares	F	Sig.	Eta Squared
Visual perception Visual and auditory processing	Group	2049.173	1	2049.173	19.009	0.001	0.71
	Error	1832.645	18	107.803			
Spatial visualization Visual perception	Group	198.623	1	198.623	30.122	0.001	0.76
	Error	112.099	18	6.594			
Visual and auditory processing	Group	5202.860	1	5202.860	31.711	0.001	0.69
	Error	2789.236	18	164.073			

PHYSICAL TREATMENTS

increased fluid intelligence, visual-spatial perception and academic progress of students. In explaining these results, yoga, which is a type of physical activity, increases mental health, improves mental functions, and regulates emotions by energizing the brain to stimulate the production of α brain waves [25]. In a study that investigated the effect of squat yoga with hands in a special position (a form of yoga exercise), it was concluded that this type of exercise can improve people's selective attention and mental state [26-28]. In a study, Jois and D'Souza [29] investigated the effects of super brain yoga on improving the academic and behavioral performance of 1945 students, and found that performing super brain yoga exercises for three months significantly increased students' self-confidence, memory, and concentration in the exam. By affecting the amygdala of the brain, this technique improved logic (reasoning), learning, and improvement in students' negative emotional responses. By affecting the amygdala of the brain, this technique can improve logic (reasoning), and learning, and improve students' negative emotional responses. Also, the results showed that yoga as a therapeutic supplement is effective in reducing the amount of math disorders in adolescents with math disorder by increasing visual and auditory processing at a probability level of 1%. This result is consistent with the results of Dehghani et al. [30], Van der Fels et al. [15]. In explaining this result, practicing yoga causes interactions and connections in the mind that bring children to a correct understanding of themselves and their environment. These movements from rich sensory and movement experiences, auditory, visual musical stimuli and the emergence of a sequence of stimuli, and responses, create conditions and situations for children that, in addition to the mental, cognitive, perceptual, and movement questions, create grounds for the growth and successful learning of educational skills in the future, such as reading, writing, and arithmetic. [31]. Also, in the explanation of these results, sports training, such as balance can strengthen concentration due to its relaxing feature [32]. The philosophy of yoga is to fill the human being with endless energy and vitality. With the limitations we create in our minds, we build walls in the path of these energies and cause illness and disorder in the body and mind. Yoga is a way to reach these inner treasures and increases self-confidence. For this reason, in the new era, this sport can be one of the vital ways to strengthen executive functions, including strengthening concentration and attention. Evidence shows that physical fitness increases attention and concentration and reduces the amount of distraction [15]. Also, the results showed that yoga as a therapeutic supplement is effective in reducing the amount of math disorders in teenagers with math disorder by increasing spatial visualization at the probability level of 1%. The results are

consistent with the results of Pradhan [33], and Sinha et al. [34]. In yoga exercises, due to the increase in the activity of the frontal lobe of the brain and the decrease in the activity of the parietal lobe, attention and spatial awareness increase, and due to the increase in the perception of proprioception in the brain or the ability to perceive the body, the balance of people who have posture disorders is improved [35]. Also, yoga training plays a crucial role in self-management, and people who undergo yoga training gain a higher ability to manage themselves in the face of problems and challenges [36]. In this regard, Caviola et al. [37] state that students who have a good working memory are more successful in completing assignments and retrieving course information, and this feature helps them solve mathematical problems. In other words, yoga exercises at any age leave a lasting role and effect for the next ages. In the explanation of this finding, we can mention the role of yoga exercises on the brain. Yoga, with the peace it brings and the connection it establishes with the deeper layers of the brain, brings a feeling of inner satisfaction and deep happiness because with regular practice and constant yoga movements, concentration is strengthened and the necessary changes are made in the brain to achieve the goal. Yoga exercises lead to increased blood flow in the brain, increased concentration, and improved breathing rhythm, all of which are effective for increasing memory skills and learning math.

5. Conclusion

The present study showed that yoga exercises have positive effects on increasing visual processing, visual perception, and spatial visualization. Therefore, regular yoga exercises are effective in reducing dyscalculia.

Limitations and suggestions

Several limitations have caused problems in decision-making for the present research and have affected the presentation of the results, including the statistical population of the present research is limited to the population of male students in the first year of high school, internal studies are limited to comparison, and the present study is related to Tabriz City and it should be conducted in other geographical areas as well. Therefore, we suggest that in future research, this research should be conducted on a wide range of people and in other communities to increase the generalizability of the findings. According to the obtained results, psychologists, counselors, and school administrators are suggested to use sports interventions, including yoga training, to improve and increase the academic performance of students of different grades.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

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Authors' contributions

The both authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interests.

