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The Comparison of the Effect of Different Core Stability Training on Lower Extremities Strength among Deaf Children

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Abstract: The aim of this study was to comparison the effect of different core stability training on lower extremities strength among deaf children.
28 deaf students (aged: 8-14 yr) selected and randomly divided into 3 groups: dynamic core stability, static core stability and control. Training continue for 8 weeks and 3 session per each week. The protocol composed of: specific training for spinal column stability, breathing maneuver with multifidus contraction, using dynamic stability in different positions accompany by extremities movements and using swiss ball. Dynamometer device was used to measures the strength of core stabilizer muscles. Dependent t (pre and post comparison in each group) and one way Anova were used to analyze data. Level of significant was 0.05 and statistical calculations were used by SPSS (version 22).
The results of this study show that dynamic and static core stability lead to significant changes in lower extremities strength ($P \leq 0.05$, t=2.2, t= 5.7, t= 4.8, t= 2.8, t= 3, t=7.4), but the differences between dynamic and static core stability training and control were not significantly ($P \geq 0.05$, f=0.74, f=1.4, f=0.13, f=0.46, f=0.18, f=0.24).
It can be concluded that dynamic and static core stability training can be a benefit method to improve lower extremities strength in deaf children and this finding leads to decreasing risk and probable injuries.

Keywords: Core stability training, lower extremities strength, Deaf

1. Introduction

Hearing is one of the most critical factors in establishing communication with others, and any disruption in this system can lead to the isolation of individuals with hearing loss or deafness from society. This separation can hinder their personality development and other aspects of growth. Deaf individuals exhibit unique motor and social behaviors, some of which are quite noticeable. These characteristics are particularly evident in coordination, movement speed, and body balance. The problems faced by hearing-impaired individuals are often considered only from a communicative perspective. Although communication issues are the most significant consequence of hearing loss, physical challenges may also accompany by hearing impairments.

In this regard, damage to sensory integration and motor development is a common deficit observed in hearing-impaired individuals. Hearing impairment is the third most prevalent chronic condition, significantly impacting an individual's health and leading to stress for both the patient and their family (1). This condition can range from mild (26-40 db) to moderate (41-55 db), severe (71-90 db), and profound hearing loss (more than 90 db) (2). The prevalence of moderate to severe hearing loss is approximately 1 to 6 per 1,000 children. Additionally, it is estimated that 440 million children worldwide experience hearing loss exceeding 85 db, and if the hearing threshold decreases to 50 db, this number rises to about 800 million (3).

In individuals with hearing impairments, the vestibular part of the cochlear system is often damaged, leading to balance problems and postural weaknesses. Postural control requires a complex interaction between the musculoskeletal and nervous systems. The neurological components essential for postural control include motor processes like neuromuscular synergies, sensory processes such as visual, vestibular, and proprioceptive systems, and higher neurological functions (4, 5). In other words, improving motor skills and maintaining postural control necessitate a mutual and complex interaction between sensory inputs and appropriate motor responses, including an efficient motor control system and adequate muscular strength (6). Since various systems, including visual, muscular, and proprioceptive receptors, influence balance and posture, focusing on each of these components can minimize problems faced by deaf individuals. One effective method to improve their postural stability and balance is strengthening the muscles in different body parts, especially the lower limbs, ultimately enhancing motor skills.

In 2005, Ulrich defined motor skills as skills involving gross motor muscles, with hands and feet playing essential roles in movement and other activities. The development of upper and lower limb motor skills is a critical aspect of psychomotor and social development in deaf children (7). In early childhood, motor skills such as pulling, crawling, walking, and eventually running develop progressively. Between one and two months of age, children begin to learn how to stand on their own without support from objects or individuals. This newfound ability allows them to explore their surroundings more effectively. However, the development of their motor skills requires improved postural control (8). Since spinal health is crucial for postural control, special attention must be paid to this component of the musculoskeletal system.

The spine is a complex structure, and despite extensive research, many questions about it remain unanswered. The spine performs seemingly contradictory functions, such as protecting the delicate spinal cord and nerve roots, providing sufficient stability, maintaining proper posture and alignment, bearing loads, and enabling movement in various directions. Functionally, the spine faces the dual demands of movement and stability. The stability of the spine, particularly the lumbar, pelvic, and hip regions—referred to as the "core"—is influenced by the interaction of various systems. If one system is compromised, other systems attempt to compensate for the imbalance to prevent spinal instability.

