THE FLORIDA STATE UNIVERSITY

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Optimizing Periodization and Program Design Muscle Performance Adaptations

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Overview

- 2 Parts:
  - 1. Definitions/Examining the Data, 2. Progression/Implementation
- Defining Periodization
- Background Data
  - Linear vs. Non-Periodized
  - Linear vs. Undulating
- How to Design a Program
  - DUP, Liner, and Block
- Not, does this work? **Is This Optimal?**

Periodization

Periodization: Planned manipulation of training variables to maximize adaptations

(Buford et al. 2007)

- 1. Linear Periodization – Altering training volume and intensity across multiple mesocycles (Buford et al. 2007)
- 2. Undulating Periodization
  - **Daily Undulating Periodization (DUP)**
  - Alterations each training session
- **Non-Periodized:** Constant intensity and volume throughout a training cycle. (Fleck 1999)

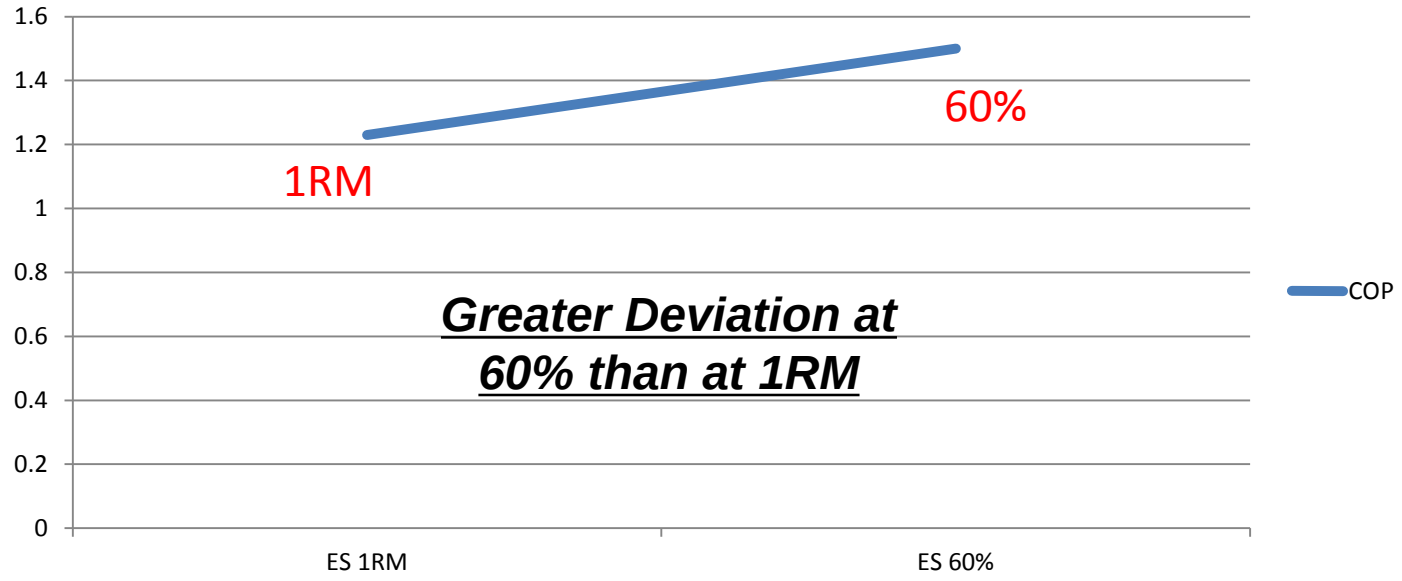
Resistance Training Emphases

- **Traditional Hypertrophy** – Moderate-High Repetitions (8-12)/Moderate-Low Intensity
- **Traditional Strength** – Low-Moderate Repetitions (≤6)/High Intensity
- **Power Training?**

Baechle and Earle 2001

Illustrating Low Load Motor Pattern Deviaition

This Data Demonstrates a Significant Difference in Distance From Center in Experienced Lifters Between a 1RM and a 60% Squat (p=0.01)

