VISBODY

# Visbody Creator600:

## Running Gait Analysis and Advantages


Date: March 11, 2025

VISBODY

CONTENTS

# PART 01

## Report Interpretation

# 1. Dynamic Joint Load (Hip and Knee Joint Load) Interpretation

**Indicator Significance:** Dynamic joint load reflects the pressure and impact force exerted on the joints during running. Excessive load may lead to sports injuries.


**01**

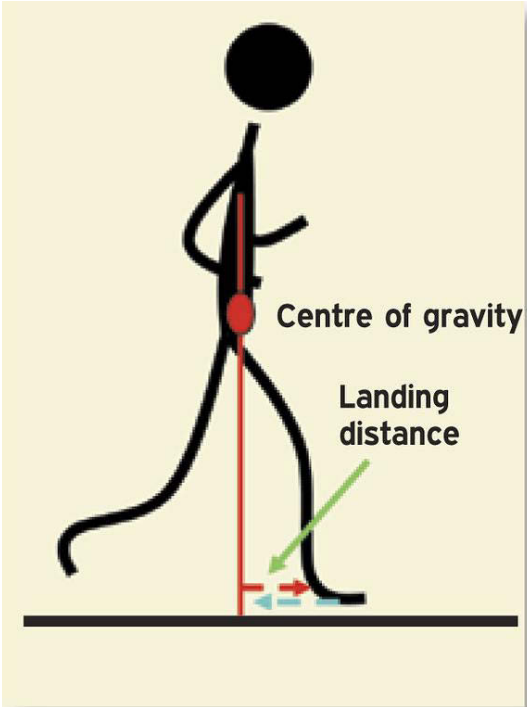
**Report Interpretation:** The report shows that the load on the left and right hip joints and the right knee joint is relatively high.

**02**

**Assessment Value:** By identifying joints with high loads, runners can adjust their running posture, reduce joint injury risks, and extend their athletic longevity.

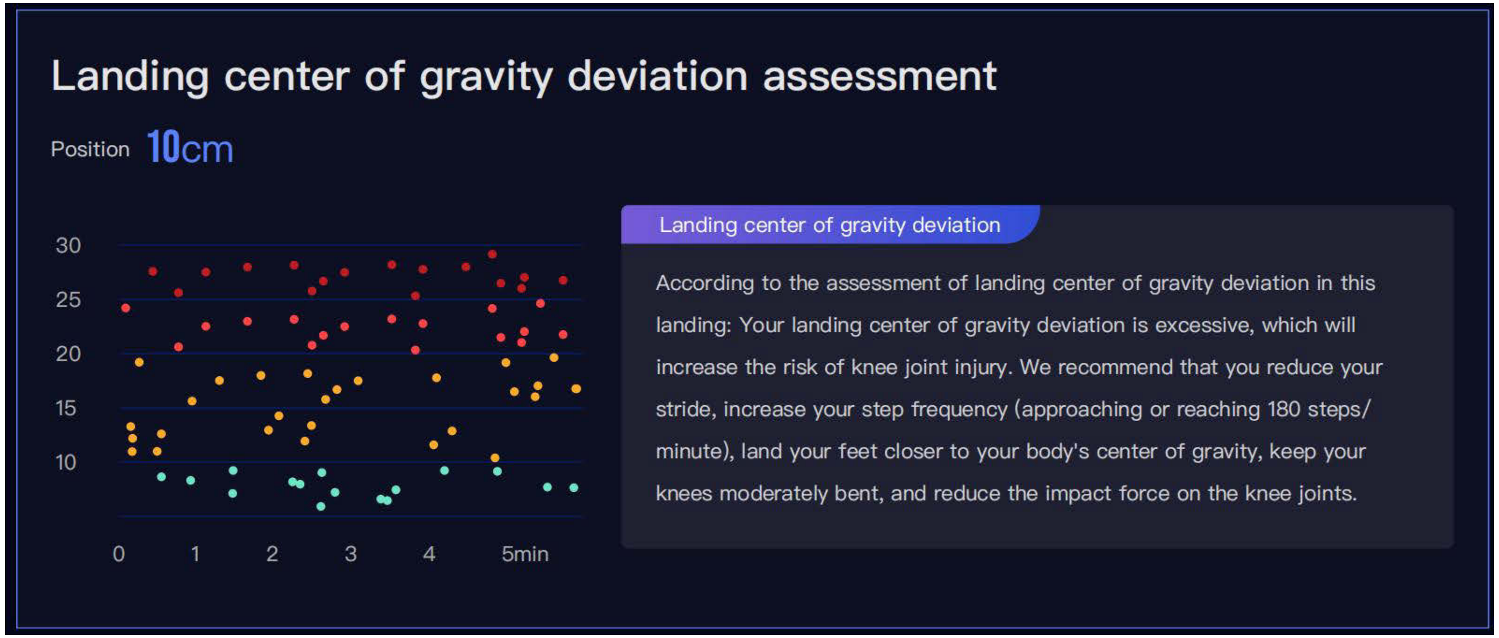
## 2. Landing Center of Gravity Deviation Interpretation