Given that the anatomical location of the center of gravity is within this area, core stability is highly significant. The core acts as a connection point between the upper and lower body, where body segments are linked like a chain through joints. By effectively transferring forces from the lower limbs to the upper limbs via the trunk, the core facilitates physical activities. Without adequate core stability, forces from the contraction of pelvic and shoulder girdle muscles are transmitted to the spine, placing excessive pressure on spinal structures and surrounding soft tissues (9). Additionally, the muscles of the core region influence the activation of limb muscles. Research examining physical fitness and disabilities across different age and gender groups has demonstrated a relationship between hearing impairment and physical fitness (10, 11). Studies have shown that children with sensory impairments participate less in physical activities compared to their healthy peers, have lower levels of physical fitness, and experience higher rates of obesity and overweight. This level of physical fitness is directly related to the strength and endurance of muscles in various parts of the body, especially the lower limbs (12).

Because information about the external world is an integral part of human life and plays a vital role in connecting with the world, the loss of any sensory component may reduce or limit an individual's ability to perform effectively. Research findings have shown that core stability exercises improve muscle strength, activation, and play a significant role in maintaining posture. In a study conducted by Johnson et al. (2007), the effects of Pilates exercises, which focus on strengthening trunk muscles, particularly in the lumbar and pelvic regions, were examined on the dynamic balance of healthy individuals. These exercises demonstrated significant effects on the strength and endurance of trunk muscles (13). Deaf children face challenges in personal development that may manifest in social, emotional, cognitive, speech, and motor skill issues. One critical parameter for deaf individuals, who struggle with receiving sensory inputs, is improving their capacity to resist fatigue, which is defined as physical fitness. Participation in sports activities is particularly important for deaf individuals due to its physical, psychological, and social benefits (14). Moreover, a deaf child who experiences success in physical activities or sports is more likely to adopt an active lifestyle.

Core stability exercises prevent joint injuries to the vertebrae and help maintain the normal alignment of the spinal cord, improving physical capacity in daily activities. These exercises enhance muscle strength, endurance, and coordination of spinal muscles. Since core muscles contract before limb movements to ensure better limb performance, focusing on this area is crucial (15).

The importance of muscle strength and its effects on daily activities such as walking, climbing stairs, and rising from a chair has been widely recognized by researchers. Previous studies have highlighted the role of muscle strength in improving balance, which is a primary issue for deaf individuals. In 2021, Seyedi and colleagues found a significant relationship between muscle strength (ankle plantar flexors and hip extensors) and static and dynamic balance in deaf individuals. They concluded that the proprioceptive system plays a vital role in transmitting information about body movement and position in space relative to the support surface. Proprioceptive receptors, including muscle spindles, joint receptors, skin receptors, Golgi tendon organs, and muscular receptors, are instrumental in maintaining balance (17).

These findings underscore the importance of addressing muscle strength to alleviate some challenges faced by deaf individuals. Given the significance of this issue, the present study aims to compare the effects of two types of core stability exercises on the lower limb strength of deaf students. It seeks to answer the question: Which type of core stability training has the most substantial effect on the lower limb strength of deaf students?

2. Materials and Methods

This study employed a quasi-experimental design, with measurements of the relevant variables conducted in the laboratory of the Faculty of Physical Education at the University of Sistan and Baluchestan. The statistical population consisted of elementary school-aged deaf girls students in Zahedan city. Before initiating the training protocols, a session was held to explain the research objectives to the participants. Personal information and injury history were collected, and individuals with prior injuries were excluded. Among the eligible students meeting the inclusion criteria, 28 participants were selected as the sample size using G*Power software, with an effect size of 0.84 and a confidence level of 0.95. Participants were randomly assigned into three groups: static core stability, dynamic core stability, and control (Appendix 1).