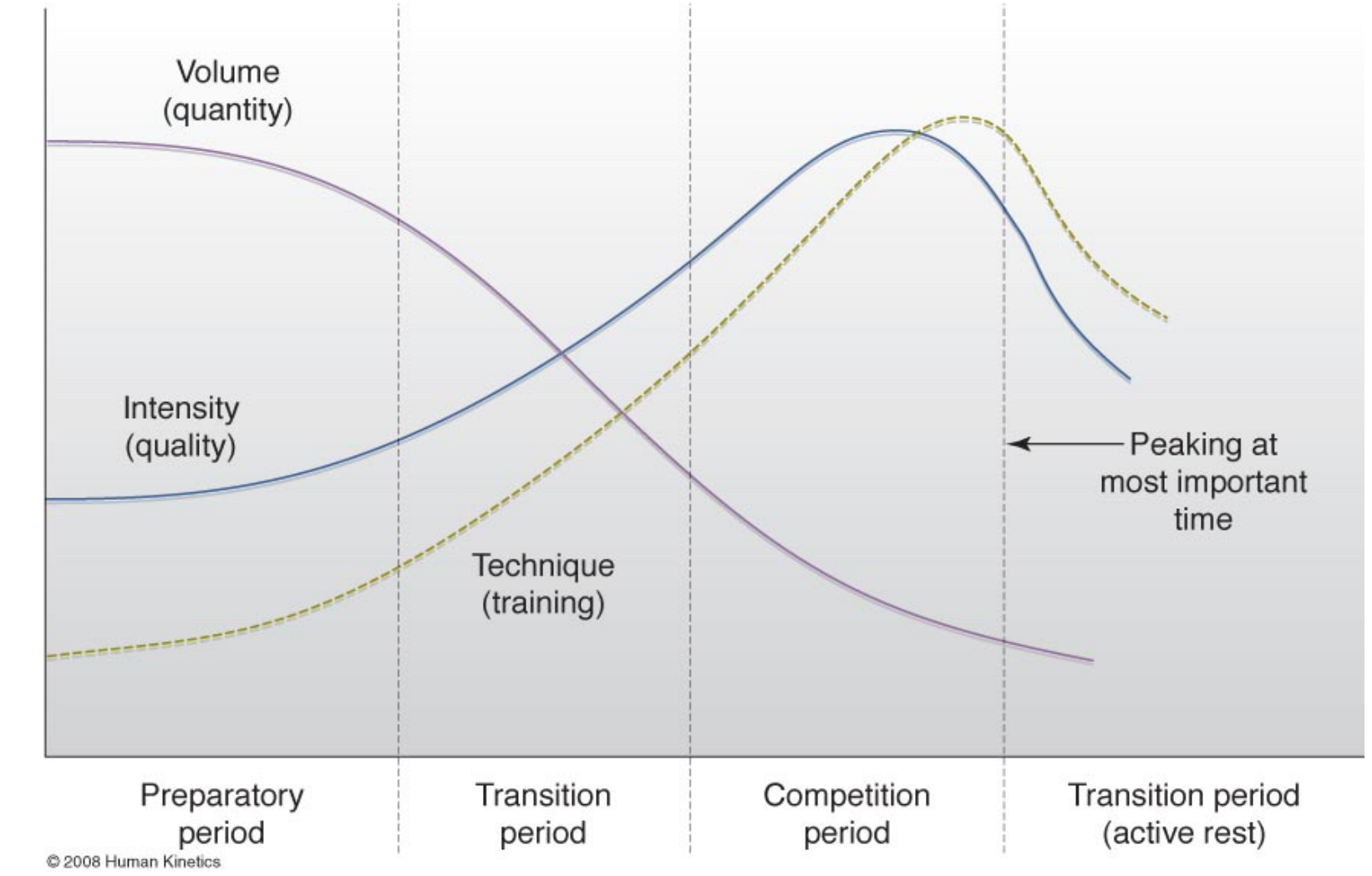


Zourdos et al. In Preparation

Periodization Rationale: Interrelationship

- **Bottom-Line:** Increases in hypertrophy, strength, and power are **interrelated** and in some cases possibly dependent on each other. Due to this it is important to utilize a periodized training program, even when one specific goal is the outcome.
    - Linear Periodization
    - Undulating Periodization