**Indicator Significance:** Landing Center of Gravity Deviation refers to the horizontal displacement of the body's center of gravity (COG) from the ideal support base center during jumping, falling, or running landing phases. The body's center of gravity is a theoretical point where the weight of all parts of the body is evenly distributed, typically located at the level of the S2 vertebra in front of the pelvis.

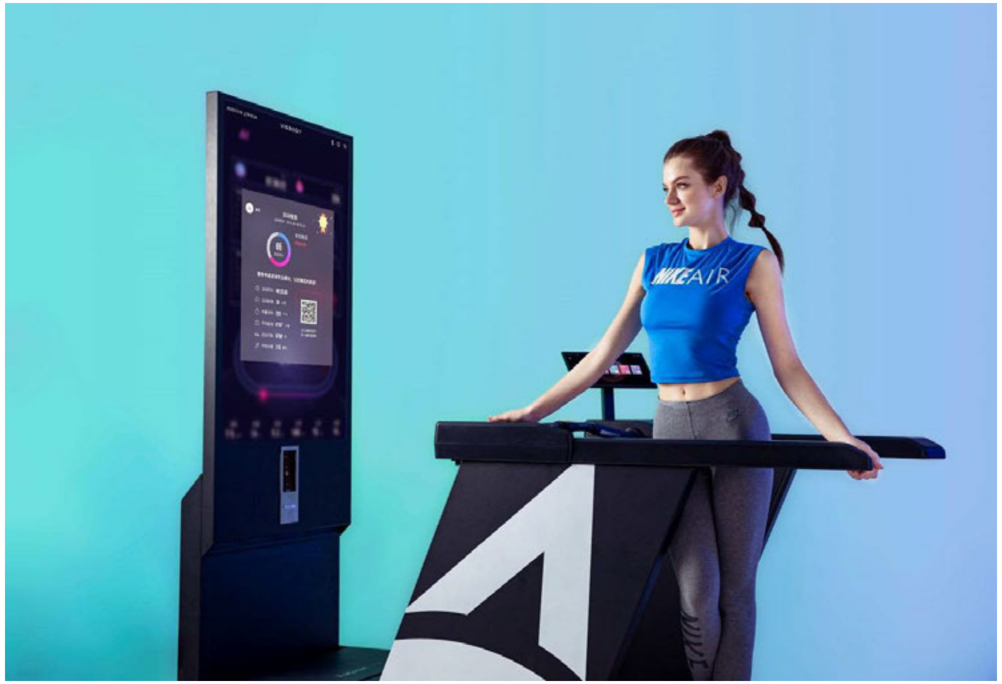


# 2. Landing Center of Gravity Deviation Interpretation

**Report Interpretation:** The center of foot landing should ideally be directly beneath the body’s center of gravity. Your average deviation is 10 cm, which is relatively high. Large deviations are associated with increased risk of lower limb injuries, especially anterior cruciate ligament (ACL) injuries and patellar tendon diseases. Additionally, it reduces the body's ability to efficiently convert energy into forward movement.



