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Editorial

Some Insights Regarding Symmetry Relevance in Biomedicine

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The subject of symmetry has always been a matter of interest in biomedicine, particularly in exercise physiology and biomechanics [1]. Studies have considered static and dynamic symmetry, particularly regarding human comparative movement and locomotion [2–4]. Asymmetry levels can depend on genetics and, thus, laterality (viz., showing a dominant side [5]). Regarding this, static asymmetry was found to negatively affect locomotion performance in both humans [6] and animals [7]. Depending on the specific physical activity, humans tune such innate asymmetry towards higher (e.g., fencing, throwing and tennis) or lower (e.g., ice-skating, skiing and crawl-style swimming) levels. The aim of this editorial was to provide some insights regarding symmetry in biomedicine and, in particular, injury prevention, performance optimization and the relationship between symmetry and ergonomics.

A volleyball spike is a match-winning team-sport fundamental characterized by a high level of asymmetry during both the hitting and landing phases. An improper landing after a high vertical jump might cause non-contact injures to body parts such as the knee and ankle. For correct landing management, the trunk and lower-limb muscles need to be used as force dissipators [8]. Effective force-dissipation strategies decrease injury risk. Afonso et al. [9] published a fully comprehensive review on the kinematics of landing after a volleyball spike-jump in female and male players, with a particular focus on (dynamically) asymmetric (i.e., unilateral) and symmetric (i.e., bilateral) touchdown. They found a prevalence of asymmetric landing (most often on the left foot in right-handed athletes) in all players, but this was more common in males. In terms of practical suggestions for injury prevention, Afonso et al. [9] recommended that coaches assign their players—men, in particular—training protocols to improve their asymmetric landing in terms of both correct coordination and force development.

Bench-press is a very common strength-training exercise, especially among weight-lifters, and is theoretically characterized by a high level of symmetry. Franco-García et al. [10] investigated shoulder kinematics during bench-press with increasing external loads in female and male weight-lifters, with a particular focus on (dynamic) inter-shoulder asymmetry. Contrary to the common belief that this exercise is generically symmetric, high asymmetry levels were detected in terms of range of movement, speed and acceleration over the different exercise phases (i.e., negative-eccentric and positive-concentric [11]) and external loads. In terms of practical suggestions for performance optimization, Franco-García et al. [10] recommended that weight-lifters periodically assess their shoulder kinematic symmetry levels, and possibly counteract them, to better perform during weightlifting competitions.

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In addition to several psycho-physiological stressors (sleep, water and food deprivation; weather-driven hypothermia and dehydration; and altitude-driven hypoxia), aircraft pilots are confined to small cabins with controls on one side. Curiel-Regueros et al. [12] published a research article on body-composition (static) symmetry in male aircraft pilots, assessed using a bioimpedance analyzer. They found some insignificant inter-side asymmetry in all the assessed body segments (i.e., the upper and lower limbs and the trunk), with healthier values in the aircraft cabin control side compared with (female and male non-pilot) controls. In terms of practical suggestions for asymmetry management regarding the relationship between symmetry and aircraft ergonomics, Curiel-Regueros et al. [12] recommended continuing to research the topic and overcoming its limitations (i.e., by measuring skinfolds, using dual-energy X-ray absorptiometry, and recruiting an all-male control group) and starting to assign pilots counter-asymmetry training protocols.

In conclusion, it is confirmed that the subject of symmetry is relevant for both health- and sport-related issues. Much is already known about symmetry in biomedicine, but there are still "gray" areas (e.g., the extent to which humans undertake effective counter-asymmetry strategies to compensate for at least minor asymmetries), which deserve further research.

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