Traditional (Linear) Periodization

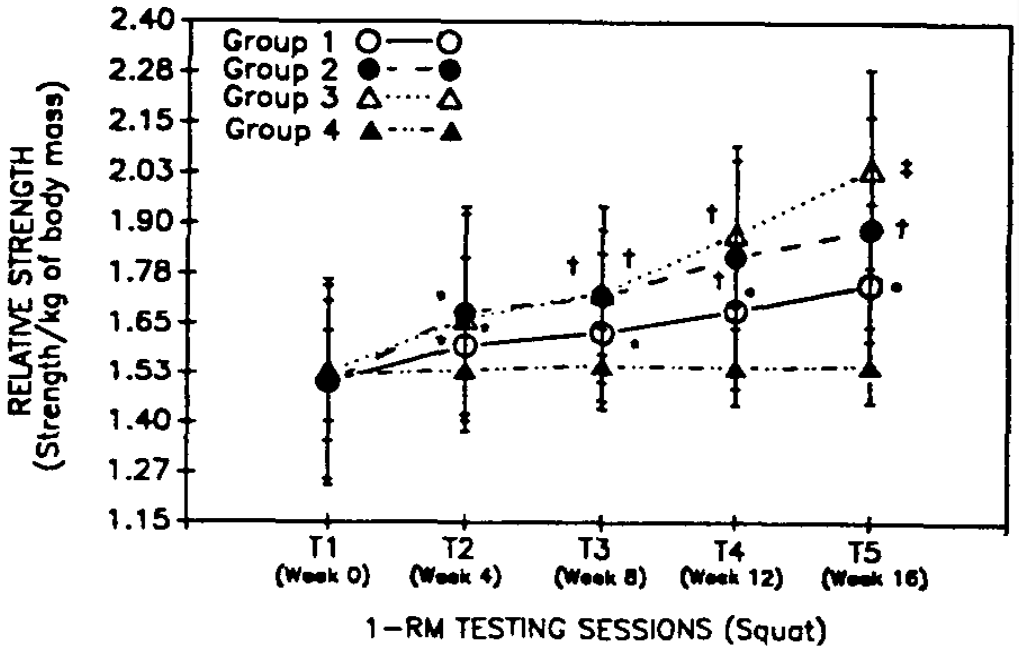


From Stone and O'Bryant, 1987.

Examining The Data: Non-Periodized Vs. Linear Periodiztion

Periodized vs. Non-Periodized Strength

Back Squat 1RM Increase w/ LP



LP BREAKDOWN – GROUP 3

4 weeks – 5X10 RM (80 % 1-RM)
4 weeks - 6X8 RM (83.3 % 1-RM)
4 weeks – 3X6-RM with (87.6% 1-RM)
4 weeks of 3X4-RM with (92.4% 1-RM)

