Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

Basic Body Awareness Therapy in Schizophrenia: A Case Study

Farha naz[1],Dr.Pinky dutta[2] , Dr. Shwetha sasidharan[3]

[1]Department of physiotherapy, school of health science, PG student at Gardencity university, India, Bengaluru

[2] Professor & Head of Department of Physiotherapy, School of health Science and research co-ordinator ,Garden City University, Bengaluru, India.

[3]Professor , Department of Physiotherapy, School of health Science and research co-ordinator ,Garden City University, Bengaluru, India.

(Received: 16 February 2026 Revised: 25 March 2026 Accepted: 10 April 2026)

KEYWORDS

Basic Body Awareness Therapy;

Schizophrenia;

Physiotherapy;

Body Awareness;

Movement Quality;

Mind–Body Therapy;

Mental Health Rehabilitation

ABSTRACT:

Introduction: Schizophrenia is a chronic psychiatric disorder commonly characterized by a lack of physical activity, motor coordination, postural deviations, and lack of body awareness. These functional and physical impairments adversely affect everyday life and quality of life. Complementary to both pharmacological and psychological management, movement-oriented intervention consisting of physiotherapy can also offer substantial value.

Objectives: To study the outcome of Basic Body Awareness Therapy (BBAT) regarding postural control, movement quality, coordination of breathing, and body awareness of a chronic schizophrenic patient.

.**Methods:** This study is a single-subject case study design including a 47-year-old female diagnosed with Schizophrenia. Conducted for period of 2 weeks, involved mindful movement, postural and breathing alignment, balance, coordination and relational movement exercises. Outcome had measured using the Body Awareness Rating Scale (BARS) before and after the intervention.

Results: The intervention focused on mindful movement, postural alignment, awareness of breathing, balance, coordination, grounding, and relational in movement. After intervention results showed that there was an improvement in postural stability, balance, coordination, breathing synchrony, grounding, and the overall quality of movement and body awareness and functional involvement.

Conclusions: The results suggest that Basic Body Awareness Therapy can be a safe and effective complementary treatment in rehabilitation of chronic schizophrenic patients. Leading to a body-mind integration via conscious movement, BBAT could enhance physical functioning, self-awareness and psychosocial functioning. The evidence base should be strengthened by conducting further research on larger samples and with extensive follow-up.

1. Introduction

Schizophrenia is a severe and long-lasting mental illness characterized by cognitive, perception, mood and behavioral abnormality and, often, social and occupation impairment as well. In addition to psychiatric manifestations, schizophrenia has been linked to severe physical, functional, and psychosocial impairment which has significant impact on quality of life.[1]

Schizophrenia is a psychiatric concern and also a condition with pronounced physical, functional, and psychosocial variations. Moreover, antipsychotic medications, including weight gain, metabolic syndrome, extrapyramidal symptoms (EPS), and dyskinesia, may further deteriorate mobility and physical health in people with schizophrenia.(2)(3)

Schizophrenia causes functional and physical health deterioration due to a combination of factors, including sedentary behavior and negative symptoms, social withdrawal, lack of self-care and exercise motivation, motor side effects of medications, impaired proprioception, and postural adaptations due to long term inactivity. .(3)

Schizophrenia is a psychotic disorder, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) classifies it as a psychotic disorder, and its prevalence measures about 1% of the world population. It generally begins during late adolescence or early adulthood and the life expectancy of those with schizophrenia is approximately 1520 years lower than the general population.[4]

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

Basic Body Awareness Therapy (BBAT) is a physiotherapy method focusing on quality of movement and involvement of physical, emotional and cognitive awareness. Through conscious movement, BBAT seeks to improve body awareness, postural stability, breathing, and mental presence, by working with the entire person. The method offers people an understanding of habitual movement patterns and encourages adaptive and intentional movement strategies that can be used in everyday life[8]

The practice of the BBAT is organized on the basis of three basic elements of movement: postural stability, free and coordinated breathing and mental awareness. These factors are regarded as the necessary preconditions to alter stereotyped or limiting patterns of movement. Therapeutic movements are based on the daily activities, which include lying, sitting, standing, turning, changing weight, walking, and interrelation processes. Practices are done slowly and consciously with a person given enough time to feel subtle body sensations and become aware through repetition and experience learning. [9], [10]