The evaluation of variables was conducted pre and post-training in the Pathology and Corrective Exercises Laboratory of the University of Sistan and Baluchestan. Participants were congenitally profoundly deaf, had no prior participation in sports, and were matched in terms of age and physical activity levels (8–14 years). Additional inclusion criteria were the absence of other disabilities (physical, mental, or neurological), no use of medication for specific diseases, no history of bone fractures or musculoskeletal surgeries, no cardiovascular diseases, no use of protein supplements, and no cochlear implants.

Participants were excluded if they encountered specific problems during the protocol or were unable to complete the exercises. The severity and depth of hearing loss were determined by an audiologist, and individuals with hearing loss greater than 61 db were selected (18). To ensure precise communication, a sign language specialist was involved throughout the study. The research was approved by the ethics committee of the University of Sistan and Baluchestan (IR.USB.REC.1398.008), and informed consent forms were completed by participants and their guardians. Participants' height, weight, and body mass index (BMI) were recorded. Real leg length was measured to normalize data and facilitate comparisons (19). The dominant leg was identified based on the participant's preferred leg for kicking (20).

Two days before the training sessions, pre-tests were conducted to evaluate the strength of static and dynamic core stabilizing muscles. Results were recorded as baseline data. Participants warmed up for 5 minutes, including light jogging and stretching exercises. Following the warm-up, they performed the tests with a 15-minute rest period between trials. Two days after the pre-tests, experimental groups began 8 weeks of core stability training. The control group was instructed to maintain their normal daily routines and refrain from any organized sports activities. The static core stability group trained from 9:00 to 10:00 AM, and the dynamic core stability group trained from 10:00 to 11:00 AM under the researcher’s supervision. Two days after the training sessions concluded, the same tests conducted during the pre-tests were administered, and the results were recorded as post-test data.

Leg Length Measurement

Real leg length was measured from the anterior superior iliac spine (ASIS) to the medial malleolus. The participant was placed in a supine position with knees extended and feet spaced 15 cm apart. The measurement was repeated three times on the dominant leg, and the average value was recorded as the leg length index. Participants were provided with detailed instructions and practiced the test six times to ensure correct execution.

Core Strength Testing

A hand-held dynamometer (SPF brand, made in China) was used to measure isometric strength in kilograms. The results were normalized to participants' body weight percentage (21). To ensure consistency and minimize variability caused by the examiner's hand strength, stabilizing straps were used to provide resistance at the required positions. These modifications reduced variability and improved the clinical utility of the hand-held dynamometer (22).

Measurement of Hip External and Internal Rotation Strength

Participants lay prone on a table and were instructed to bend one knee to 90 degrees. The hip joint was stabilized using a strap, and the dynamometer was placed 5 cm above the medial malleolus. Participants were asked to actively perform hip external rotation. Each test was repeated three times, with a 15-second rest between repetitions. The maximum isometric contraction strength across the three repetitions, measured in kilograms, was recorded. The hip internal rotation test was conducted in reverse (23). Strength measurements for both the dominant and non-dominant hips were taken randomly, with a 5-minute rest interval between tests (Figure 1).

Measurement of Hip Flexion and Extension Isometric Strength

Participants lay on their side on a table, with their dominant leg positioned on top for evaluation. A strap was used to stabilize the pelvis on the examination table, and an additional towel was placed between the participant's thighs. Participants were instructed to position the test leg at 0 degrees of flexion. A second strap secured the dynamometer to the wall, positioned 5 cm above the lateral knee joint. Participants were instructed to keep their toes pointed forward and avoid bending their knee while performing maximal hip flexion. The maximum isometric flexion strength was recorded in three repetitions, measured in kilograms, and the participant's position was then switched to test the other side.

For hip extension, the participant faced the dynamometer and performed maximal hip extension by moving the leg backward (22). Measurements were taken similarly, with strength values recorded for both dominant and non-dominant hips in a randomized order. A 5-minute rest interval was provided between tests (Figure 2).