References

- [1] Svenaeus F. Diagnosing mental disorders and saving the normal. *Medicine, Health Care and Philosophy*. 2014; 17:241-4. [Link]
- [2] Wong TT, Ho CS, Tang J. Identification of children with mathematics learning disabilities (MLDs) using latent class growth analysis. *Research in Developmental Disabilities*. 2014; 35(11):2906-20. [DOI:10.1016/j.ridd.2014.07.015] [PMID]
- [3] Lange-Küttner C, Kochhar R. Fine motor skills and unsystematic spatial binding in the comon region test: Under-inclusivity in autism Spectrum disorder and over-inclusivity in attention-deficit hyperactivity disorder. *Journal of Motor Learning and Development*. 2020; 8(3):544-68. [DOI:10.1123/jmld.2019-0033]
- [4] Sadock BJ, Sadock VA, Kaplan HI. Kaplan and Sadock's concise textbook of child and adolescent psychiatry. Amsterdam: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2009. [Link]
- [5] Arsalani F, Sheikh M, HemayfTalab R. [Effectiveness of selected motor program on working memory, attention and motor skills of students with math learning disorders (Persian)]. *The Scientific Journal of Rehabilitation Medicine*. 2019; 8(3):209-20. [Link]
- [6] Cramer H, Lauche R, Anheyer D, Pilkington K, de Manincor M, Dobos G, et al. Yoga for anxiety: A systematic review and meta-analysis of randomized controlled trials. *Depression and Anxiety*. 2018; 35(9):830-43. [DOI:10.1002/da.22762] [PMID]
- [7] O'Shea M, Capon H, Skvarc D, Evans S, McIver S, Harris J, et al. A pragmatic preference trial of therapeutic yoga as an adjunct to group cognitive behaviour therapy versus group CBT alone for depression and anxiety. *Journal of Affective Disorders*. 2022; 307:1-10. [DOI:10.1016/j.jad.2022.03.028] [PMID]
- [8] Kraftsow G. Yoga for wellness: Healing with the timeless teachings of viniyoga. New York: Penguin Publishing Group; 1999. [Link]
- [9] Emerson D, Hopper E. Overcoming trauma through yoga: Reclaiming your body. California: North Atlantic Books; 2011. [Link]
- [10] Carmody J, Baer RA. Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*. 2008; 31(1):23-33. [DOI:10.1007/s10865-007-9130-7] [PMID]
- [11] Dick AM, Niles BL, Street AE, DiMartino DM, Mitchell KS. Examining mechanisms of change in a yoga intervention for women: The influence of mindfulness, psychological flexibility, and emotion regulation on PTSD symptoms. *Journal of Clinical Psychology*. 2014; 70(12):1170-82 [DOI:10.1002/jclp.22104] [PMID]
- [12] Cramer H, Anheyer D, Lauche R, Dobos G. A systematic review of yoga for major depressive disorder. *Journal of Affective Disorders*. 213; 70-7. [DOI:10.1016/j.jad.2017.02.006] [PMID]
- [13] Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: A systematic review and meta-analysis. *Depression and Anxiety*. 2013; 30(11):1068-83. [PMID]
- [14] Jalilishishavan A, Sadeghian N. [Effectiveness of executive functions training on anxiety, self-efficacy and self-regulation of student athletes participating in sports olympiad (Persian)]. *Journal of Modern Psychological Researches*. 2023; 18(69):81-91. [Link]
- [15] van der Fels IMJ, de Bruijn AGM, Renken RJ, Königs M, Meijer A, Oosterlaan J, et al. Relationships between gross motor skills, cardiovascular fitness, and visuospatial working memory-related brain activation in 8-to 10-year-old children. *Cognitive, Affective, & Behavioral Neuroscience*. 2020; 20(4):842-58. [DOI:10.3758/s13415-020-00805-5] [PMID] [PMCID]
- [16] Koutsandreou F, Wegner M, Niemann C, Budde H. Effects of motor versus cardiovascular exercise training on children's working memory. *Medicine & Science in Sports & Exercise*. 2016; 48(6):1144-52. [DOI:10.1249/MSS.0000000000000869] [PMID]
- [17] Dehghani Y, Hoseini FS, Jamshidi F. The effects of easy minds program on working memory and selective attention in students with math learning disabilities. *International Journal of Disability, Development and Education*. 2022 Nov 9:1-3. [DOI:10.1080/1034912X.2022.2140782]
- [18] Schmidt M, Mavilidi MF, Singh A, Englert C. Combining physical and cognitive training to improve kindergarten children's executive functions: A cluster randomized controlled trial. *Contemporary Educational Psychology*. 2020; 63:101908. [DOI:10.1016/j.cedpsych.2020.101908]