NP#1=5X10RM
NP#2=6X8RM
C=No Training

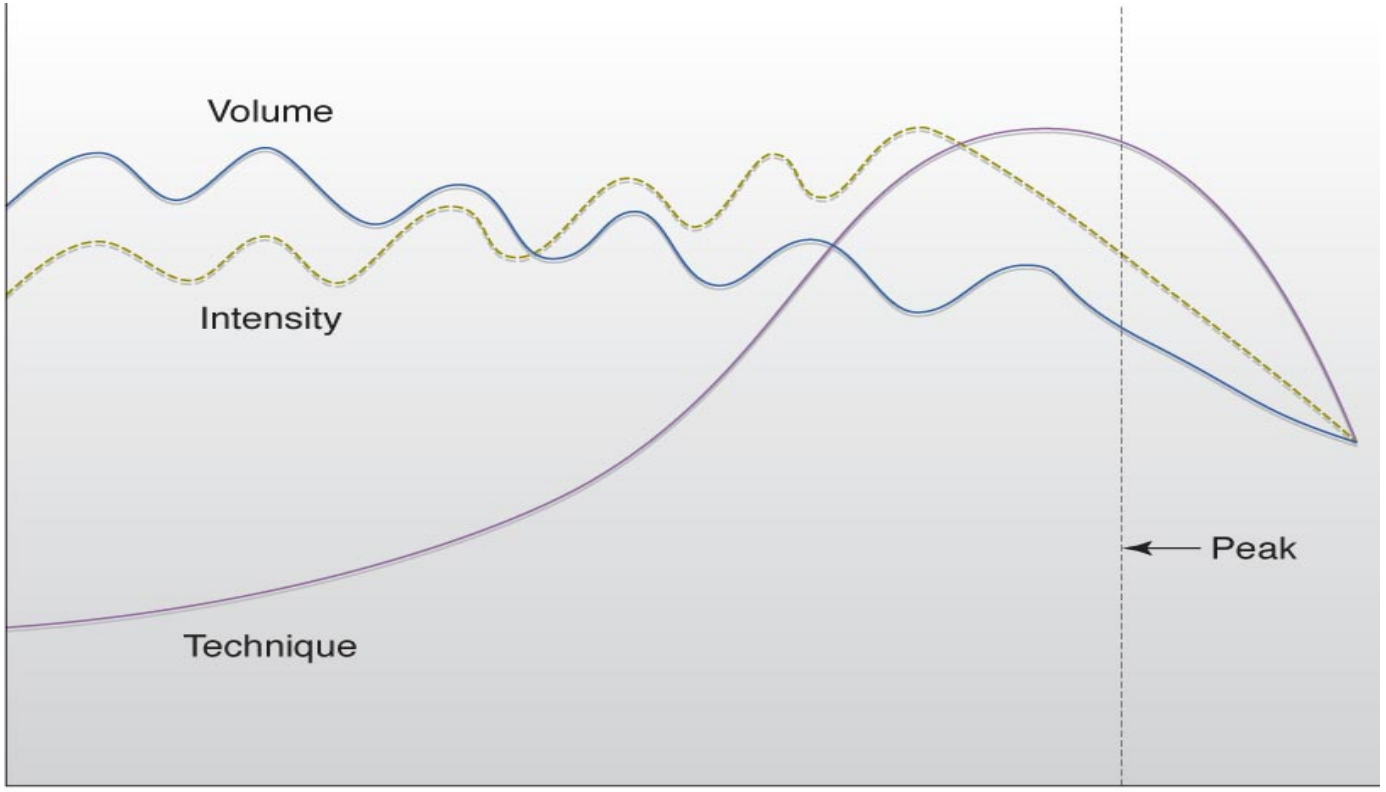
Willoughby 1993

Mechanisms/Limitations of Linear Periodization

- **Positive Mechanisms:** Allows for more variation than non-periodized training
- **Limitations:** May lead to loss of specific adaptations due to extended time in one phase
  - Motor Unit Recruitment
- **Conclusion**: Linear yields greater gains than non-periodized training

But, Is it Optimal?

Non-Linear/Undulating Model



Stone and O'Bryant, 1987.

Undulating Design

- Weekly Undulating Periodization (WUP)
