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CISM Sport Science Abstract
Research line: Psychophysiological military fitness and operational readiness

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Assessment of muscle strength by the mobile application *ready* is valid for military training and selection procedures

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Introduction
Performance tests are relevant in occupations with high physical demands for training planning, selection and injury prevention purposes. Several valid field tests to estimate muscle strength in the lower extremities are available. As such, Armed Forces are using the standing long jump (SLJ) for occupational selections (Foulis et al., 2017; Wyss, Marti, Rossi, Kohler, & Mäder, 2007) and the one repetition maximum (1RM) leg press for individual training planning (Baechle and Earle, 2008). The digital personal trainer of the Swiss Armed Forces (application *ready* #teamarmee) incorporates a fitness test for both purposes. The mobile application *ready* uses the smartphone's built-in accelerometer to assess the flight time of the counter movement jump (CMJ), which is used as an indicator for the muscle performance of the lower extremities. The aim of this study was to analyse the validity of the CMJ of the mobile application *ready* (*ready*-CMJ) for applications in military training and selection procedures.

Methods
In the present paper the results of three different studies with a total of 57 male and 63 female healthy volunteers aged 18 to 30 years were combined. Firstly, 35 volunteers (27 females and 8 males) performed the *ready*-CMJ while assessed at the same time by the gold standard for flight time (Optojump Next, Microgate GmbH, Bozen, Italy). Second, 71 volunteers (29 females and 42 males) performed the *ready*-CMJ in comparison to the SLJ. Third, 14 volunteers (7 females and 7 males) performed the *ready*-CMJ in comparison to the 1RM leg press. The 1RM leg press test was performed according to the protocol of Baechle and Earle (2008). The *ready*-CMJ was performed with both hands holding a smartphone to the chest, evaluating flight time on 0.001s. Descriptive and statistical analyses were performed to assess correlation coefficients, group comparisons and linear regressions. Data are shown as mean±standard deviation.

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Results

In the first study, the mobile application *ready* measured 1.5% (p<0.05) lower flight time (0.453±0.060s vs. 0.460±0.065s) than the Optojump system. The data were strongly correlated (r=0.839, p<0.05) with a modest root-mean-square error of 5.5%. In the second study the volunteers reached an average flight time of 0.596±0.058s in the *ready*-CMJ compared to a distance of 2.35±0.36m in the SLJ. The correlation between the two tests was strong (r=0.829, p<0.05). In the third study, the volunteers reached an average flight time of 0.432±0.098s in the *ready*-CMJ compared to 181.57±43.08kg in the 1RM leg press test. The correlation coefficient between the two tests was high (r=0.782, p<0.05) and increased when body weight was included in the linear regression to estimate 1RM from *ready*-CMJ data (r=0.837, p<0.05). The regression formulas to calculate jump height, SLJ and 1RM from CMJ are presented in Table 1. *Ready*-CMJ performance in the second study group was significantly (p<0.05) higher than in the first and third study group (which did not differ among each other, p=0.551)

Table 1: Estimated muscle strength indicators based on *ready*-CMJ data.

Dependent variable	Estimation based on *ready*-CMJ data	*r*
Jump height [m]	Jump height = $(g * t_{CMJ}^2) / 8$	1.00
Standing long jump [m]	SLJ = $5.176 * t_{CMJ} - 0.752$	0.83
1RM leg press [kg]	1RM = $249{,}927 * t_{CMJ} + 1.264 * BW - 10.265$	0.84

Notes: *ready*-CMJ = counter movement jump assessed by the mobile application *ready*, SLJ = standing long jump [m], BW = body weight [kg], t_{CMJ} = flight time *ready*-CMJ [s], 1RM = one repetition maximum leg press [kg], g = 9.81 m/s^2.

Limitations

The three study groups were of different numbers of participants and gender distributions. Therefore, CMJ performances in the second group with more well trained men was higher. In a future study, all three parts of such a study should be performed by the same participants representing both genders equally as well as different age groups and fitness levels.

Practical implications

The results showed that the modified CMJ assessed by the mobile application *ready* #teamarmee reported a strong correlation with the measured flight time, the SLJ and the 1RM leg press. The present study offers conversion formulas from *ready*-CMJ results to SLJ and 1RM leg press data. To conclude, the mobile application can be recommended to assess lower extremities' muscle strength in a field setting. The *ready*-CMJ demonstrated to be valid as an instrument for military selection and training optimization procedures.

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References

Beachle, T.R., Earle, R.W. (2008). Essentials of Strength Training and Conditioning, NSCA - National Strength & Conditioning Association.

Foulis, S. A., Sharp, M. A., Redmond, J. E., Frykman, P. N., Warr, B. J., Gebhardt, D. L., . . . Zambraski, E. J. (2017). U.S. Army Physical Demands Study: Development of the Occupational Physical Assessment Test for Combat Arms soldiers. J Sci Med Sport, 20 Suppl 4, S74-S78. doi:10.1016/j.jsams.2017.07.018.

Wyss, T., Marti, B., Rossi, S., Kohler, U., & Mäder, U. (2007). Assembling and verification of a fitness test battery for the recruitment of the Swiss Army and Nation-wide use. Schw Zeitschr Sportmed Sporttraumatol, 55(4), 126-131.

***Ready* #teamarmee**

https://apps.apple.com/ch/app/ready-fit-for-teamarmee/id1453160942
https://play.google.com/store/apps/details?id=ch.zem.ready