# 2. Landing Center of Gravity Deviation Interpretation

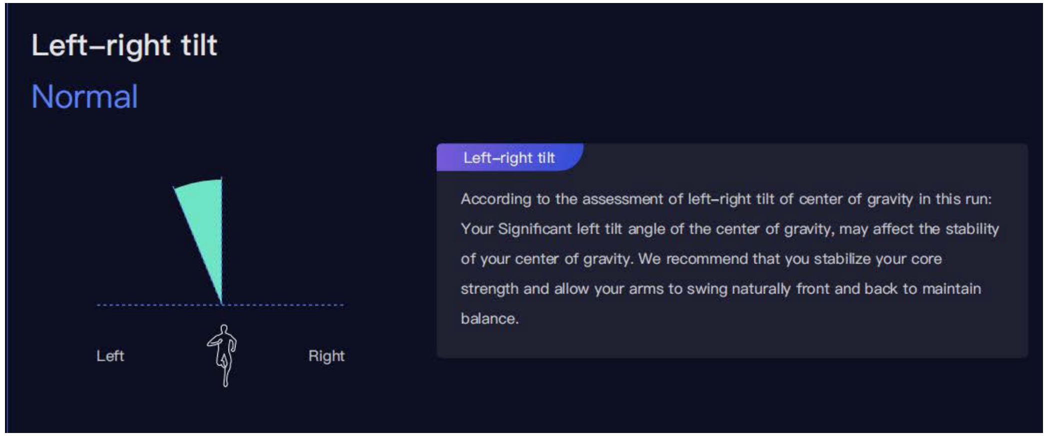


## Significance of Optimizing Landing Center of Gravity

- Optimizing the landing position can reduce joint impact. By adjusting the foot landing position directly beneath the body's center of gravity, injury risks can be lowered.
- Improved running economy makes running more energy- efficient.

# 3. Lateral Tilt of the Center of Gravity Interpretation

**Indicator Significance:** Lateral tilt of the center of gravity is the degree to which the body's center of gravity deviates towards the left or right side on the frontal plane during running, typically measured in degrees. This indicator reflects the runner's balance control ability in the lateral direction.




01

**Report Interpretation:** Your center of gravity has a noticeable left tilt. It is recommended to conduct a static posture assessment and evaluate muscle tension in the quadratus lumborum and tensor fascia lata.

# 3. Lateral Tilt of the Center of Gravity Interpretation

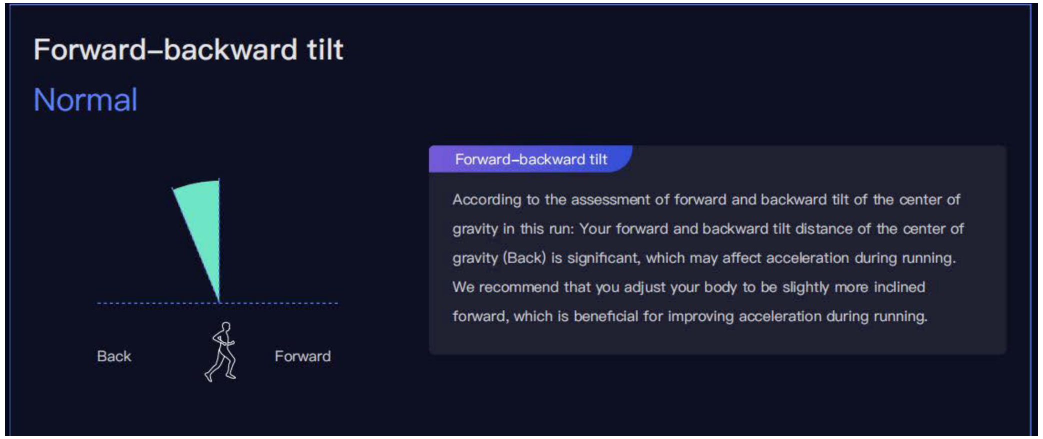
## Assessment Value of Lateral Tilt of the Center of Gravity

This indicator reflects core stability, overall posture control, and symmetrical load distribution on both sides of the body. Significant lateral tilting is associated with iliotibial band syndrome, plantar fasciitis, hip and pelvic stress injuries, and quadratus lumborum strain.