  - Alterations every week (Baker et al. 1994)
- **Daily Undulating Periodization (DUP)**
  - Alterations each training session (Buford et al. 2007)
- Non-linear Periodization (NLP)
  - May constitute any undulating design (Monteiro et al. 2009)

Examining The Data:

Linear Periodiztion
Vs.
Undulating Periodization

DUP Is Superior To Linear

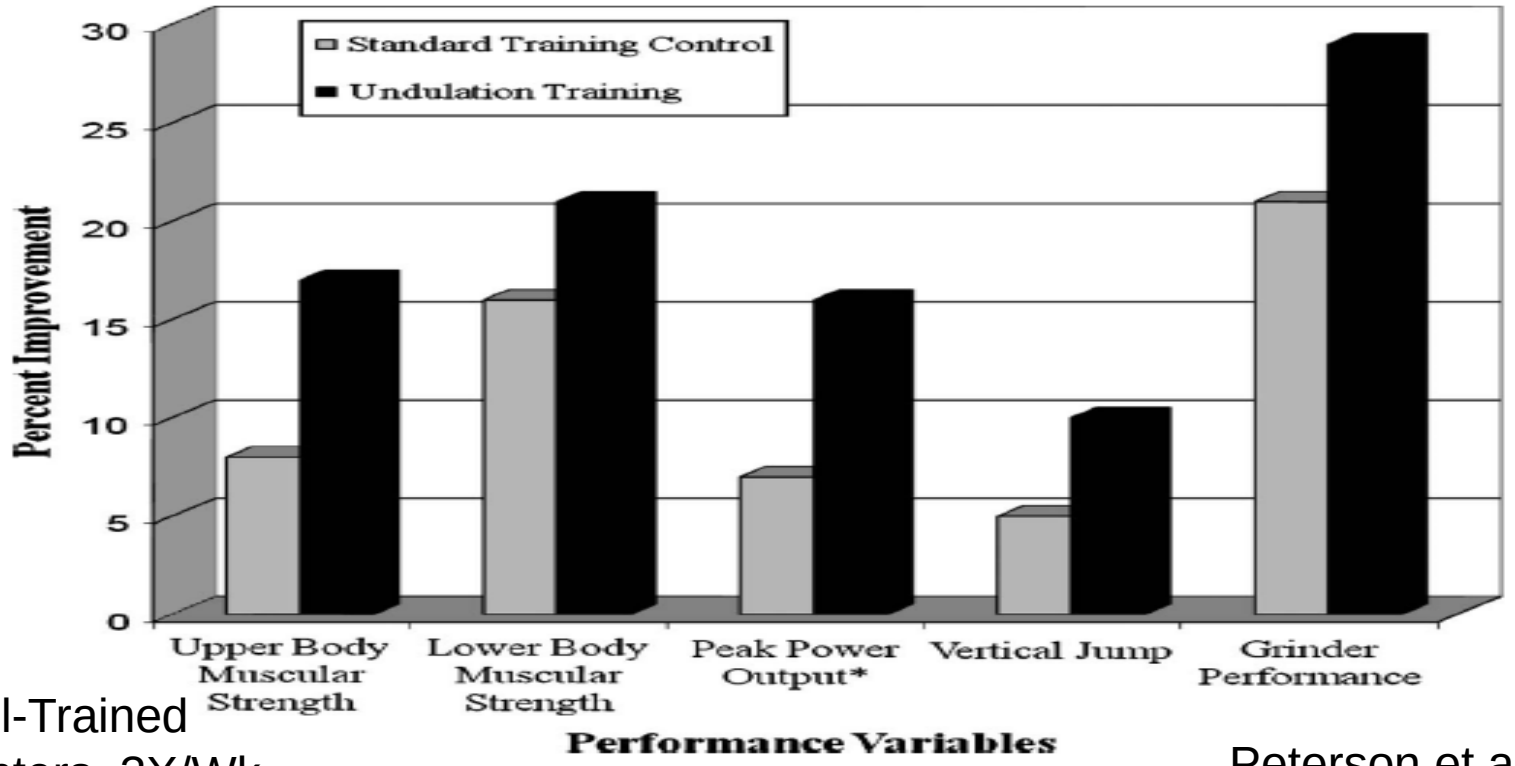
Exercise	Exercise	Percentage Increase in 1RM Strength
Linear Periodization	Bench Press	14.37%*
	Leg Press	28.78%*
DUP	Bench Press	25.61%**
	Leg Press	55.78%**