Figure 1: Hip External and Internal Rotation Strength Test

Figure 2: Hip Flexion and Extension Strength Test

Measurement of Isometric strength in Hip Abduction and Adduction

The subject lay supine on the examination table, with the dominant limb extended and resting on the table, while the non-dominant limb was bent at the knee. A strap was placed around the pelvis to stabilize it on the examination table. The subject was instructed to position the test limb at zero degrees of abduction. Another strap was used to secure the handheld dynamometer, fixed to the wall, 5 cm above the external part of the knee joint. The subject was instructed to keep their toes pointed forward, avoid knee flexion or external hip rotation, and perform maximum effort abduction. The maximum isometric strength of hip abduction was recorded in three trials, expressed in kilograms (22). Hip adduction was assessed similarly, involving the opposite movement. Hip abduction and adduction strengths were measured randomly, with a 5-minute rest interval between tests.

Core Stability Training Program

The participants underwent an 8-week core stability training program (three sessions per week) from 9:00 to 11:00 AM in the school's training hall. Each session lasted 60 minutes, including a 5-minute warm-up, 50 minutes of core stability exercises, and a 5-minute cool-down. The exercises in the protocol were designed to target spinal stabilizers. They started with abdominal hollowing maneuvers coupled with multifidus muscle activation. Once stability was achieved, dynamic stability was introduced in various positions, progressing to dynamic elements (e.g., limb movements, using Swiss balls) in later stages.

The training was based on Jeffrey's (2002) proposed core stability program, consisting of three levels:

- Level 1: Static contractions in a fixed position, progressing to slow movements in a stable environment.
- Level 2: Static contractions in an unstable environment, progressing to dynamic movements in a more stable environment.
- Level 3: Dynamic movements in an unstable environment, progressing to resistance movements in an unstable environment.

The exercises utilized the participant's body weight and Swiss balls (24). Levels 1 and 2 were performed by the static core stability group, while Level 3 exercises were assigned to the dynamic core stability group (Table 1).

Table 1: Core Stability Training Program

level	Training program
1	Plank with one leg lift (10-15 reps per leg) Shoulder and head on the ground with lifting the hips (10-15 reps per leg) Wall squat (3 sets, 12 reps per set)
2	Plank on back with leg extended, dragging the sole of the foot on the ground (15-10 reps per leg) Shoulders and head on the ground with lifting the hips and one leg (2 sets, 12-10 reps) Side bridge (2 reps per side, 30-20 second hold)
3	Squats with a Swiss ball placed between the wall and shoulders (3 sets, 15 reps per set) Lunges on a 45-degree angle to the left and right Plank lying on a Swiss ball with the soles of the feet on the ground and the back on the Swiss ball Lying supine on a Swiss ball, performing a plank with one leg lifted Simultaneous lifting of opposite hand and foot in a squat position Bridge with feet on a Swiss ball and lifting one leg

Data Analysis

Descriptive statistics were used to describe the data for each group (age, height, leg length, weight, and body mass index), including measures of central tendency (mean and standard deviation). Kolmogorov-Smirnov test was used to assess the data distribution, and Levene's test was used to check for homogeneity of variances. Comparison of results for each parameter was performed using a one-way ANOVA at a significance level of 0.05, and paired t-tests were used to compare pre- and post-intervention data for each group. Statistical calculations were carried out using SPSS version 27.

3. Results

The demographic information of participants presented in Table 2.

Table 2: demographic information of subjects (n = 28)

Group / Variable	control	Dynamic core stability	Static core stability
Age(yr)	11±2	10.7±1.8	11±2.2
Height (cm)	141.8±8.43	132.7±15.56	137.5±13.09
Weight (kg)	34.1±4.61	34.6±7.39	35.1±8.46
BMI (kg/m2)	17.2±1.89	19.8±4.51	18.5±3.81

Information on Lower Limb Strength of Participants in Pre and Post-Test Stages presented in Table 3.