Excessive lateral tilt increases energy consumption, reducing running efficiency and hinders the direct transmission of forward propulsion. Abnormal results may indicate leg length discrepancies, pelvic asymmetry, or unilateral muscle imbalance. An ideal lateral tilt is between 0-3°, though fatigue may increase it by 1-2°.

# 4. Forward-backward Center of Gravity Tilt Interpretation

**Indicator Significance:** forward-backward tilt refers to the forward or backward tilt of the torso relative to the vertical line in the sagittal plane during running, typically measured in degrees. This indicator reflects the runner's posture control and center of gravity position.




01

**Report Interpretation:** Your center of gravity shows noticeable backward tilt, possibly caused by a low cadence. It is recommended to strengthen iliopsoas and quadriceps muscles.

# 4. Forward-backward Center of Gravity Tilt Interpretation

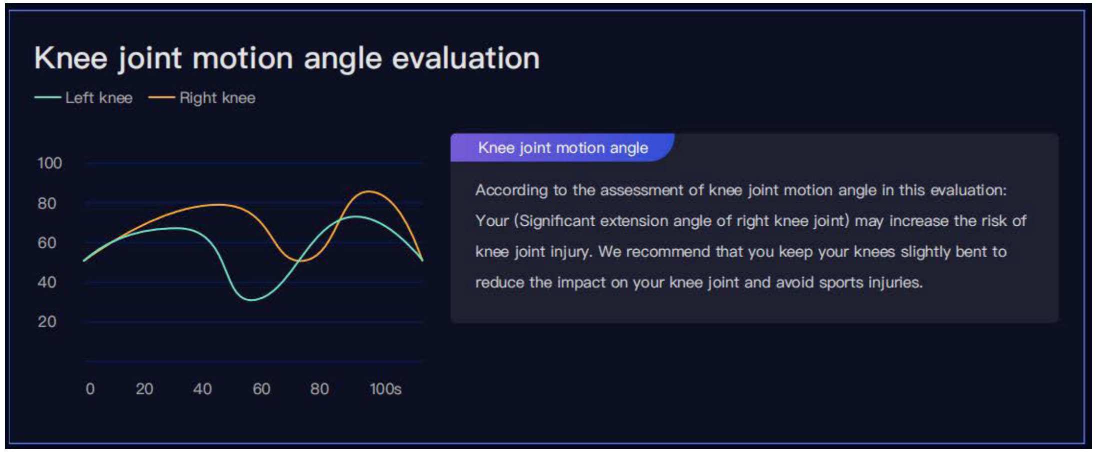
## The Importance of Forward-backward Center of Gravity Tilt

This indicator directly impacts forward center of gravity shift and propulsion efficiency and is closely related to stride length, cadence, and foot landing patterns. This also impacts the loading patterns of the spine, pelvis, and lower limbs, determining the transmission path of ground reaction force.

Additionally, it reflects the functional coordination of the core and hip muscles. Excessive forward tilt increases lumbar stress, while excessive backward tilt increases anterior knee pressure and iliotibial band tension. The optimal forward tilt angle is 5-9° . Any degree of backward tilt or a forward tilt greater than 15° is considered abnormal.

# 5. Knee Joint Motion Angle Evaluation Interpretation

**Indicator Significance:** Knee joint movement angle measures the degree of flexion and extension of the knee joint during the running cycle, typically measured in degrees. It reflects maximum flexion, extension, and overall symmetry of the knee joint during running.




## 01

**Report Interpretation:** The right knee (yellow line) demonstrates significant extension during the mid-stance phase (approximately 40-60% of the gait cycle), with a significantly lower minimum angle compared to the left knee. This suggests the right knee undergoes greater extension. Additionally, the peak knee flexion angle (around 80-90% of the gait cycle) is slightly higher in the left knee than the right knee, with both knees reaching their peaks and troughs simultaneously but showing asymmetric magnitude. Excessive knee extension on one side increases the risk of knee injuries. Long-term asymmetry may lead to overuse injuries on the dominant side, higher energy consumption, and decreased running economy. Increasing cadence and reducing stride length can help mitigate excessive knee extension. Targeted hamstring strengthening exercises for the right knee are recommended.

