VELOCITY BASED TRAINING

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IN THE BEGINNING...

- My start with VBT- and why is it called VBT anyways?
  - Louie Simmons and Tendo
  - Pat Ivey and Tendo
  - Other devices
LOUIE SIMMONS AND THE TENDO
PAT IVEY, MIZZOU AND THE TENDO
IT’S NOT JUST TENDO ANYMORE B- SO WHAT DO YOU CALL IT NOW?
• Velocity Based Training (VBT)
  • Use of various devices that measure displacement and time
  • Calculate velocity
  • Calculate power
HOW THE VBT HELPS

• SAID Principle
  • Quantify traits to velocity
    • Absolute Strength (0-.5m/s)
    • Accelerative Strength (.5-.75m/s)
    • Strength-Speed (.75-1.0m/s)
    • Speed-Strength (1.0-1.3m/s)**
    • Starting Strength (>1.3m/s)
HOW VBT HELPS, CONT’D

- No other way to quantify/differentiate traits
  - Speed-Strength & Olympic lifts
    - Regression Analysis
STRENGTH-SPEED VS SPEED-STRENGTH DIFFERENTIATION

• Strength-Speed vs Speed-Strength

  • 2 different traits, not interchangeable (Jidovtseff, Jandacka, Roman, Verkhoshansky)
    • Strength-speed= heavier weights, slower acceleration. .75-1.0m/s
      • Squats for speed
    • Speed-Strength= lighter weights, faster acceleration. 1.0-1.3m/s**
      • Olympic Lifts (these are higher velocity due to amplitude of motion).
WHAT VBT DOES

• Gives feedback in forms of Velocity, Power, % of best repetition
  • Avg and Peak

• Accounts for stress and current training status
  • Outside stressors effect training

• Autoregulation or Flexible Non-Linear Periodization
  • Allows one to train at the weight they need for that day/set
WHY YOU NEED VBT

• Getting stronger is only part of the equation (F=ma) (Zatsiorsky)

• Expressing force quickly may be more important than strength down the line for performance

• SAID Principle-Transfer of Trainedness
  • Absolute Strength and Bompa
    • If you want to be fast, train fast......
IMPORTANCE OF VELOCITY

Adapted from Kraemer’s Gatorade Sports Science #53
Specific Strengths

Absolute Strength

Base Strength

Work capacity and mobility
• Specific Strengths
  • Target specific performance variables
    • Offensive Lineman
      • Fires out at 1.5m/s (Mann & Jacobson)
        • Speed-Strength**
      • After contact, when dominating, moves at ~.6m/s
        • Accelerative strength
      • May move slower, which would indicate circamax or max.
HOW VBT WORKS

• Measures the speed [velocity] of the bar. (Jennings et al)
  • Immediate feedback
  • Different lifts have different speeds [velocities]
  • Different strengths have different speeds [velocities]
  • Athlete moves their proper weight for that exact set
• Immediate Feedback
  • Instantaneous and objective
    • Doesn’t matter if it’s a Heisman or walk-on, the speed is the speed
  • Encourages competitive nature
  • Another coach on the floor
SAID-TRANSFER OF TRAINEDNESS/FEEDBACK

- Randell et al. Effect of instantaneous performance feedback during 6 weeks of velocity based resistance training on sport-specific performance tests