Table 3: Lower Limb Strength, Participants in Pre-Test and Post-Test Stages (Mean ± Standard Deviation)

Variable(body weight percent)	phase	control	Dynamic core stability training	Static core stability training
Hip extension strength	pre	16.04±3.88	4.12±14.42	4.02±15.57
	post	3.84±15.81	4.73±16.5	5.17±18.39
Hip flexion strength	pre	4.44±17.28	4.34±20.33	6.31±20.48
	post	4.41±17.18	5.40±21.09	7.08±21.58
Hip external rotation strength	pre	2.23±15.21	3.48±14.57	3.58±14.59
	post	2.29±15.04	3.94±15.05	4.87±15.85
Hip internal rotation strength	pre	3.31±15.38	2.98±11.99	3.18±12.68
	post	3.26±15.33	2.56±15.10	3.96±13.95
Hip abduction strength	pre	7.11±21.23	2.28±20.58	5±20.32
	post	7.09±21.19	5.28±22.77	5.64±22.61
Hip adduction strength	pre	0.28±12.86	3.55±12.54	2.71±12.37
	post	0/17±12.7	2.76±13.62	3.67±13.19

Table 4: Paired t-Test Results for Comparing Means of Strength in Pre- and Post-Test in the Static Core Stability Group

Variable(body weight percent)	phase	X±SD	mean difference	t	Sig.
Hip extension strength	pre	15.04±4	-2.63	-4.87	0.001
	post	5.1±18.3			
Hip flexion strength	pre	6.3±20.4	-1.09	2.80	0.02
	post	7±21.5			
Hip external rotation strength	pre	3.5±14.5	-1.25	-1.90	0.08
	post	4.8±15.8			
Hip internal rotation strength	pre	3.1±12.6	-1.26	-3.04	0.001
	post	3.9±13.9			
Hip abduction strength	pre	5±20.3	-2.28	-7.45	0.001
	post	5.6±22.6			
Hip adduction strength	pre	2.7±12.3	-0.82	-1.87	0.009
	post	3/6±13.1			

According to Table 4, a significant difference was observed in most variables of the study ($p \geq 0.05$), except for the variables "external hip rotation" and "hip adduction," where no statistically significant difference was found between pre-test and post-test in the static core stability group ($p < 0.05$).

Table 5: Results of the paired t-test for comparing the mean strength in pre- and post-tests in the dynamic core stability group

Variable(body weight percent)	phase	X±SD	mean difference	t	Sig.
Hip extension strength	pre	14.4±4.1	-2.14	-2.29	0.004
	post	4.7±16.5			
Hip flexion strength	pre	4.3±20.3	-0.76	-0.69	0.50
	post	5.4±21			
Hip external rotation strength	pre	3.4±14.5	-0.48	-0.42	0.67
	post	3.9±15			
Hip internal rotation strength	pre	2.9±11.9	-3.10	-5.72	0.00
	post	2.5±15.1			
Hip abduction strength	pre	5.2±20.5	-2.18	-3.29	0.09
	post	22.7±5.2			
Hip adduction strength	pre	3.5±12.4	-1.16	-1.76	0.11
	post	2.7±13.6			

Based on the paired t-test results (Table 5), there was no significant difference in the strength variables of flexion, external rotation, internal rotation, abduction, and adduction of the dominant hip between pre- and post-tests in the dynamic core stability group ($p \geq 0.05$). However, other within-group comparisons showed significant differences $p \leq 0.05$).

The results of the Levene's test (equality of variances) related to the strength of lower limb variables are provided in Table 6.

Table 6: Results of Levene's Test (Equality of Variances)

Variable(body weight percent)	group	X±SD	f	Sig.
Hip extension strength	Dynamic core stability training	16.5±4.73	1.31	0.28
	static core stability training	18.39±5.17		
	control	3.84±15.81		
Hip flexion strength	Dynamic core stability training	5.04±21.09	1.70	0.20
	static core stability training	21.58±7.08		
	control	4.41±17.18		
Hip external rotation strength	Dynamic core stability training	7.08±21.58	3.63	0.04
	static core stability training	17.18±4.41		
	control	3.94±15.04		
Hip internal rotation strength	Dynamic core stability training	2.56±15.10	1.51	0.24
	static core stability training	13.95±3.96		
	control	3.26±15.33		
Hip abduction strength	Dynamic core stability training	5.28±22.77	0.96	0.04
	static core stability training	22.61±5.64		
	control	21.19±7.09		
Hip adduction strength	Dynamic core stability training	2.76±13.62	0.53	0.59
	static core stability training	3.67±13.19		
	control	3.19±17.82		

Table 7: comparing the components of strength among groups (post test)