-20 Trained Males: At Least 2Days/2wk. Training for 2 years
-12 Week Training Study, 3Days/wk.
*Significantly Different From Baseline
**% Gain Significantly Different From Baseline and LP Group

Rhea et al. 2002

DUP Yields Greater 1RM In Trained Males Than LP

Effect Sizes > 0.50 and increased power/task performance



14 Well-Trained Firefighters, 3X/Wk. for 9 Weeks

Peterson et al. 2008

DUP Design

How To Design DUP

- **2 Options** how DUP is designed in the literature
  - **1. Undulate the typical training phases**
    - **Peterson et al. 2008**

DUP	Day I	Day II	Day III
Squat	Hypertrophy	Strength	Power

Training emphasis	Repetitions	Intensity
Hypertrophy	8-12	65-75%
Strength	≤ 6	85-95%
Power	1	80-90%

How To Design DUP

- 2 Options DUP is designed in the literature
  - 2. Undulate the reps

Rhea et al. 2002

DUP	Day I	Day II	Day III
Squat	4X8	5X6	6X4

No Typical 'Power' Day, but the repetitions still undulate to classify as 'DUP'

DUP Works, But Is It Optimal?

Traditional Model: Adapted from Peterson et al. 2008

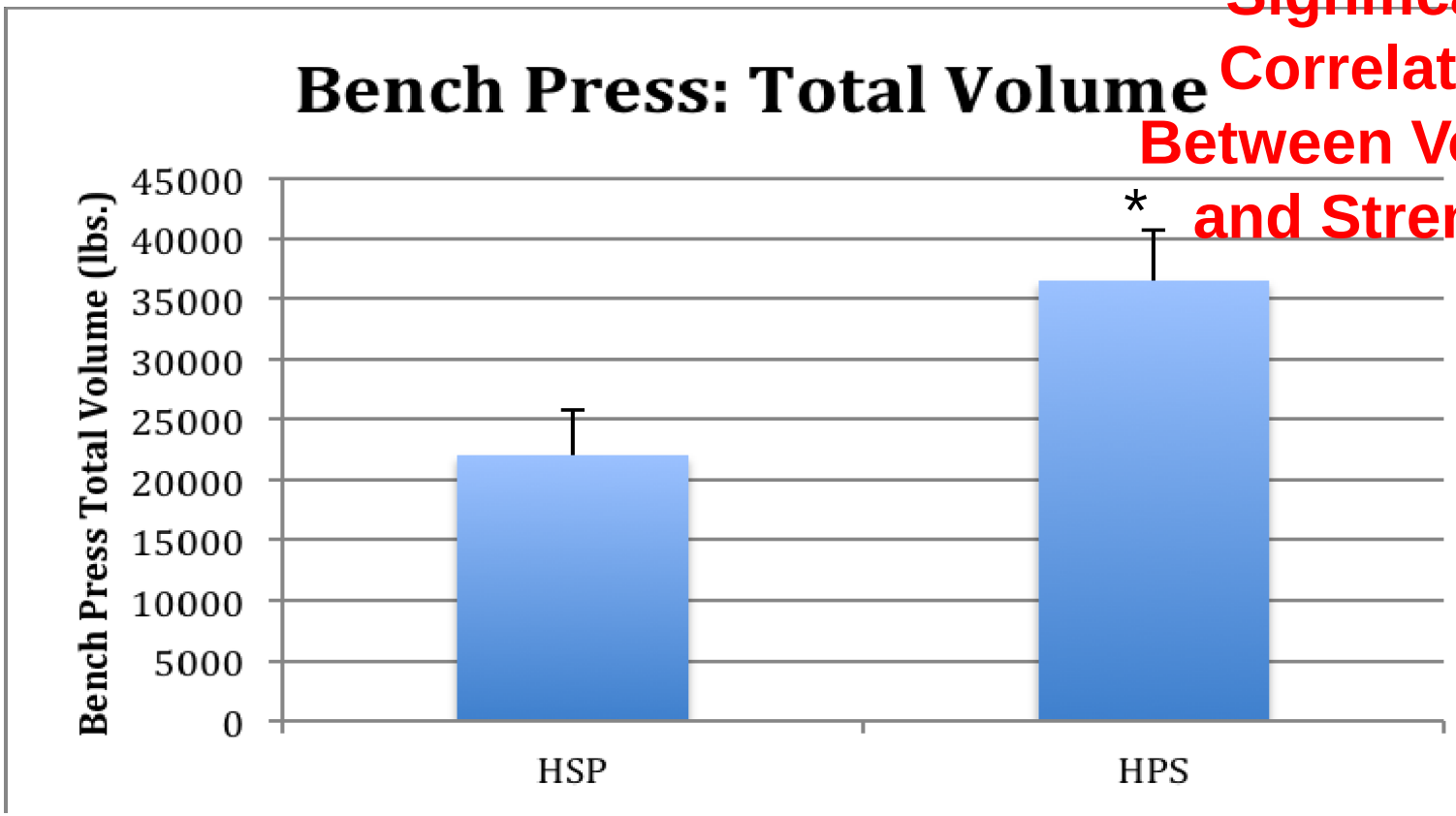
A

UT Model	Day I	Day II	Day III
Upper Body	Endurance/Hypertrophy	Strength	Power/Speed
Lower Body	Strength	Power/Speed	Endurance/Hypertrophy