# 5. Knee Joint Motion Angle Evaluation Interpretation

## Assessment Value of Knee Joint Motion Angle

Optimal knee joint angle variation maximizes elastic energy storage and release, which directly influences stride length, cadence, and running pace. Appropriate knee flexion is critical for absorbing ground reaction force, reducing the risk of patellofemoral pain syndrome, iliotibial band syndrome, and tibial stress syndrome.

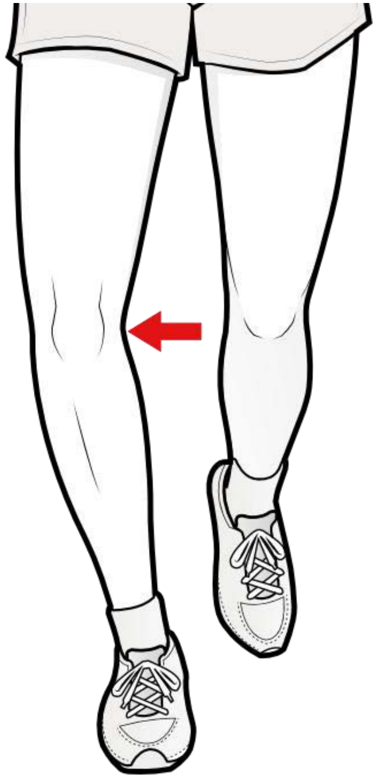
The ideal inter-limb difference in knee angle is 10-15°, with fatigue potentially increasing it by 3-5°.

VISBODY

# 6. Knee Valgus and Varus Interpretation

**Indicator Significance:** Knee valgus refers to the inward deviation of the knee joint towards the midline, causing the knees to move closer together. That is, the knees are close to each other while the ankles are relatively separated.

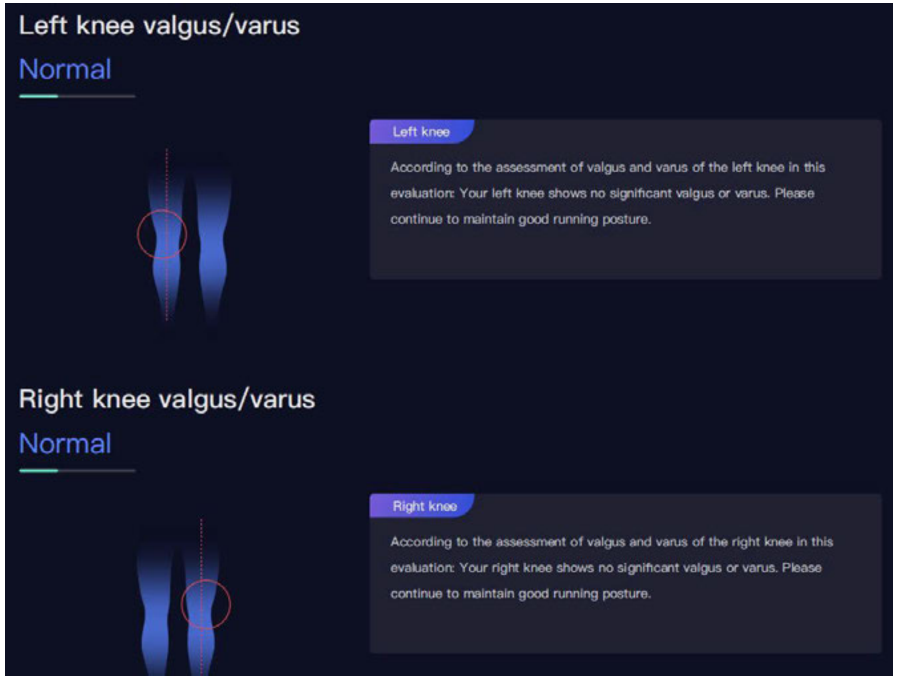
Knee varus refers to the outward deviation, causing the knees to move apart.

Knee varus refers to the outward deviation, causing the knees to move apart.