Variable(body weight percent)	group	X±SD	f	Sig.
Hip extension strength	Dynamic core stability training	16.5±4.73	0.774	0.448
	static core stability training	18.39±5.17		
	control	3.84±15.81		
Hip flexion strength	Dynamic core stability training	5.04±21.09	1.46	0.25
	static core stability training	21.58±7.08		
	control	4.41±17.18		
Hip external rotation strength	Dynamic core stability training	7.08±21.58	0.13	0.87
	static core stability training	17.18±4.41		
	control	3.94±15.04		
Hip internal rotation strength	Dynamic core stability training	2.56±15.10	0.63	0.46
	static core stability training	13.95±3.96		
	control	3.26±15.33		
Hip abduction strength	Dynamic core stability training	5.28±22.77	0.83	0.18
	static core stability training	22.61±5.64		
	control	21.19±7.09		
Hip adduction strength	Dynamic core stability training	2.76±13.62	0.324	0.078
	static core stability training	3.67±13.19		
	control	3.19±17.82		

4. Discussion and Conclusion

According to the results of this study, dynamic core stability training significantly increased the strength of hip extension and internal rotation in the dominant hip of deaf students. Additionally, static core stability exercises significantly improved the strength of lower limbs in terms of hip extension, flexion, internal rotation, and abduction. This study supports the hypothesis that physical activity can largely prevent the decline in muscle mass and, consequently, strength in deaf students. Therefore, adequate physical activity programs for at-risk groups are essential. In a study conducted by Johnson et al. (2007), the effects of Pilates exercises, which focus on strengthening core muscles, particularly the lumbar and pelvic regions, were examined. These exercises demonstrated a significant impact on the strength and endurance of core muscles (13). However, in the present study, dynamic core stability training did not show significant improvements in the strength of flexion, external rotation, abduction, and adduction of the dominant hip. Similarly, static core stability exercises did not lead to a statistically significant increase in the strength of external rotation and adduction of the dominant hip.

It is important to note that no significant differences were found in the strength of lower limbs between dynamic and static core stability training and control groups in deaf students. Current evidence suggests that a lack of adequate central body stability can create a risk for injuries. Therefore, appropriate training can help reduce such risks. Moreover, it is crucial to control movements using core muscles to manage the stability required against loads placed on the lower limbs, preventing overloading injuries. Additionally, static and dynamic core stability exercises play a vital role in enhancing physical capacity to maintain the natural state of lower limbs during daily activities, improving endurance and coordination of core stability muscles. Strengthening the core leads to better functional integration of the body.

If there is insufficient stability in the central region, forces from the contraction of pelvic and shoulder girdle muscles can be transferred to the spine, leading to undue stress on the spinal structures and surrounding soft tissues (25). Furthermore, central muscles affect the activation of limb muscles. Any weakness in these muscles can delay limb activation and contribute to various injuries (26). Given the clear relationship between core muscle activity and lower limb movements, core stability offers numerous benefits for the musculoskeletal system, ranging from maintaining spinal health to preventing knee injuries. Therefore, proper core preparedness can prevent injuries and enhance performance. However, due to the limited studies conducted in this area, definitive results cannot yet be matched.

Discussion and Analysis of Results on Two Types of Core Stability Training and Dynamic Lower Limb strength

Core strength can be defined in its traditional sense as the maximum force a muscle or muscle group can generate at a given speed. When core strength is considered, it refers to the muscle contractions responsible for stabilizing the spine and maintaining postural control. Central strength is essential for maintaining stability, as it is through the coordinated activation of surrounding muscles that spinal stability is achieved. Therefore, central strength plays a critical role in ensuring effective control of spine stability. In unpredictable situations such as sudden falls or abrupt loads on the spine, and during rapid movements, central strength becomes essential. Studies, such as the research conducted by Pourkiani et al. (2014), have explored the relationship between core stability and dynamic movements. They found that bodybuilders exhibited significantly lower flexor stability times compared to non-athletes, highlighting how core strength and flexibility can influence injury risk. Additionally, poor core stability has been associated with increased susceptibility to injuries, which underscores the importance of maintaining strong and stable core muscles (27). In the context of deaf students, no significant differences were observed between dynamic and static core stability training and control groups regarding the strength of lower limbs. This finding aligns with current evidence indicating that reduced central stability can predispose individuals to injury. Adequate core training can mitigate these risks by controlling the forces acting on the lower limbs, thus reducing the likelihood of injury due to excessive loads. Core stability influences not only spinal health but also the activation and coordination of limb muscles. Weakness in core muscles can delay the activation of lower limb muscles, increasing the risk of various injuries. As demonstrated in existing research, particularly by Johnson et al. (2007), core stability exercises improve muscular endurance and stability, which are crucial for preventing injuries and enhancing overall functional performance. In summary, while the present study provides insights into the importance of both dynamic and static core stability training, more research is needed to solidify these findings, particularly for specific populations like deaf students. The integration of effective core stability programs can lead to improved musculoskeletal health, injury prevention, and better functional outcomes.

