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ORIGINAL ARTICLE

# Acute effects of static stretching or whole body vibration on peak torque and peak power of collegiate athletes

## *Comparaison des effets aigus d'étirements statiques et de vibration corps entier sur le couple force et la puissance musculaire des membres inférieurs dans une population d'étudiants*

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**KEYWORDS**
Whole body vibration;
Vibration;
Static stretching;
Power

**Summary**
*Introduction.* — Several studies have reported that stretching before exercise or performance events in fact reduces isometric muscle strength; conversely, recent studies suggested that low amplitude, low frequency mechanical stimulation of the human body is a harmless and efficient way to train musculoskeletal structures. The aim of this study was to compare the acute effects of static stretching and whole body vibration (WBV) on peak torque (PT) and peak power of collegiate athletes, and to see if there will be any positive effect of whole body vibration on possible decrease of peak power or torque after static stretching.
*Subjects and methods.* — Twenty college athletes enrolled in fitness class (age: $24.1 \pm 2.38$ years; body mass: $69.48 \pm 11.40$ kg; height: $174.15 \pm 0.8$ cm) volunteered to participate in the study. Peak torque and peak power data were obtained in a total of three days before and after stretching and after WBV.
*Results.* — Post-stretching and vibration values for both extension and flexion position were not significantly higher than the baseline values even though there was significant difference between pre- stretching and post-stretching ($P > 0.05$). Peak torque values of the subjects were decreased insignificantly after stretching compared to baseline measurements.
*Conclusion.* — To conclude, these results may not be satisfactory to provide ultimate findings in solving the disagreement between the studies. In future studies, effects of static stretching

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and vibration on chosen physiological parameters should be investigated in different levels of athletes with different arrangements of frequency, duration and volume of vibration application combined with static stretching.


**MOTS CLÉS**
Vibration corps entier ;
Étirement statique ;
Puissance musculaire

**Résumé**
*Introduction.* — Plusieurs études ont suggéré que la réalisation d'étirements avant l'exercice diminuait la force isométrique des muscles. À l'inverse, de récentes études mettent en évidence qu'une stimulation de type vibration corps entier à basse fréquence est un moyen efficace et sans risque pour entraîner le système musculaire. Le but de cette étude est de comparer les effets aigus d'étirements statiques et d'une sollicitation de type vibration corps entier sur le couple de force et la puissance musculaire des membres inférieurs chez des étudiants.
*Méthodes.* — Vingt étudiants sportifs inscrits à des cours de fitness (âge : 24,1 ± 2,38, masse corporelle : 69,48 ± 11,40 kg, taille : 174,15 ± 0,8 cm) ont volontairement participé à l'étude.
*Résultats.* — Les résultats obtenus après la vibration et l'étirement statique ne montrent aucune amélioration significative de la performance musculaire. À l'inverse, le couple de force a diminué de façon significative après l'étirement.
*Conclusion.* — En conclusion, ces résultats ne permettent pas de conclure à l'effet de la vibration et/ou des étirements sur la performance musculaire. Des études ultérieures sont nécessaires pour examiner l'effet de la vibration corps entier et des étirements statiques chez des sportifs de différents niveaux.


## 1. Introduction

Stretching is frequently performed before exercise and athletic events [1,2]. Traditionally, it is assumed that escalating joint range of motion (ROM) will support superior performance [3] but some studies have reported that stretching before exercise reduces isometric [4,5] and dynamic muscle strength [6,7]. Consequently, this phenomenon has been defined as the stretching-induced force deficit [8]. Two main hypotheses have been projected to enlighten the stretching-induced force deficit phenomenon [8,9]:

- mechanical factors such as decreases in muscle stiffness may affect the length—tension relationship;
- neural factors such as altered motor control strategies and/or reflex sensitivity.

It was also indicated that static stretching before vigorous activities decreases force production [10—12].

Another application intended to improve performance is vibration training. Vibration training has been studied widely for its hazardous effects on humans at particular amplitudes and frequencies. Recent studies suggested that low amplitude, low frequency mechanical stimulation of the human body is a harmless and efficient way to train musculoskeletal structures. Essentially, it increases the muscular strength and power of individuals even if there are some contradictory results concerning the effects of vibration training on the muscular performance [13—15]. A decrease in muscle stiffness is a mechanical factor for stretching-induced force deficit that may affect the length—tension relationship. Within the skeletal muscles, each cross-bridge between the actin and myosin myofilaments produces some stiffness [16]. Muscles can damp externally applied vibrations and, in reality, extra vibration energy is absorbed by activated muscle [17] rather than by muscles in firmness signifying that the active cross-bridge cycling is a vital part of the damping practice [18]. Not many studies compared the acute effects of static and whole body vibration on muscle performance. Thus, the aim of this study was to compare the acute effects of static stretching and whole body vibration (WBV) on peak torque (PT) and peak power of collegiate athletes. In order to address the controversy of using SS (static stretching) in pre-competition warm-up protocols, WBV is applied after static stretching to observe if vibration might diminish the negative effects of SS.

## 2. Methods

### 2.1. Subjects

Twenty college athletes enrolled in fitness class (age 24.1 ± 2.3 years; body mass 69.4 ± 11.4 kg; height 174.1 ± 0.8 cm) volunteered to participate in the study. The subjects were healthy and indicated no existing or current knee-, hip- or ankle-related injuries and no noticeable limits in knee ROM (range of motion). The university local ethic committee approved the study and a health history questionnaire and signed informed consent forms were completed by all subjects before testing. Aim and procedures of the study were illustrated to each participant and all procedures conformed to the Helsinki declaration as revised in 2008.