Modified Model: **Does This Allow For More Volume?**

DUP	Day I	Day II	Day III
Full Body	Hypertrophy	Power	Strength

Strength is Related to Volume

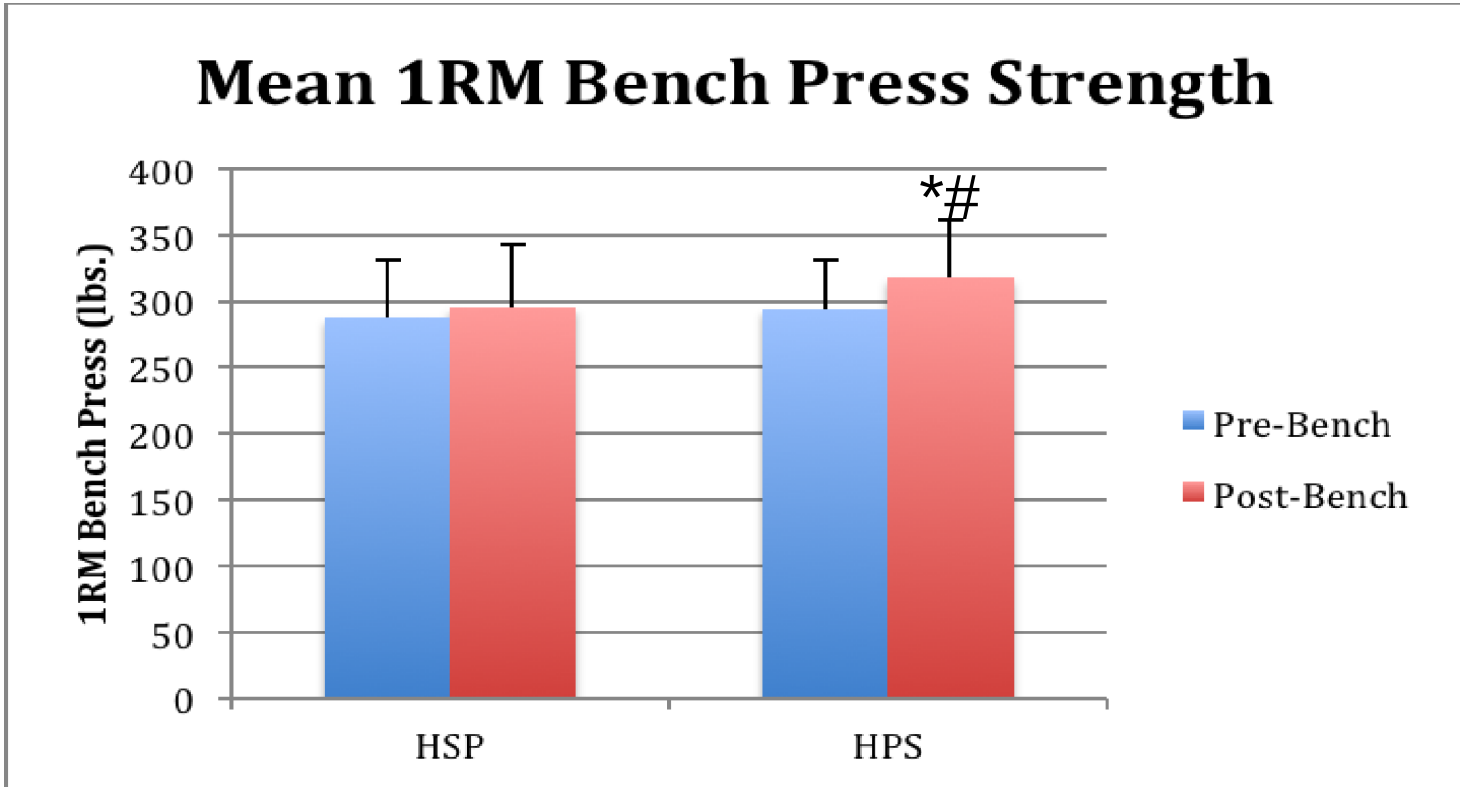


Significant Correlation Between Volume and Strength

*p<0.05, significantly different from HSP

Zourdos et al. In Preparation

Results: 1RM Bench Press Strength



*p<0.05, significantly different from pre-training
#p<0.05, significantly different from post-training HSP

Zourdos et al. In Preparation

Flexible Nonlinear: Training When Ready

Flexible Nonlinear > NLP for Maximum Strength

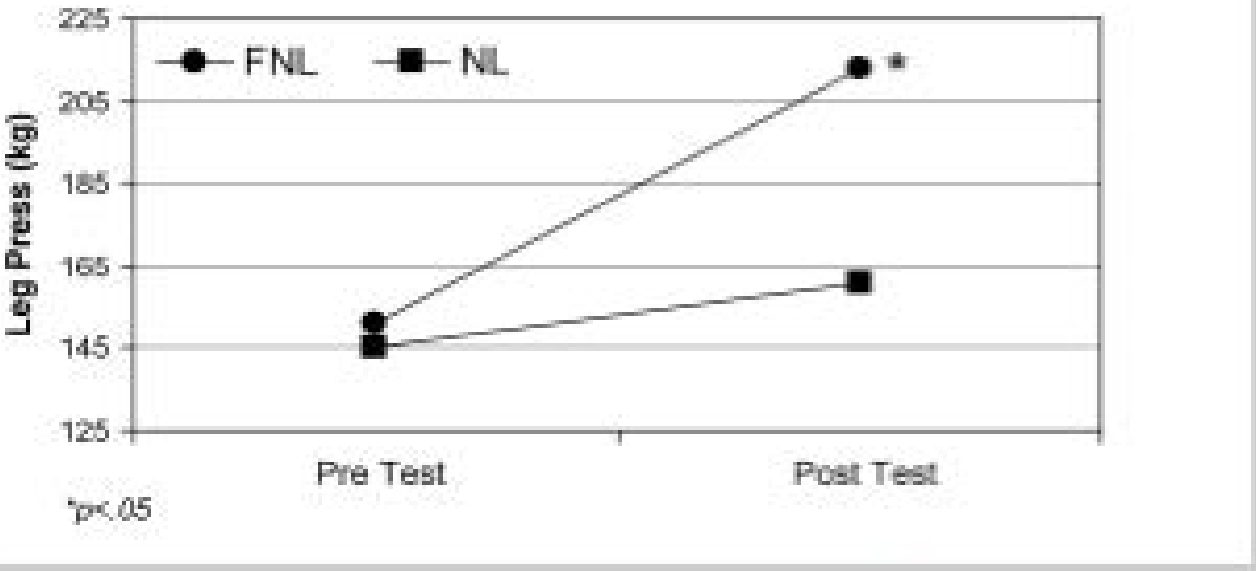


Figure 1. Superior leg press performance using a flexible non-(FNL) periodized workout program compared to a non-linear periodized one. $p = 0.02$. Pretest and posttest mean leg press results shown by group.