# 6. Knee Valgus and Varus Interpretation

**Assessment Value:** Identifying abnormal knee movement patterns can help prevent knee injuries. Excessive knee valgus increases the risk of ACL injuries, while excessive knee varus increases medial collateral ligament (MCL) stress, inner meniscus damage, and medial tibiofemoral joint injuries. Both valgus and varus misalignments compromise force transmission efficiency, negatively impacting directional changes and acceleration during running. A dynamic monitoring angle of knee valgus exceeding 8-10° or knee varus exceeding 7-8° is considered a potential risk zone.




01

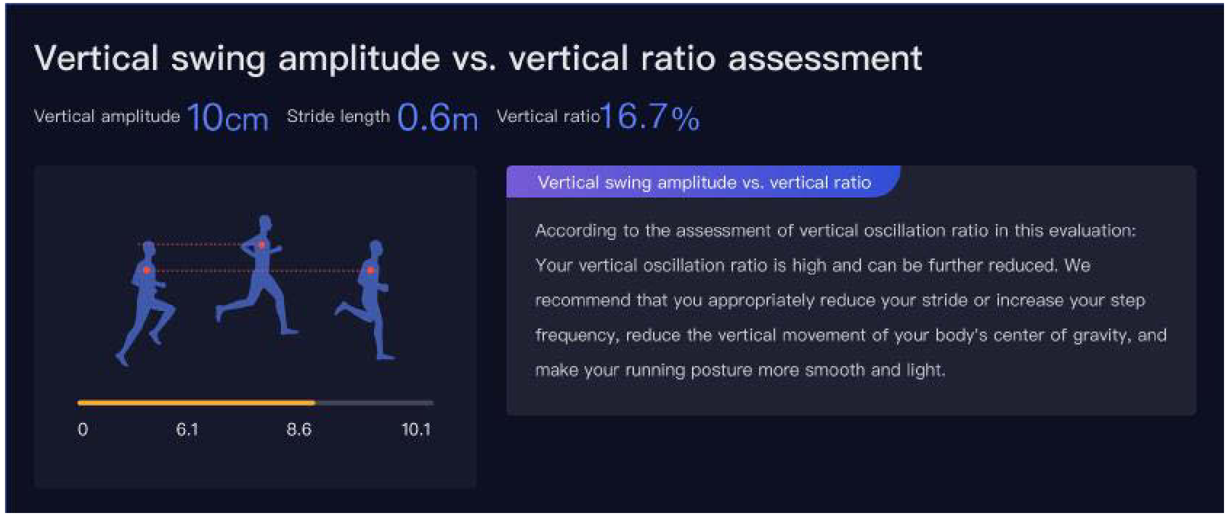
**Report Interpretation:** Your knee valgus and varus are within the normal range..

# 7. Vertical Oscillation and Vertical Ratio Interpretation

**Indicator Significance:** Vertical oscillation referred to as vertical bounce, measures how much you move up and down, or bounce, with each running stride, typically in centimeters (cm).

The vertical ratio is the ratio of vertical displacement to stride length, expressed as a percentage.

Vertical Ratio(%)= Vertical Oscillation / Stride Length × 100




**01**

**Report Interpretation:** Your vertical oscillation is 10 cm, which is higher than the recommended 6-7 cm for your running speed (8-10 km/h). Your vertical ratio is 16.7%, exceeding the recommended <10%.

# 7. Vertical Oscillation and Vertical Ratio Interpretation

## The Importance of Vertical Oscillation

This is important because a runner with too much vertical oscillation expends extra energy moving up and down, rather than propelling forward, making them slower and less efficient. Alternatively, a runner with too little vertical oscillation more frequently shuffles, resulting in not using their feet to propel forward, a key component of fast running.

Alternatively, a runner with too little vertical oscillation more frequently shuffles, resulting in not using their feet to propel forward, a key component of fast running.

When comparing two runners, one with good vertical oscillation and the other with too much, the head of the runner who has good vertical oscillation will remain steady and not drastically bounce up and down as they run.