2. Objectives:

The objective of this study is to examine the effectiveness of Basic Body Awareness Therapy (BBAT) in improving physical and functional impairments in a patient with chronic schizophrenia. The study primarily aims to understand how BBAT influences postural control, movement quality, breathing coordination, and overall body awareness. It also seeks to observe changes in the patient's ability to maintain balance, coordinate movements, and perform everyday functional activities with greater ease and confidence. In addition, the study focuses on evaluating improvements in the patient's awareness of body positioning, grounding, and connection between mind and body following the intervention. By comparing the scores obtained before and after the intervention using the Body Awareness Rating Scale (BARS), the study attempts to identify measurable changes brought about by the therapy. Furthermore, it aims to explore the broader impact of BBAT on enhancing functional independence, motivation, and psychosocial engagement, thereby highlighting its potential role as a supportive treatment approach in the rehabilitation of individuals with schizophrenia.

3. Methods

CASE REPORT

1. Patient Information

A 47-year-old female, the fourth daughter in her family, belonging to an upper middle socioeconomic background (as per the Kuppuswamy scale), was initially diagnosed with bipolar disorder and subsequently diagnosed with chronic schizophrenia 15 years ago. According to family reports, behavioural changes emerged during adolescence but were initially overlooked. Over time, symptoms progressed to include irritability, antisocial behaviour, and episodes of violence, leading to multiple hospitalizations and outpatient consultations across various psychiatric centre's in Karnataka.

- **Name: Mrs. XYZ**
- **Age / DOB:** 47 years
- **Gender: Female**
- **Marital Status:** married
- **Educational Level: pre university(12th pass).**

2. Chief Complaints

The patient reported persistent fatigue, reduced energy levels, poor motivation for physical and daily activities, social withdrawal, reluctance to go outdoors, disturbed sleep without medication, reduced appetite, and occasional generalized body pain.

3.History of present Illness:

The patient had been diagnosed with schizophrenia approximately 20 years ago and had received treatment at multiple psychiatric hospitals, including NIMHANS, Abhaya, Manipal, and Manasa Hospital. She exhibited markedly reduced motivation, spent most of the day indoors, and lacked engagement in regular physical activity. Psychotic symptoms such as hallucinations and mood fluctuations were reported when medication adherence was inconsistent.

4. Past History

The patient underwent surgical fixation for a fracture of the tibial shaft 10 years prior. A gradual weight loss from 62 kg to 50 kg was reported over the past five years. There was no history of hypertension, diabetes mellitus, tuberculosis, asthma, or other major systemic illnesses.

5. Family History:

The patient resided with her husband and two children in an urban rented residence. She was dependent on family members for several activities of daily living, including eating. She reported no close friendships and significant social isolation. A family history revealed that the patient's grandmother exhibited symptoms suggestive of bipolar disorder with hallucinations but remained untreated.no history of any complicated trauma, drug dependency, physical or psychiatric illness of mother during pregnancy.

6. Occupational history

Formal education began at five years of age and discontinued at 17 years. No learning difficulties or school phobia were reported. The patient was employed briefly for six months

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

after marriage but discontinued work due to illness and had since remained a homemaker for approximately 20 years.

7. Personal history

. Lifestyle history revealed a sedentary routine, absence of structured exercise, poor sleep (3–4 hours per night without medication), no history of smoking, and reduced dietary intake (one to two meals per day).

8. Medical history

At the time of assessment, the patient was receiving Sizopin 100 mg, Riscure, and Spenzo 40 mg, prescribed by Abhaya Psychiatric Hospital, Bengaluru. Sedation and daytime drowsiness were reported as side effects.

9. General Observation

- **Appearance:** poor Grooming, hygiene, clothing.
- **Posture:** Slouched while sitting
- **Facial Expression:** poor eye contact, agitation (restlessness).
- **Built :** mesomorph.

10. Cardiopulmonary Assessment

The patient demonstrated a shallow breathing pattern, likely attributable to physical inactivity.

METHODOLOGY:

1. Patient is diagnosed with schizophrenia by the psychiatric hospital
2. The patient will be evaluated pre and post the intervention of basic body awareness therapy with basic body awareness scale.
3. Basic body awareness rating scale : Movement quality assessed by the Body Awareness Rating Scale (BARS) is used as an indicator of self-efficacy in patients musculoskeletal and mental health conditions such as patients with chronic schizophrenia.
4. The duration of the treatment in the study will be 2 weeks

Table 1: basic body awareness scale assessment pre intervention.

