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ORIGINAL ARTICLE

Relationships between power outputs measured from force-velocity test, Optojump test and Five-jump test in male shot putters

Relation entre les puissances mesurées par le test charge-vitesse, l'Optojump test et le Five-jump test chez les lanceurs de poids

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Anthropometric parameters;
Peak power;
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Summary
Purpose. — The purpose was to investigate relationships between force-velocity peak power output, Optojump average power output, 5-jump relative leg length power output and shot put performance.
Methods. — Twelve shot putters participated in this study ($n = 12$, age 18.8 ± 1.5 years, weight = 96.6 ± 8.8 kg, height = 178 ± 7 cm, BMI = 30.5 ± 3.2 kg·m^{-2}). Force-velocity peak power output, Optojump average power output and 5-jump relative leg length power output were estimated using force-velocity test, Optojump test and 5-jump test, respectively. Shot put performances were measured during a simulated competition.

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Results. — Significant correlations were found between absolute value force-velocity peak power output (W) and leg muscle volume ($r = 0.80$; $P < 0.01$) and between force-velocity peak power output expressed relatively to body mass value and average vertical jump height ($r = 0.77$; $P < 0.01$). Shot put performance was significantly correlated with force-velocity peak power output (W) and maximal force ($r = 0.81$; $P < 0.01$; $r = 0.63$; $P < 0.05$), respectively. Optojump average power output and 5-jump relative leg length power output were not correlated to shot put performance ($r = -0.25$; $r = 0.55$), respectively.
Conclusion. — The correlation between force-velocity peak power output (W) and shot put performance showed that force-velocity test constitutes a useful tool assessing peak power output in shot putter athletes. Optojump test and 5-jump test seem not to be accurate for such subjects. Technical abilities and fat mass probably constitute the limiting factor in shot putter during those tests.

MOTS CLÉS
Paramètres anthropométriques ;
Pic de puissance ;
Détente verticale ;
Lancer du poids

Résumé
Objectif. — L'objectif était d'étudier les relations entre les valeurs de puissance charge-vitesse, Optojump test (OJT) et 5-jump test (5JT) avec la performance sportive.
Méthodes. — Douze lanceurs de poids ont participé à cette étude ($n = 12$, âge $18,8 \pm 1,5$ ans, masse corporelle = $96,6 \pm 8,8$ kg, taille = 178 ± 7 cm, IMC = $30,5 \pm 3,2$ kg·m^{-2}). Le pic de puissance charge-vitesse a été mesuré à l'aide d'un test charge-vitesse. Les valeurs moyenne et relative de puissance ont été estimées par l'OJT et le 5JT, respectivement. La performance sportive a été mesurée dans les conditions réglementaires.
Résultats. — Des corrélations significatives ont été enregistrées entre la valeur absolue du pic de puissance charge-vitesse (W) et le volume musculaire des jambes ($r = 0,80$; $p < 0,01$) et entre la valeur relative du pic de puissance charge-vitesse (W·kg^{-1}) avec la masse corporelle et la hauteur moyenne de détente verticale ($r = 0,77$; $p < 0,01$). La performance sportive était significativement corrélée avec le pic de puissance charge-vitesse (W) et la force maximale ($r = 0,81$; $p < 0,01$; $r = 0,63$; $p < 0,05$), respectivement. La moyenne de puissance Optojump (W·kg^{-1}) et la puissance relative du 5JT ne sont pas corrélées avec la performance sportive ($r = -0,25$; $r = 0,55$), respectivement.
Conclusion. — La corrélation entre le pic de puissance charge-vitesse (W) et la performance sportive a montré que le test charge-vitesse constitue un outil utile dans l'évaluation de pic de puissance des lanceurs de poids. L'OJT et 5JT ne semblent pas être adéquat pour ces sujets. Les capacités techniques et la masse grasse constituent probablement les facteurs limitant chez les lanceurs de poids.

1. Introduction

Different sports activities are based on explosive actions such as, throwing, jumping, short sprint, weightlifting and swimming short distances. They require assessment tests of athletes' physical abilities. Coaches preferred that these tests must be similar in part, to the used sports activities in order to reproduce the real condition of the sporting gesture.

Several laboratories in collaboration with coaches try to develop some in situ protocols, which are easy to perform and which are able to give immediate results [1,2]. For this reason, the use of field-testing remains one of the suitable solutions that can help coaches in their field evaluation process. In these activities, physical performance is highly dependent on peak power output (PPO) [3,4]. These activities require strength, speed and power as essential physical qualities. To evaluate PPO, several laboratory tests and field have been proposed and validated [1,5,6]. The force-velocity test is the most used one to assess PPO of upper and lower limbs (PPO_{Ergo}) [3,7,8]. Significant correlations were recorded between vertical jump (V·J) and PPO_{Ergo} in sprinters [9], swimmers [8], cycling [10], rugby [11] and tennis players [4,12].

In several previous studies [1,6,13—15], authors proposed Optojump test (OJT) and 5-jump test (5JT) to evaluate athletes' PPO in various disciplines. By using V·J protocols, OJT performance is typically measured for estimating power. Although, 5JT performance is generally expressed in absolute and relative terms, subject body mass and leg length can strongly influence the performance. Davies and Young [10] showed that PPO produced during the impulse on the force platform was correlated with the V·J height and PPO_{Ergo}. Vandewalle et al. [11] found significant correlation between V·J performance and PPO_{Ergo}, in subjects practicing different sports. When, Lehance et al. [6] evaluated the relationship between PPO_{Ergo} and Optojump power output estimated during a V·J test. They concluded that OJT was accurate to analyze lower limbs explosive strength in untrained subjects. Furthermore, Castagna et al. [16]