**But**, you'll notice that the head of a runner with too much vertical oscillation moves up and down far more.

Reference

VISBODY

# 7. Vertical Oscillation and Vertical Ratio Interpretation

## The Assessment Value of Vertical Oscillation and Vertical Ratio

Vertical oscillation is a primary indicator of running economy. Excessive vertical displacement leads to unnecessary energy waste, as more energy is spent on vertical movement instead of forward propulsion. Research shows that reducing vertical oscillation by 1 cm can improve running economy by approximately 2% [2] .

Additionally, higher vertical oscillation is associated with increased ground impact force, elevating the risk of iliotibial band syndrome, tibial stress fractures, and other running-related injuries. Elite runners typically demonstrate optimal (but not minimal) vertical oscillation.

Vertical ratio accounts for stride length, providing a more standardized measure across individuals of different heights and leg lengths. Over time, improvements in vertical ratio indicate better running efficiency, while an increase often signifies fatigue accumulation.

**Ideal Standards:**

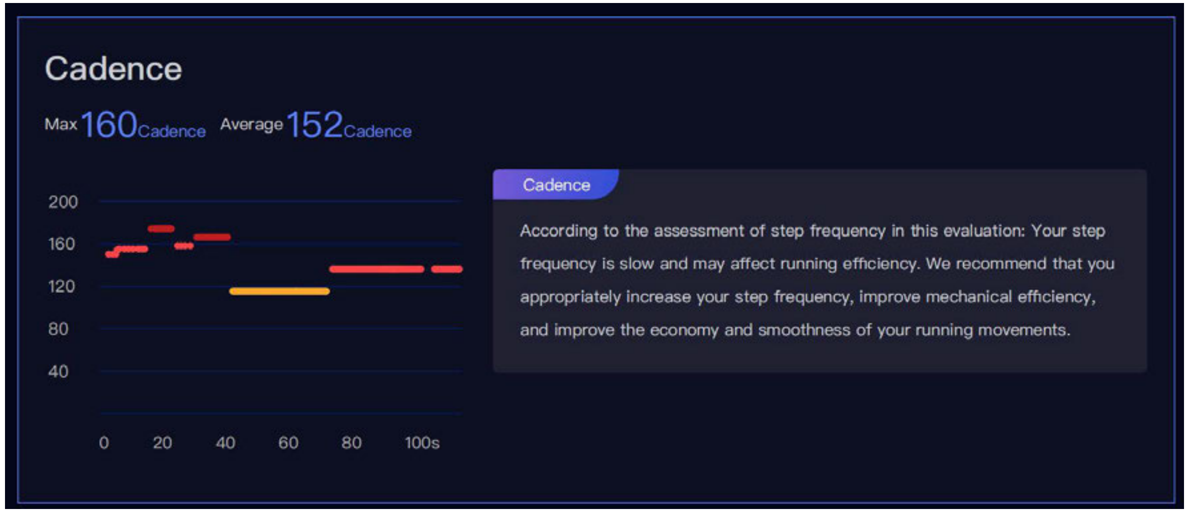
Jogging (8-10 km/h): Vertical Oscillation: 6-7 cm

Moderate Running (12-15 km/h): Vertical Oscillation: 7-9 cm

Vertical Ratio: Excellent: 6-8%, Good: 9-10%.

# 8. Cadence Interpretation

**Indicator Significance:** Cadence refers to the number of steps taken per minute. usually measured in steps per minute (SPM). A step is defined as the process from one foot contact to the opposite foot contact.




## 01

**Report Interpretation:** Your average cadence is 152 SPM, which is relatively low. Recommended values for jogging should be around 160-170 SPM, while sprinting can exceed 200 SPM.

# 8. Cadence Interpretation

## Importance of Optimizing Cadence

- Optimal cadence maximizes running economy and reduces energy consumption. Lower cadence is often associated with higher vertical impact force, increased braking force, and a higher risk of lower limb injuries.

- Studies indicate that increasing cadence by 10% can reduce patellofemoral joint peak loading by approximately 14%. Monitoring cadence over time can also reflect fatigue, technical efficiency, and adaptation status.