Category	Item	Description / Observation Focus	Score (0–4)
1. Postural Control	Standing posture	Alignment, stability, relation to ground, presence	2
	Sitting posture	Upright sitting, balance, relaxation, contact with ground	2
	Lying posture	Symmetry, contact with surface, relaxation	3
2. Dynamic Movements	Transitions (e.g., sit ↔ stand, lying ↔ sitting)	Smoothness, flow, control during change of position	2
	Walking / Gait	Rhythm, balance, coordination, breathing during gait	3
3. Movement Quality	Balance / Stability	Ability to maintain equilibrium, weight transfer	2
	Coordination	Integration of body parts in movement	3
	Breathing pattern	Naturalness, synchrony with movement, absence of restriction	3
	Flow & Rhythm	Continuity, smooth transitions, absence of rigidity	2
4. Awareness & Presence	Grounding	Contact with floor/earth, stability, sense of support	2
	Centering	Awareness of midline, weight distribution, orientation	3
	Relational aspect	Contact with therapist/others, presence in space, openness	3

PROTOCOL FOR BASIC BODY AWARENESS THERAPY

1. Frequency: 2 to 3 times per week.
2. Intensity: exercises with low-moderate intensity will be performed
3. EXERCISES

A.Postural awareness exercise:

I. Standing : Wall alignment exercise and pelvic tilt[15,16](figure 1) and (figure 2)

II. Sitting: sitting in a chair with support with correct posture[17](figure 3)

III. Lying: pelvic tilt and bridging with posture control.[16](figure 4)

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

B . Breathing awareness:

I. Diaphragmatic breathing in supine and sitting[21](figure 5)

II. Breathing with movement [22](figure 6)

C . Dynamic movement awareness exercise:

I. Everyday movements : rising from chair(figure 7) , walking and reaching exercise(figure 8) (performed slowly, consciously with attention)[23,24]

D . Movement quality exercise:

I. Balance: heel raises(figure 9),single leg stance (figure 10) weight shifting(figure 11).[25,26]

II. Co-ordination: cross pattern arm leg movements(figure 12), diagonal arm movements(figure 13).[28,29,30]

E . Awareness and presence:

I. **Grounding Exercises: (**Feet connection with floor) : heel toe rocking exercise[31]

II. **Reflection and relational aspect :** Relaxation in lying or sitting, Verbal sharing of bodily experiences, emotions, and awareness, encouragement of transfer to daily life

INTERVENTION:

The patient was subjected to a two-week body awareness Therapy (BBAT) program to enhance body awareness, postural control, quality of movement and grounding.

Exercises during the intervening two weeks were adjusted to the capability of the patient. Every session included learning to focus on weight distribution, posture alignment, being present with movements that are executed with mindfulness and conscious attention to breathing. The aim of the intervention was to enhance physical and psychological health to enable better functional and self-conscious movement in everyday life.

fig 3.sitting in a chair with support

fig 4.pelvic tilt in lying

fig 5.Diaphragmatic breathing

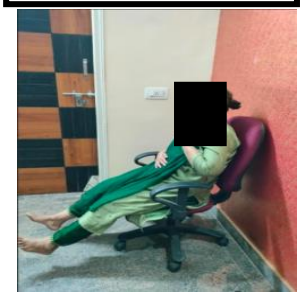

fig 6.Breathing with movement

fig 7.rising from chair

fig 8.reaching exercise

fig1.Wall alignment exercise

fig 2.pelvic tilt

fig 3.sitting in a chair with support

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

fig 9. heel raises

fig 10.single leg stance

fig 11. weight shifting

fig 12. cross pattern arm leg movements

fig 13.diagonal arm movements

4. Results

The result of this case study indicates that the patient showed significant noticeable improvement after following the two-week Basic Body Awareness Therapy (BBAT) program. On comparing the pre- and post-intervention scores using the Body Awareness Rating Scale, there was a clear positive shift across most domains . Postural control improved, as the patient demonstrated better alignment and stability in standing, sitting, and lying positions, with reduced slouching and improved contact with the support surface. Movement-related aspects such as balance and coordination also showed progress, with the patient performing transitions and simple functional movements more smoothly and with greater control. Breathing patterns became more natural and better synchronized with movement, reflecting a reduction in shallow and irregular breathing observed initially.