Based on the results of the study, both dynamic and static core stability exercises demonstrated an increase in the strength of lower limb variables among participants. Given the importance of physical activity for the hearing impaired and the role of muscle strength in daily activities, it is essential for sports professionals and those working with the hearing impaired to pay close attention to the planning and implementation of such protocols to improve their overall quality of life and reduce risks associated with imbalance and muscle weakness.

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مقایسه اثردو نوع تمرین ثبات مرکزی بر قدرت اندام تحتانی دانش آموزان ناشنوا

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چکیده: هدف از پژوهش حاضر، مقایسه اثر دو نوع تمرین ثبات مرکزی بر قدرت اندام تحتانی دانش آموزان ناشنوا بود. ۲۸ دانش آموز ناشنوا با دامنه سنی ۱۴-۸ سال، به صورت هدفمند انتخاب و در سه گروه (تمرین ثبات مرکزی پویا، تمرین ثبات مرکزی ایستا و کنترل) به صورت تصادفی قرار داده شدند. تمرینات به مدت ۸ هفته و هر هفته ۳ جلسه انجام شد. پروتکل اجرا شده شامل: تمرینات اختصاصی ثبات دهنده ستون فقرات، مانور تو دادن شکم همراه با انقباض عضله مولتی فیدوس و سپس با حفظ مانور ثبات دهنده مذکور، استفاده از ثبات دینامیک به دست آمده در وضعیت های مختلف و همچنین اضافه نمودن اجزاء دینامیک به آن(حرکت اندام، استفاده از توپ سوئیسی) در مراحل بعدی بوده است. از دستگاه دینامومتر جهت اندازه گیری قدرت عضلات ثبات دهنده مرکزی استفاده شد. جهت تحلیل داده ها از آزمون تی وابسته (مقایسات قبل و بعد در هر گروه) و تحلیل واریانس یکطرفه در سطح معناداری ۰/۰۵ استفاده شد. محاسبات آماری با استفاده از نرم افزار SPSS (نسخه ۲۷) انجام شد. براساس نتایج تحقیق، تمرینات ثبات مرکزی پویا و ایستا تغییرات معناداری را در اکثر متغیرهای قدرت اندام تحتانی آزمودنیها(قدرت اکستنشن، فلکشن، چرخش داخلی و آبداکشن هیپ برتر) نشان داد(P≤۰/۰۵، t=۲/۲، t=۵/۷، t=۴/۸، t=۲/۸، t=۳، t=۷/۴) اما تفاوت معناداری از لحاظ آماری در بین تمرینات ثبات دهنده مرکزی پویا، ایستا و کنترل بر قدرت اندام تحتانی آزمودنیها مشاهده نشد(P>۰/۰۵، f=۰/۷۴، f=۱/۴، f=۰/۱۳، f=۰/۴۶، f=۰/۱۸، f=۰/۲۴). با توجه به نتایج این تحقیق به نظر می رسد که دانش آموزان ناشنوا با تمرینات ثبات مرکزی ایستا و پویا به صورت هفته ای سه جلسه، می تواند از عملکرد بهتر قدرت که ضروریات انجام فعالیت های روزانه است، بهره مند شوند و می توان انتظار داشت که این تغییرات بتوانند میزان خطرات و آسیب های احتمالی را به حداقل برسانند.

واژه‌های کلیدی: تمرین ثبات مرکزی، قدرت اندام تحتانی، ناشنوا

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