

Biomechanical Analysis of the Handstand: A Systematic Review

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INTRODUCTION:

In gymnastics, the handstand is one of the most important fundamental skills. It provides a progression route for transferable skills on various apparatuses i.e. (rings, beam, uneven-bars and parallel bars) and various floor disciplines (1). The handstand can be characterized as the action of maneuvering the body into a fixed body configuration in an inverted vertical position while balancing on the hands. However, this maneuver can be made extremely difficult as it involves the use of specific apparatuses, overall balance influences, and mechanical characteristics (2). Challenging conditions during the handstand become apparent when the distance between the base and the center of gravity is increased as a result of support of extended arms which causes decreased stability (3). The aim of this systematic review was to investigate the performance of the handstand from a biomechanical perspective.

METHODS:

Databases SPORTDiscus, ScienceDirect and PubMed were searched up to November 2020. The search terms used were "EMG or Electromyography and Handstand AND Gymnastics", "Kinetics AND Kinematics and Handstand AND Gymnastics" "Kinetics AND Handstand", "Kinematics AND Handstand". Originally 489 publications were identified, and 19 studies were included in this systematic review.

RESULTS:

From the data extracted from the articles, 31% of studies conducted an analysis of balance-control-strategies in the handstand, 57% conducted a kinetic and kinematic analysis of the handstand and 10% of publications compared muscle activity during the handstand. 42% analyzed centre of pressure, 36% analyzed joint angles, 21% reported on velocity related parameters, 21% reported on joint torque contributions, 15% reported on angular velocity, 10% analyzed ground reaction forces (GRF), 10% reported on EMG and 5% reported on vertical ground reaction forces (vGRF).

CONCLUSION:

Gymnasts employ a 'wrist strategy' to maintain balance in handstands, resorting to a mixed control strategy involving wrists, shoulders, hips, and elbows if needed. Greater strength enhances balance control, while factors like participation level and age also impact handstand performance.

REFERENCES

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