In addition, the quality of movement appeared smooth with less rigidity and improved rhythm during activities of daily living. The patient also showed enhanced grounding and awareness, which indicate a better sense of body positioning and connection with the environment. Interaction and responsiveness during sessions improved as well, which showed a positive change in relational and psychosocial aspects. Overall, the reduction in BARS scores across categories reflects an improvement in body awareness, movement efficiency, and functional ability. These changes, although observed over a short duration, suggest that even a brief, structured BBAT intervention can bring meaningful improvements in both physical and psychological domains in individuals with chronic schizophrenia.

5. Discussion

The case study illustrates how Basic Body Awareness Therapy (BBAT) has a positive effect on enhancing the postural control, quality of movement, balance, coordination, and over all awareness of the body in patients with chronic schizophrenia. The intervention brought about apparent change in the Body Awareness Rating Scale (BARS) scores especially in areas of stability in posture, breathing synchronization and relational awareness. Poor motor coordination, loss of proprioceptive control and slowing of the psychomotor functions are usually associated with schizophrenia, leading to impairment of functions and low quality of life. The specifics of the patient that included poor eye contact, slouched posture ,shallow breathing, fatigue, and loss of motivation were characteristic. All these physical and behavioral symptoms indicate the lack of contact with the body and mind, which is frequently mentioned in persistent psychotic conditions .The guided sessions of the BBAT offered the patient with a chance to re-experience the sensations in his body by mindful, slow and conscious exploration of his movements, which enhanced his postural awareness and motivation. The results of the study are consistent with the results of the studies by Hedlund et al. (2019) and Dragesund and Raheim (2008), who indicated that BBAT improves self-awareness, balance, and psychosomatic integration among patients with chronic mental illnesses. In addition, the fact that the flow of movement and breathing has been enhanced in this case is in line with the prior studies that reveal that mind-body interventions like BBAT, yoga, and Tai

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

Chi have a positive effect on sensorimotor regulation, emotional control, and self-efficacy in schizophrenic patients .Breathing exercises and grounding exercises were likely why the restlessness was reduced and the postural stability was enhanced, as they fostered a feeling of calmness and integrity of the mind and body. Psychophysiological explanation of these improvements could be given by the fact that body mind feedback loops are activated. Autonomic nervous system balance, amplification of parasympathetic response and decreased muscular tension are modulated by slow, rhythmic, and conscious movements. The repetition and guided thought probably allowed the patient to gain a much higher sense of bodily coherence and stability, which led to the improved ability to maintain movement and functional confidence. Relational nature of BBAT, in which the focus is on the therapist-patient interaction and reflective sharing, could have also improved the interpersonal awareness and trust, which are usually being compromised in schizophrenia. The other thing that is brought out in this case is the need to incorporate physiotherapy and movement-based awareness programs in the multidisciplinary management of schizophrenia. BBAT may be used as supplement to a psychotherapy to treat physical inactivity, poor postures ,and lack of motivation that usually follow the disorder. The fact that the given practice of mindful movement produced actual change in both functional and psychological aspects, despite the low-intensity level, indicates that mindful, consistent, and focused movement practice can have a significant effect on the situation as well. The results of the enhanced score of the basic body awareness rating scale are encouraging and contribute to the therapeutic efficacy of the use of BBAT that helps to improve bodily integration and self-perception of schizophrenic patients. The method is easy, non-dangerous and can be integrated within both the clinical and community based mental health programs.

Table 2: post intervention Basic body awareness assessment.

Category	Item	Description / Observation Focus	Score (0–4)
1. Postural Control	Standing posture	Alignment, stability, relation to ground, presence	1
	Sitting posture	Upright sitting, balance, relaxation, contact with ground	1
	Lying posture	Symmetry, contact with surface, relaxation	2
2. Dynamic Movements	Transitions (e.g., sit ↔ stand, lying ↔ sitting)	Smoothness, flow, control during change of position	2
	Walking / Gait	Rhythm, balance, coordination, breathing during gait	2
3. Movement Quality	Balance / Stability	Ability to maintain equilibrium, weight transfer	1
	Coordination	Integration of body parts in movement	2
	Breathing pattern	Naturalness, synchrony with movement, absence of restriction	2
	Flow & Rhythm	Continuity, smooth transitions, absence of rigidity	2
4. Awareness & Presence	Grounding	Contact with floor/earth, stability, sense of support	1
	Centering	Awareness of midline, weight distribution, orientation	2
	Relational aspect	Contact with therapist/others, presence in space, openness	1

References

1. Modestin J, Huber A, Satirli E, Malti T, Hell D. Long-term course of schizophrenic illness: Bleuler's study reconsidered. **Am J Psychiatry**. 2003 Dec 1;160:2202–2208.