- [19] Rasuli M, Choobdary A, Hakimirad E. [Effectiveness of response inhibition training in selective attention and motor skills improvement in students with attention deficit/hyperactivity disorder (Persian)]. *Journal of Modern Psychological Researches*. 2017; 12(45):81-103. [\[Link\]](#)
- [20] Davis DW, Burns BM, Wilkerson SA, Steichen JJ. Visual perceptual skills in children born with very low birth weight. *Journal of Pediatric Health Care*. 2005; 19(6):363-8 [\[DOI:10.1016/j.pedhc.2005.06.005\]](#) [\[PMID\]](#)
- [21] Beck LH, Bransome ED Jr, Mirsky AF, Rosvold HE, Sarason I. A continuous performance test of brain damage. *Journal of Consulting Psychology*. 1956; 20(5):343-50. [\[DOI:10.1037/h0043220\]](#) [\[PMID\]](#)
- [22] Hadianfar H, Najarian B, Shekarshekan H, Mehrabizad, M. [Preparing and making the Farsi form of continuous performance test (Persian)]. *Journal of Psychology*. 2000; 39(16):388-400. [\[Link\]](#)
- [23] Willcutt EG, Boada R, Riddle MW, Chhabildas N, DeFries JC, Pennington BF. Colorado Learning Difficulties Questionnaire. *Psychological Assessment*. 2011. [\[DOI:10.1037/t03737-000\]](#)
- [24] De Manincor MJ. Yoga for Mental Health: Evaluation of yoga interventions for reducing depression and anxiety, and improving well-being [PhD dissertation]. Sydney: Western Sydney University; 2017. [\[Link\]](#)
- [25] Mousavi-Sadati SK, Jirsarai-Bazargard M. [The effect of superbrin yoga practice on fluid intelligence, spatial vision perception, academic achievement and balance in children with Down syndrome (Persian)]. *Psychology of Exceptional Individuals*. 2020; 9(36):151-68. [\[DOI:10.22054/jpe.2020.44391.2024\]](#)
- [26] Parajuli N, Pradhan B, Bapat S. Effect of yoga on cognitive functions and anxiety among female school children with low academic performance: A randomized control trial. *Complementary Therapies in Clinical Practice*. 2022; 48:101614. [\[DOI:10.1016/j.ctcp.2022.101614\]](#) [\[PMID\]](#)
- [27] Chandrasekeran A, Rajesh SK, Srinivasan T. Effect of repetitive yogic squats with specific hand position (Thopukaranam) on selective attention and psychological states. *International Journal of Yoga*. 2014; 7(1):76-9. [\[DOI:10.4103/0973-6131.123497\]](#) [\[PMID\]](#) [\[PMCID\]](#)
- [28] Jalili Shishavan A. The effectiveness of pilates training on cognitive function, mental wellbeing, and students' hope for education. *Physical Treatments - Specific Physical Therapy Journal*. 2022; 12(3):189-198. [\[DOI:10.32598/ptj.12.3.546.1\]](#)
- [29] Jalilishishavan A. [Investigating the effectiveness of sports intervention based on intergenerational programs on happiness and mental well-being in bodybuilding athletes (Persian)]. *Organizational Behavior Management in Sport Studies*. 2022; 9(2):93-100. [\[Link\]](#)
- [30] Jois SN, D'Souza L. The effectiveness of superbrain yoga on concentration, memory and confidence in school students. *Indian Journal of Traditional Knowledge*. 2018; 17(4):741-4. [\[Link\]](#)
- [31] Janjhua Y, Chaudhary R, Sharma N, Kumar K. A study on effect of yoga on emotional regulation, self-esteem, and feelings of adolescents. *Journal of Family Medicine and Primary Care*. 2020; 9(7):3381-6. [\[DOI:10.4103/jfmpe.jfmpe_153_20\]](#) [\[PMID\]](#) [\[PMCID\]](#)
- [32] Jalili Shishavan A, Dortaj F, Sadipour E, Farrokhi N. [The mediating role of self-esteem in the relationship between social capital and academic hope in elite athlete students (Persian)]. *Journal of Research in Educational Science*. 2017; 11(36):7-40. [\[Link\]](#)
- [33] Pradhan B. Yoga in maintenance of psychophysical health. In: Pradhan B, editor. *Yoga and mindfulness based cognitive therapy*. Cham: Springer; 2015. [\[DOI:10.1007/978-3-319-09105-1_8\]](#)
- [34] Sinha S, Dubey LK, Hussain A. Yoga for specially-abled children: A therapeutic means to increase body awareness. *International Journal of Yogic, Human Movement and Sports Sciences*. 2021; 6(1):160-6. [\[Link\]](#)
- [35] Alizadeh Khanghah H, Bahram A, Shahdoost K. [Comparison of 12-week exercises of yoga, pilates and yagalates on older women functional balance with high risk of falling under dual-task conditions(Persian)]. *Motor Behavior*. 2017; 9(27):49-64. [\[DOI:10.22089/mbj.2017.971\]](#)
- [36] Patel NK, Nivethitha L, Mooventhan A. Effect of a yoga based meditation technique on emotional regulation, self-compassion and mindfulness in college students. *Explore (NY)*. 2018; 14(6):443-7. [\[DOI:10.1016/j.explore.2018.06.008\]](#) [\[PMID\]](#)
- [37] Caviola S, Colling LJ, Mammarella IC, Szűcs D. Predictors of mathematics in primary school: Magnitude comparison, verbal and spatial working memory measures. *Developmental Science*. 2020; 23(6):e12957 [\[DOI:10.1111/desc.12957\]](#) [\[PMID\]](#)