VISBODY

# References


[1]Lenhart RL, Thelen DG, Wille CM, Chumanov ES, Heiderscheit BC. Increasing Running Step Rate Reduces Patellofemoral Joint Forces. Medicine & Science in Sports & Exercise. 2014;46(3):557-564

[2]Sellari-Franceschini S, Dallan I, Bajraktari A, Fiacchini G, Nardi M, Rocchi R, Marcocci C, Marinò M, Casani AP. Surgical complications in orbital decompression for Graves' orbitopathy. Acta Otorhinolaryngol Ital. 2016 Aug;36(4):265-274. doi: 10.14639/0392-100X-1082. PMID: 27734978; PMCID: PMC5066461.

VISBODY

# PART 02

## The Importance of Running Gait Analysis

VISBODY

# 1. Preventing Injury Risks

**Running** may appear simple, but it is a highly technical sport.

Studies show that **65-80%** of runners experience injuries annually, most of which result from cumulative damage **due to improper running form. Common injuries include:**

1. **Imbalanced Joint Load:** Undetected excessive joint load may lead to chronic hip and knee injuries.
2. **Abnormal Knee Movement:** Improper knee angle changes are a major cause of ACL injuries and patellofemoral pain.
3. **Poor Center of Gravity Control:** Shifted centre of gravity on landing and abnormal anterior/posterior/horizontal body lean are directly related to common running injuries such as iliotibial band syndrome and plantar fasciitis.
4. **Precision gait analysis** allows the early detection of these invisible technical defects, enabling proactive intervention to significantly extend an athlete's running career and prevent chronic injuries.

# 2. Optimizing Running Efficiency

**Gait analysis** is not only crucial for injury prevention but also directly impacts **running efficiency**.


**Excessive Vertical Oscillation**

Excessive Vertical Oscillation

**Excessive Center of Gravity Deviation**

Increases knee load and reduces the body's ability to efficiently convert energy into forward movement.

**Low Cadence**

Compromises running economy

Studies show that reducing vertical oscillation by 1 cm can improve running economy by approximately 2%, allowing runners to cover longer distances or maintain higher speeds with the same energy output.

# 3. Personalized Training Plans

The precise data provided by gait analysis serves as the scientific foundation for developing individualized training programs, including:

01

Targeted Muscle Strengthening: Addressing specific muscular imbalances.

02

Balance Development Strategies: Reducing asymmetry in force distribution

03

Technical improvements Priorities: Improving propulsion efficiency and minimizing energy waste.

# PART 3

## Visbody Creator600: Revolutionizing Running Gait Analysis

# Visbody Creator600: Revolutionizing Running Gait Analysis

?

**Traditional gait analysis methods have significant limitations:**

- **Subjective Visual Observation: Prone to human error and unable to capture millisecond-level motion details.**
- **2D Video Analysis: Provides limited information without capturing three-dimensional movement.**
- **Wearable Sensors: Limited data points and potential influence on natural running form.**

# Visbody Creator600: Revolutionizing Running Gait Analysis

The Visbody Creator600 revolutionizes gait analysis by simultaneously capturing and analyzing eight key biomechanical indicators, including:

- Dynamic joint load distribution
- Foot landing center offset
- Lateral and forward-backward tilt
- Knee joint angle variation and knee valgus/varus
- Vertical oscillation and vertical ratio
- Step frequency

- Equipped with high-precision motion capture technology, accurately tracks knee joint angle trajectories and subtle bilateral differences while capturing millimeter-level vertical oscillation and center of gravity deviations.
- Its intuitive visual report system converts complex biomechanical data into actionable insights, providing professional interpretations and personalized improvement suggestions.
- Without the need for wearable sensors that may interfere with natural movement, the evaluation can be conducted in a real running state.

# Application Scenarios

Professional Athletes: Optimize technical details and break performance bottlenecks.

Running Coaches: Obtain objective data to improve coaching accuracy.

Amateur Marathon Runners: Prevent common running injuries and improve training efficiency.

Sports Institutions: Build baseline data for athletes and track technical development.

Post-injury Rehabilitation: Scientifically monitor recovery progress and prevent re-injury.

# ThanK YOU