2. Schuch FB, Vancampfort D. Physical activity, exercise, and mental disorders: it is time to move on. **Trends Psychiatry Psychother**. 2021 Jul-Sep;43:177–184. doi:10.47626/2237-6089-2021-0237

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

3. González F, Montoya O, Rosenbaum S. Exercise and schizophrenia. **Curr Top BehavNeurosci**. 2024;67:367–379. doi:10.1007/7854_2024_505

4. Tandon R, Gaebel W, Barch DM, Bustillo J, Gur RE, Heckers S, Malaspina D, Owen MJ, Schultz S, Tsuang M, Van Os J, Carpenter W. Definition and description of schizophrenia in the DSM-5. **Schizophr Res**. 2013 Oct;150:3–10. doi:10.1016/j.schres.2013.05.028

5. Vancampfort D, Probst M, Scheewe T, Knapen J, De Hert M. Physical activity in patients with schizophrenia: a systematic review. **Schizophr Res**. 2012;138:251–258. doi:10.1016/j.schres.2012.03.020

6. Soundy A, Wampers M, Probst M, De Hert M, Stubbs B, Vancampfort D. The benefits of physical activity for people with schizophrenia: a systematic review and meta-analysis. **Psychiatry Res**. 2015;229:329–339. doi:10.1016/j.psychres.2015.07.075

7. Sherrington C, Tiedemann A. Physiotherapy in mental health and psychiatry: a scientific and clinical based approach. Amsterdam: Elsevier Health Sciences; 2015.

8. Gyllensten AL. Basic body awareness therapy: assessment, treatment and movement dialogue [dissertation]. Lund: Lund University; 2001. Available from: https://lup.lub.lu.se

9. Gyllensten AL, Hansson L, Ekdahl C. Patient experiences of basic body awareness therapy and the relation to movement quality. **J BodywMovTher**. 2003;7:151–160. doi:10.1016/S1360-8592(02)00073-6

10. Roxendal G. Body awareness therapy and the body awareness scale: treatment and evaluation in psychiatric physiotherapy. Gothenburg: University of Gothenburg; 1985.

11. Skjaerven LH, Kristoffersen K, Gard G. An eye for movement quality: a phenomenological study of movement quality reflecting a group of physiotherapists' understanding of the phenomenon. **Physiother Theory Pract**. 2008;24:13–27. doi:10.1080/09593980701378142

12. Hedlund L, Gyllensten AL. The experiences of basic body awareness therapy in patients with schizophrenia. **J BodywMovTher**. 2010;14:245–254. doi:10.1016/j.jbmt.2009.03.002

13. Gyllensten AL, Ekdahl C, Hansson L. Long-term effectiveness of basic body awareness therapy in psychiatric outpatient care: a randomized controlled study. **AdvPhysiother**. 2003;5:179–190. doi:10.1080/14038190310015252

14. Jang HJ, Hughes LC, Oh DW, Kim SY. Effects of corrective exercise for thoracic hyperkyphosis on posture, balance, and well-being in older women: a double-blind, group-matched design. **J GeriatrPhysTher**. 2019 Jul-Sep;42:E17–E27. doi:10.1519/JPT.0000000000000146

15. Day JW, Smidt GL, Lehmann T. Effect of pelvic tilt on standing posture. **PhysTher**. 1984 Apr;64:510–516. doi:10.1093/ptj/64.4.510

16. Levine D, Whittle MW. The effects of pelvic movement on lumbar lordosis in the standing position. **J Orthop Sports PhysTher**. 1996 Sep;24:130–135. doi:10.2519/jospt.1996.24.3.130

