

Letter to Editor concerning “Push up, explosive push up and free fall tests to evaluate the upper body power: A preliminary study in aerobic gymnastics”

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Dear Editor:

Push up exercises have been widely studied (Dhahbi et al., 2018) and it is very interesting to study in depth this exercise. Recently, the Journal of Human Sport & Exercise published the article titled “*Push up, explosive push-up and free fall tests to evaluate the upper body power: A preliminary study in aerobic gymnastics*” (Albano et al., 2021). We appreciate the authors' efforts to show a relationship between the push-up exercise and injury prevention in aerobic gymnastics. This article promotes a simple but worthy of further scientific evaluation approach. The present letter points a few issues which are still necessary to verify. In particular, we suggest some methodological shortcomings which lead to dubious interpretation of the results (Russo et al. 2021; Russo et al., 2019; Padulo et al., 2014; Padulo et al., 2013):

1. Two gymnasts (younger than 18 years of age) involved in this study. From the analysis of the text, it appears that informed consent from the parents and ethical committee approval are missing. Moreover the “*Gold level of Italian Gymnastics Federation*” make little sense without details of ranking level/training experience (for example, hours per weekly).

2. The authors state that they acquire data at 1000Hz and used a “*2nd order Butterworth low pass filter with a cut-off frequency of 580Hz, according to Street et al. (2001)*”. This methodological choice to filter ad

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580Hz is misleading, because: a) Street et al. (2001) studied jump height (m) related to the lower limbs while in Albano et al. (2021) studied upper limbs (without data); b) the flight time measure is a simple methodological approach suitable for the concurrent device (thus, accelerometer or photoelectric cells) to estimate the jump height (m) while with force platform the double integration of force (DIF Method) should be used (Attia et al. 2017).

3. A direct consequence of the previous point is the methodological error in the RFD measurement. In 2016, it was suggested that RFD should be measured with a sampling rate higher than 1000Hz (Maffiuletti et al., 2016). Moreover, regarding the filtering process, the same Authors state “*If filtering is unavoidable due to high baseline noise amplitude, then we recommend using a zero lag, low-pass digital filter (e.g., fourth-order Butterworth) (Winter 1990) at the highest possible cut-off frequency, to minimise time shifts.*” (Maffiuletti et al. 2016). Regarding RFD, we point out that in the paper it was defined as “*ratio between Fmax and time from the start of the push to the peak force*”, but the proper definition should be “*the rate of change of the force value in the defined time interval*” (Maffiuletti et al. 2016).

4. Elbow flexion during the push up exercise seems to be approximately 90°, but it is unclear how the authors checked this parameter (as demonstrated from the figure in Albano et al. 2021).

5. The Symmetry Index is defined by Albano et al. (2021) as “*the ratio between Fmax of the left arm and the right arm*” citing (Impellizzeri et al. 2007) and in Table 1 this point it was confirmed (L/R). This point is misleading because Impellizzeri et al. (2007) wrote “[*stronger leg - weaker leg*]/*stronger leg*] × 100”. This is different compared to the methodological approach used by Albano et al. (2021).

6. Figures 4-5-6 show the ground reaction force during the three different push up modalities, but it is not clear whether these are real or ideal data, and whether they are average values of both subjects or limbs. Moreover, the first peak in Figure 5 do not match the description of the exercise.

7. There was no mention of how the experimental conditions were controlled (for example, laboratory temperature and humidity, subject positioning, test–retest for measurement repeatability (Intra-class correlation coefficient) (Hopkins, 2000), time of the day when the tests took place) (Ammar et al., 2015).

8. Finally, no results or statistical analyses are available. The reader has to rely on three figures and one table including the data about the explosive push up test for one subject only.

9. The authors stated aim was to identify, if present, the relationship between the push-up exercise and injury prevention in aerobic gymnastics. Their aim is absolutely commendable, especially given its direct effect on the quality of push-up exercise. Unfortunately, missing data about test performed, reliability of the measurements, sample size/power, participants’ characteristics, materials and methods impair the validity of the study.

In conclusion, the attention of researchers should be focused on the need to strict and reproducible experimental design and methodology. We hope that the points raised will be useful to improve the quality of research on this topic.

Keywords: Biomechanics; Push up; Strength; Power; Jump height.

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