Introduction

• Aim of resistance training
  – Develop muscles specifically
  – Improve athletic performance

• Limits of traditional free weight resistance training
  – Force needed to initiate the movement
  – Low velocity at the beginning of the movement
  – Decrease of force toward the end of movement

• Pneumatic resistance could be an interesting alternative (Frost et al, 2008)
Introduction

Bench press with pneumatic resistance
Not subject to inertia nor momentum !!!

45% 1RM (Frost et al, 2008)

Pneumatic versus isoinertial resistance

• The only inertia that need to be overcome = mass of the arms and the barbell
• Limited inertia => lower force to initiate movement => superior velocity.
• Toward the end of movement superior level of force could be maintained.
Introduction

Pneumatic versus Isoinertial resistance

Aim of the study

• Both resistance modalities have advantages and disadvantages

• The effect of combining isoinertial with pneumatic loading on F-V-P is still unknown

• The aim of this study was to determine how different isoinertial-pneumatic ratio influence the F-V-P relationships during bench-press.
**Methods**

**15 healthy males subjects**

- **Familiarization 1**
  - Bench press position standardization
  - Familiarization with pneumatic and isoinertial resistance
  - Isoinertial 1RM

- **Familiarization 2**
  - Familiarization with pneumatic and isoinertial resistance
  - Pneumatic 1RM

- **Testing session**
  - Influence of pneumatic/isoinertial ratio on F-P-V relationships

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**Methods**

**Experimental Design**

- **5 pneumatic/isoinertial ratio**
  - 100%P
  - 75P-25I
  - 50P-50I
  - 25P-75I
  - 100%I

- **5 increasing loads**
  - 30% – 45% – 60% – 75% – 90% 1RM

- **Randomized order**

- **Maximum intensity + intention to throw the bar**
Methods
F-P-V measurements

Keiser Rack 3111, USA

Linear Position Sensor
Rack wires
Pneumatic Force

\[ F_{\text{total}} = m(a+g) + F_{\text{PNE}} \]

\[ P = v \cdot F_{\text{total}} \]
RESULTS

30% 1RM Difference between 100P and 100I
CONCLUSION

- **Kinetics and kinematics patterns are affected** by loading type during ballistic bench press
  - Pneumatic resistance should be used to:
    - Enhance velocity development in the initial phase
    - Increase force toward the end of the movement
  - Iso-inertial resistance should be used to:
    - Improve force in the initial phase
    - Increase velocity toward the end of movement
    - To favour maximal power output
- Influence of the resistance ratio on the slope of the force-velocity relationship
- *Pneumatic* loading elicit a FV profile oriented towards velocity vs. a force-oriented profile for *isoinertial* loading
- The repartition between resistance types can be adapted to meet the specific demands of each sport

Acknowledgments

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