Review Article

Main title

An insight into the Biomechanics and other details of *Vrikshäsana*, one of the standing Yoga *āsanās*

Abstract

Aim: Adopting a perfect final pose of specific yoga *āsanā* and obtaining maximum benefits is possible by learning the major to minor details of the *āsanā* including the preparations, steps and parts of the body involved, benefits, contra-indications, final pose and much more. However, understanding the specific body parts involved and how muscles, bones and joints work together to create movements and shape is through the study of Biomechanics. Anatomically, human body adapts to a specific posture of *Yoga āsanā* with proper sync of Bones, muscles, and joints. Studies on biomechanics of selected yoga *āsanās* are found in sparse in Scientific interfaces. Therefore, with this article, we intended to give an insight on one of the standing poses named as *Vrikshäsana*, known as Tree pose. For which, related information was obtained from scientific and non-scientific sources and to postulate the details of practice of *Vrikshäsana*, citing the biomechanics.

Methodology: Manuscripts related to *Vrikshäsana* and its details including Biomechanics were identified from scientific interfaces like PubMed and Google Scholar. Books on Anatomy of Human body and Scriptures describing the steps of adopting the final pose and benefits were

referred to extract details specific to the correct position of hip, muscles, ankle joints for reaching at appropriate posture of *Vrikshäsana*.

Conclusion: This observational work emphasizes the importance of practice of *Vrikshäsana* on enhancing the wellness at body and brain. But the benefits are obtained only when the practitioner is well aware of the right posture, higher benefits and Biomechanics.

Key words: *Vrikshäsana*, Biomechanics, Anatomy, Appropriate posture, Standing *āsanās*

Introduction

Healthy body is essential for every individual to achieve their life goals[1]. The western world has adopted more of physical components of *Yoga* such as physical postures. Therefore, the classical approach in *Yoga* is being compromised. Hence compilation of this form is needed to bring the traditional knowledge base to people for a proper understanding[2] about the practice of *Yoga āsanā*[3].

Yoga, derived from medieval Haṭha *Yoga* period[4], is known to public since the mid of 20th century[5]. Yoga constitutes physical postures called *āsanā,* and interestingly, adopting of which involves almost all the parts of the human body with specific stretch and impact on particular parts. During the practice, understanding the parts involved is inevitable in order for the practitioner to be mindful during the practice which can adapt proper posture thereby attaining maximum benefit of the practice[6].

While the interest and awareness about *Yoga* among public is increasing over the last 7-8 decades, the unavailability and scarcity of skilled and experienced teachers has always been in scarcity is leading to wrong ways of practicing yoga. For sure, the inappropriate ways of practice

results in either adverse effects or obtaining lesser benefit to the practitioner[7]. However, with the demand, attempts are being made by the learners of present generation to use the existing technologies or by developing new devices to evaluate the perfection of the practitioner. The search in this direction took the researchers to develop interest in Biomechanics and Kinesiology of particular *āsanā*[8]. Adopting such methods, help individuals to understand their capability and extend to which they can try attaining the final pose, which is one of the interesting principals of Golden rule of Anatomy of *Yoga*.

Adding on, of many known yoga *āsanā*, *Vrikshäsana*, also known as Tree pose, one of the balancing poses is the only asana presented in this observational work, exhibiting the variations, preparatory practices and steps involved and Biomechanics. However, more of attention of this work is to highlight the benefits of practice of *Vrikshäsana*, emphasizing the Biomechanics. As known, the practice of *Vrikshäsana* involves stretch of legs, arms, hands, arms, fingers, back and entire body[9]. The practice of *Vrikshäsana a* not only stretches the entire body, but also improve the body balance, attention and concentration. This is because of the involvement of central nervous system[10].

Preparation required before the practice

As *Vrikshāsanā* is a balancing *āsanā*, the practitioner should make sure about the strength of the bones, muscles, joints, ligaments, cartilages and tendons of the legs. Following which the practitioner must try adopting the posture, by taking wall support or by using props to see for the strength of the legs. Adding on, as known, avoiding solid food at least one hour before the practice and strenuous physical activities will help attain and maintain the final pose with no extra efforts[11].