17. van Almkerk M, Bierling BL, Leermakers N, Vinken J, Timmermans AA. Improving posture and sitting behavior through tactile and visual feedback in a sedentary environment. **AnnuIntConf IEEE Eng Med Biol Soc**. 2015;2015:4570–4573. doi:10.1109/EMBC.2015.7319411

18. Jackson JA, Banerjee-Guénette P, Gregory DE, Callaghan JP. Should we be more on the ball? The efficacy of accommodation training on lumbar spine posture, muscle activity, and perceived discomfort during stability ball sitting. **Hum Factors**. 2013 Dec;55:1064–1076. doi:10.1177/0018720813482326

19. Preece SJ, Tan YF, Alghamdi TDA, Arnall FA. Comparison of pelvic tilt before and after hip flexor stretching in healthy adults. **J Manipulative PhysiolTher**. 2021 May;44:289–294. doi:10.1016/j.jmpt.2020.09.006

20. Vera-Garcia FJ, Irles-Vidal B, Prat-Luri A, García-Vaquero MP, Barbado D, Juan-Recio C. Progressions of core stabilization exercises based on postural control challenge assessment. **Eur J Appl Physiol**. 2020 Mar;120:567–577. doi:10.1007/s00421-020-04313-9

21. Vieira DS, Mendes LP, Elmiro NS, Velloso M, Britto RR, Parreira VF. Breathing exercises: influence on breathing patterns and thoracoabdominal motion in healthy subjects. **Braz J PhysTher**. 2014 Nov-Dec;18:544–552. doi:10.1590/bjpt-rbf.2014.0048

22. Ndetan H, Evans MW Jr, Williams RD, Woolsey C, Swartz JH. Use of movement therapies and relaxation techniques and management of health conditions among children. **AlternTher Health Med**. 2014 Jul-Aug;20:44–50. Available from: https://pubmed.ncbi.nlm.nih.gov/25141362

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 3601-3608 | ISSN:2251-6727

23. Morris JN, Hardman AE. Walking to health. **Sports Med**. 1997 May;23:306–332. doi:10.2165/00007256-199723050-00004

24. Baltasar-Fernandez I, Alcazar J, Rodriguez-Lopez C, Losa-Reyna J, Alonso-Seco M, Ara I, Alegre LM. Sit-to-stand muscle power test: comparison between estimated and force plate-derived mechanical power and their association with physical function in older adults. **ExpGerontol**. 2021 Mar;145:111213. doi:10.1016/j.exger.2020.111213

25. Sadeghi H, Jehu DA, Daneshjoo A, Shakoor E, Razeghi M, Amani A, Hakim MN, Yusof A. Effects of 8 weeks of balance training, virtual reality training, and combined exercise on lower limb muscle strength, balance, and functional mobility among older men: a randomized controlled trial. **Sports Health**. 2021 Nov-Dec;13:606–612. doi:10.1177/1941738120986803

26. Seo JH, Lee MY. Effects of quarter heel raising exercise on balance and ankle strength in functional ankle instability subjects. **Medicine (Baltimore)**. 2022 Sep 23;101:e30672. doi:10.1097/MD.0000000000030672

27. Jung K, Kim Y, Chung Y, Hwang S. Weight-shift training improves trunk control, proprioception, and balance in patients with chronic hemiparetic stroke. **Tohoku J Exp Med**. 2014 Mar;232:195–199. doi:10.1620/tjem.232.195

28. Daniel P, Huang HJ, Kao PC. Moving the arms to activate the legs. **Exerc Sport Sci Rev**. 2006 Jul;34:113–120. Available from: https://journals.lww.com

29. Lee JH, Kim EJ. The effect of diagonal exercise training for neurorehabilitation on functional activity in stroke patients: a pilot study. **Brain Sci**. 2023 May 14;13:799. doi:10.3390/brainsci13050799

30. Morais N, Ferreira J, Gordo J, Vilas-Boas JP, Pascoal AG. A diagonal movement pattern of arm elevation and depression in overhead throwing athletes: an exploratory kinematic analysis for clinical application. **Appl Sci**. 2023;13. doi:10.3390/app13010000 *(verify exact article number if required)*

31. Murnaghan CD, Elston B, Mackey DC, Robinovitch SN. Modeling of postural stability borders during heel-toe rocking. **Gait Posture**. 2009 Aug;30:161–167. doi:10.1016/j.gaitpost.2009.03.010