McNamara and Stearne 2010

Research Notes

- Muscle Performance Adaptations (i.e. Hypertrophy/Strength) are **related to training volume and not muscle damage**
  - **Volume (Sets X Repetitions X Wt. Lifted)**
  - **Structure Volume Accordingly**
- Research gives us an idea, however, we have to take the 'cookie-cutter' research programs and practically implement them.

Specificity: Training Ratios

Option 1: Is a 1:1:1 ratio

DUP	Day I	Day II	Day III
Squat	Hypertrophy	Power	Strength

Option 2: Is a 1:1:1 ratio

DUP	Day I	Day II	Day III
Squat	4X12	5X8	6X4

Make The Ratios Specific

- Current Ratio Hypertrophy : Strength : Power
  - 1:1:1
- Powerlifter may utilize a 2:1:1 ratio in favor of strength…endless possibilities
- Optimal Ratio
  - Does it exist?

Applying The Literature

- Bridge the gap between science and application
- Linear, Block, and DUP are **NOT** mutually exclusive
- We want to take the relatively new concept of DUP (and the unique designs) and implement them into a linear and block fashion

Block Periodization

- Preparatory Phase
  - Multiple Mesocycles
    - Volume Blocks
- Peak Phase
  - Multiple Mesocycles
    - Intensity Blocks

Prep Phase: Volume Block Mesocycle Sample Week

- Volume Block Week 1:
  - Submaximal Intensities
  - Repeated bouts over many sets

Week 1	Day I	Day II	Day III
Squat	4X8 @70%	5X6 @75%	6X4+ @80%

RPE Should Be Around 7-8 During a Volume Block

Implementing RPE for Resistance Training Periodization

- Utilize a 1-10 Scale
- 10 = Max Effort
- 9 = Could Have Completed 1 More Rep
- 8 = Could Have Completed 2 More Reps
- 7 = Could Have Completed 3 More Reps

AUTOREGULATION

Preparation for a volume block?

INTRODUCTORY MICROCYCLE

Muscle Damage

- When an unaccustomed exercise or volume is introduced significant myofiber damage will incur (Nosaka 2006)
  - This will lead to fatigue and soreness resulting in a decreased ability to train
- **Repeated Bout Effect (RBE)**
  - The attenuation of muscle damage and increased performance when an exercise or relative volume is repeated (can occur with just 10%) (Zourdos et al. In Review)

Exam The Data

Implement The Design

Moving Forward, Questioning The Establishment

Recalling Traditional Recommendations:

Is it time to Question This?

- **Hypertrophy** – Moderate-High Repetitions/Moderate-Low Intensity
- **Strength** – Low-Moderate Repetitions /High Intensity
- **Power** – Low Repetitions/Moderate-High Intensity

Training emphasis	Repetitions	Intensity
Hypertrophy	8-12	65-75%
Strength	≤ 6	85-95%
Power	1	80-90%

Or, is there really just a volume/intensity effect

Baechle and Earle 2001

Common Question

- "So, how many sets and reps should I do"

This is a nonsense question

It implies magic

We are dealing with a theory/an overarching concept. There is not the 'DUP'

Frequency Theory: *General Adaptation Syndrome (GAS)*

Closer to Genetic Potential

Rebound

Plateau

1. Muscle Growth

Taper

2. Neural

Overreaching

3. Endurance

Overload

Overtraining

Alarm Reaction

Stage of Resistance

Stage of Exhaustion

Rest

Repeat the Process

Seyle 1956

Conclusions and Summary

- DUP in Large Training Phases: Preparatory and Peaking Volume and Intensity Mesocycles
- Tapering and Intro Cycles
- Specificity

- **The training possibilities are endless, more research and the concept of optimization will always continue**

- Linear Periodization, Block Periodization, and Daily Undulating Periodization are NOT mutually exclusive. They can and in some cases should be implemented together.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