Steps of practice

After being ensured about the balancing, the practitioner can make a try of reaching at the final pose adopting for few seconds in the first try and gradually can try increasing the time of maintenance. Stand in *Tādāsanā*. Slowly being on one leg, bend the other leg bent so that the foot rests on the inner thigh, by toes pointing downwards. By balancing on one leg, join the palms and raise the palms straight over the head. Breathing deeply, stay for a few seconds in the final pose. Lower the arms and separate the palms, straighten the leg and return back to *Tādāsanā*. Repeat the practice standing on the opposite leg following the same steps [12].

***Vrikshāsanā* variation with arms elevated**

There are a few variations of this asana and one among which is performed with hands extended against the chest in a prayer pose. Moreover, the variation is also known to create a higher center of gravity and therefore, is a more challenging pose to attain[13].

Breathing

Because of the stabilizing action of the muscles that keep the arms overhead, the thoracic movements of the breath might encounter more resistance in this position. In addition, the higher center of gravity tends to produce a stronger stabilizing action in the abdominal muscles. Taken together, these factors combine to reduce the overall excursion of the diaphragm.

Biomechanics

Biomechanics is the study about the structure, sync and movement of the body during each acts. Moreover, it is all about identifying the mechanical laws to the human body while adopting particular poses. A conventional approach towards modern *Yoga* is well understood though the study of Biomechanics of each *yoga* postures. The understanding bout Biomechanics includes

Stretching and relaxation properties involving each of the organs and organ systems, entailing a safe and effective practice of the *āsanā*. The Skeletal and muscular joints biomechanics of *Vrikshāsanā* is as described below [14].

Skeletal parts involved and the role played:

Spine

- To retain proper link of upper and lower limb: Neutral spine, level pelvis

Upper limbs

- To enable proper hold of the hand in *Namaskara mudra*: Slight shoulder flexion and adduction; elbow flexion; forearm pronation; wrist, hand, and finger extension

Lower limbs

Standing leg

- To help with the extension: Neutral hip extension, neutral knee extension

Lifted leg

- To ensure flexion and extension: Hip flexion, external rotation, and abduction; knee flexion; ankle dorsiflexion

Muscles:

- Erector Spinae- Iliocostalis, Longissimus, Spinalis: helps calibrate concentric and eccentric contractions to maintain neutral alignment of the spine
- Trapezius
- Gluteus medius and minimus: allow a lateral shift of pelvis over standing foot for balance and to keep pelvis level and help open it to side and help through concentric contractions
- Piriformis, obturator internus, superior and inferior Gemellus, tensor fasciae latae muscles: eccentrically contracts.

- Quadriceps, Hamstring, intrinsic and extrinsic muscles of foot: keep the knee in neutral extension and balance on a single leg and help to go through a concentric contraction.
- Tensor Fasciae Latae
- Rectus Abdominis
- Iliacus, psoas major: To flex hip and to externally rotate the leg: contracts concentrically.
- Adductor magnus and minimus: is concentrically contracted; Pectineus, adductor longus, and brevis, gracilis lengthens passively[15].

Joints:

The joints involved are Ankle, Hip, Knee, pelvis, shoulder and elbow.

Positioning of the body

While adopting Vrikshasana, the basic joint positions are such where the Ankle is dorsi-flexed, Hip is flexed externally rotated and abducted, Knee is fixed and the Spine is neutral, Pelvis in level, shoulder is slightly flexed and adducted. In the pose of *Vrikshasana*, the entire body weight is on one leg thus the practice of this asana improves the balance of the body and concentration.

Key elements of Tree pose

Proper weight distribution and strong legs to provide stability to the groin, pelvis, hips and thighs. The practice of tree pose will strengthen the core and therefore even help improve the metabolism and digestion. As we know, balancing of the total body weight on one leg requires a strong core with active engagement, which in turn help gaining strength in the body.

Benefits of the practice

Practice of *Vrikshāsanā* is known to impart enormous benefits beyond just at musculo-skeletal level. The higher level benefits are of course neurological, with the involvement of brain as

reflected through an improved concentration and attention among the practitioners. Moreover, the practice improves the body balance, flexion and extension of the limbs, overall body balance, better posture, tones up leg muscles, strengthens hip and pelvic region, improves digestion, relives constipation and flatulence issues, acidity by increasing blood flow to the stomach, flexibility of hole body and alignment, and also improves strength of the musculo-skeletal system[16].

