KINETIC ANALYSIS OF COMBAT MOVES: ASSESSING THE LINKS BETWEEN BODY SEGMENTS WEIGHT AND PUNCHES, FRONT KICK AND COUNTERMOVEMENT JUMP PERFORMANCE

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PURPOSE

While the influence of strength and body composition on combat techniques and jumps is widely acknowledged, the dynamics between the force exerted in punches and kicks, the efficiency of countermovement jumps, and the weight distribution across body segments remain underexplored. Therefore, this study investigated the relationships among the performance metrics of direct punches (DP), palm strikes (PS), elbow strikes (ES), and front kicks (FK), as well as countermovement jumps (CMJ), in correlation with the weight of the body segments, including the arms, legs, and trunk.

METHODS

Sixteen male military cadets (22.3 ± 1.8 years, 181.4 ± 7.0 cm, 83.0 ± 8.1 kg, all measurements reported as mean ± SD) serving at the Military Department of Charles University participated in this study. Each participant performed three DP, PS, ES, CMJ, and five FK, in a randomized order. Performance was quantified using a force plate, which measured peak and impact force (N) and impulse (N·s) for the punches and kicks, as well as height (cm), concentric peak velocity (m/s), and both peak and impact force (N) for the CMJ within the breaking phase. Additionally, Dual-energy X-ray absorptiometry (DXA) was employed to find participants' body segment weights. Spearman's correlation coefficient was used for statistical analysis of the data.

RESULTS

Results indicated a strong correlation between kicking leg weight and FK impulse ($r = 0.64$, $p \leq 0.01$) and CMJ impact force ($r = 0.80$, $p \leq 0.01$). The striking arm weight was moderately associated with DP impulse ($r = 0.53$, $p \leq 0.05$) and ES impulse ($r = 0.54$, $p \leq 0.05$). Additionally, FK peak and impact forces were strongly associated with CMJ height ($r = 0.74$, $p \leq 0.01$; $r = 0.77$, $p \leq 0.01$, respectively) and with CMJ concentric peak velocity ($r = 0.63$, $p \leq 0.05$; $r = 0.54$, $p \leq 0.05$, respectively).

CONCLUSIONS

The study demonstrates associations between body segment weights and performance in specific combat moves. The positive correlations between the striking arm weight and the impulse in direct punches and elbow strikes may suggest that targeted arm strength training could enhance these striking capabilities. Additionally, the strong association between kick force and jump height may indicate that improvements in leg acceleration strength may directly improve front kicking and vertical jump performance, which are essential in combat scenarios. These insights are particularly relevant for military training programs, where optimizing each aspect of physical performance is vital. The study highlights the need for a more nuanced approach to strength training and testing in military contexts, considering the specific associations between body segment weights and performance in various combat techniques.

Figure 1. On the left, a participant before performing a front kick against a force plate attached to the wall;
on the right, a participant is executing a maximal effort countermovement jump on force plates.

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