Methodology

The aim of this observational study was to study in detail the biomechanics, steps for the practice, indicating the multiple benefits a practitioner would gain with the practice of *Vrikshāsanā*. However, objectives of this study were to highlight the biomechanics referring to texts on Anatomy and Physiology of Human body, enabling guidance to the readers through steps of adopting the posture rightly using a set of images and to bring awareness about the neuro and musculo-skeletal benefits of the practice.

For obtaining information relevant to meet the objectives of this study, manuscripts were found from scientific platforms like PubMed and Google scholar. Non-scientific sources referred are Yoga texts including *Haṭha Yoga Pradīpikā, Gheraṇḍa saṁhitā, Sivasaṃhitā, Patañjali Yoga Sūtra, Bhagavad Gītā,* as well as selected contemporary texts written by great masters of *Haṭha Yoga* during 19th and 20th centuries were examined to understand: Preparations needed to start the practice, Steps involved, Variations, Breathing, proper final pose and Biomechanics of *Vrikshāsanā*.

Discussion

Vrikshäsana is one of the standing *āsanās* linking the whole body starting from foot to the nervous system. To have the best of the benefits gained, the practitioner must feel as steady as a tree while balancing on one leg. To achieve and obtain the expected benefit out of this *asana*, it would be better if the individual imagines rooted like a tree. As mentioned in the main content of this manuscript, scriptures also advise the individuals to take wall support in the beginning stage when the practitioner finds it difficult to attain the balance.

In Ancient period, sages used to recommend the disciples to practice *Vrikshāsanā* as a preparatory practice to reach into the state of Meditation. In addition, certain scriptures also describe *Vrikshäsana* as activating *Mooladhara chakra*[17], which indeed boosts energy flow, calm down the mind, or at time of need stimulates confidence and help the practitioner feel rooted both at the body and the mind level. In addition to these known benefits like improved concentration, attention, focus, which the practice of *Vrikshāsanā* can impart, praiseworthy benefit is musculo-skeletal health and mind-body balance, which not many *yoga āsanās* are found benefitting[18].

Adding on, the expected benefits are attained when the instructor is instructing properly, the instructor makes sure that the practitioner is following the instructions to the fullest, the interest and dedication of the performer to follow the instructions, learning the benefits, contraindications[19], pre preparatory practices and the parts of the body involved and getting benefitted in addition to the overall wellness at both mind and body level, as described on this observational study.

Although, there might be many inferences based on the extent of interest that a subject imparts during the steps of practice of *Vrikshāsanā*, starting with the pre-preparatory practices, ensuring

alignment and strategy of hip, knee and ankle joint. With which the stability can be attained during the course of practice of *Vrikshāsanā*. Although, a better understanding about the need of the practice is inevitable. However, maintaining, attaining and regaining stability of the posture is dependent equally on certain aspects of acceleration related to the joints and muscles related to hip, knee and ankle. Say for example, if acceleration of ankle is higher than knee, this indicates that the ankle has greater contribution in regaining stability, likewise, about the hip joint. Moreover, these accelerations are of course related to the passion of the practitioner.

To add on, the practice of *Vrikshāsanā* is not only about the balance and control of the body but also about the stability at the mind level, which also involves attention and concentration. On a wider view. However, people who have undergone neurological and nephrological disorders, knee replacement surgeries, injuries at knee, high or ankle joints, ligaments and muscles, those who have lost balance over the body, should avoid the practice. Ultimately, the insights on biomechanics provides a better way of instruction delivery by the instructors, clinicians and therapists involved in teaching specific balancing yoga poses like *Vrikshāsanā*.

Conclusion

This observational work emphasizes the importance of practice of *Vrikshāsanā* on enhancing the wellness at body and mind, but, the benefits are undoubtedly can be obtained only when the practitioner is well aware of the right posture maintained though an understanding on Biomechanics of *Vrikshāsanā*, in addition to promoting the adopting of the pose rightly and appropriately by the practitioner.

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