<table>
<thead>
<tr>
<th></th>
<th>Vertical jump</th>
<th>Horizontal jump</th>
<th>10-m Sprint</th>
<th>20-m Sprint</th>
<th>30-m Sprint</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Percent change</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Feedback</td>
<td>0.61 (0.06)</td>
<td>0.64 (0.07)</td>
<td>4.6</td>
<td>2.50 (0.16)</td>
<td>2.56 (0.15)</td>
</tr>
<tr>
<td>Non-feedback</td>
<td>0.66 (0.06)</td>
<td>0.67 (0.01)</td>
<td>2.8</td>
<td>2.58 (0.20)</td>
<td>2.59 (0.20)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Vertical jump</th>
<th>Horizontal jump</th>
<th>10-m sprint</th>
<th>20-m sprint</th>
<th>30-m sprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect size</td>
<td>0.18 (Small)</td>
<td>0.28 (Small)</td>
<td>-0.28 (Small)</td>
<td>-0.20 (Small)</td>
<td>-0.46 (Moderate)</td>
</tr>
<tr>
<td>Positive</td>
<td>45 (Possibly)</td>
<td>83 (Likely)</td>
<td>65 (Possibly)</td>
<td>49 (Possibly)</td>
<td>99 (Almost certainly)</td>
</tr>
<tr>
<td>Trivial</td>
<td>51</td>
<td>17</td>
<td>33</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>Power</td>
<td>0.131</td>
<td>0.851</td>
<td>0.791</td>
<td>0.860</td>
<td>1.000</td>
</tr>
</tbody>
</table>
VELOCITY VS POWER

- Two measures given
  - Velocity and Power
  - Velocity
    - Established standards
  - Power
    - Calculated number of watts produced in the exercise (Std Error ~12 watts) (Fry)
I use velocity
  • It’s included in the power equation already
  • More weight at same speed or faster is greater power
  • Simpler numbers
• Use whatever you want
Different lifts have different velocities (Roman, Ajan, Verkhoshansky)

- Hang Power Snatch moves at 1.96m/s (High 2’s Peak)
- Hang Power Clean moves at 1.32m/s (Low 2’s Peak)
- Clean Pulls 1.15m/s
- Snatch Pulls 1.45m/s
• Olympic Lifts side note-
  • Orthopedic issues may alter form
    • Alterations in form can equate to decreased velocity
    • High peaks & low average = form discrepancy
      • Often inability to catch
  • What is an Olympic lift at it's basis?
    • Ballistic
      • Defined portion of imparting force into the bar and then bar projected into air
      • Deceleration phase has nothing to do with force production, so doesn’t matter
    • Defined moment of peak velocity
      • Harbili
PEAK VELOCITIES I’VE BEEN USING

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snatch</td>
<td>1.85-2.35m/s</td>
</tr>
<tr>
<td>Clean</td>
<td>1.45-1.85m/s</td>
</tr>
<tr>
<td>Jerk</td>
<td>1.38-1.8m/s</td>
</tr>
</tbody>
</table>
• Different strengths have different velocities (Roman, Verkhoshansky, Zatsiorsky, Ajan, Jandacka)
  • Must stay at desired velocity for training effect
    • i.e.- if working dynamic strength, .5m/s is too slow, weight must be removed
    • Mizzou Example on Cleans
VELOCITY CONTINUUM

- Box Jump
- Hang Snatch
- Overspeed Squat
- Hang Clean
- Dynamic Effort
- Bench Press

- Neurological
- Starting Strength
- Non-Quant
- Accelerative
- Absolute

- 0%
- 20%
- 40%
- 60%
- 80%
- 100%
- Weight moved is for that exact set
  - VBT takes into account all stressors
  - Velocity Profile-Jidovtseff
    - Linear relationship btwn velocity and % 1RM. (Izquierdo)
  - Feedback for that set, that day
  - Enables use of optimal weight for that day/set
  - Stress’ cumulative effect
Figure 1. Theoretical AV-relative load (% 1 repetition maximum) relationship according to mean values observed in the whole population. The thick line represents the mean tendency; thin lines represent ±1SD. AV = average velocity; LD0 = load at zero velocity.
USING THE LOAD-VELOCITY RELATIONSHIP FOR 1RM PREDICTION. JIDOVTSEFF, HARRIS, CRIELAARD AND CRONIN. JSCR 25(1)/267-270

![Graph showing the relationship between actual 1RM (kg) and LD0 (kg). The equation is 1RM = 0.871LD0 - 0.624 and R = 0.98.]

Figure 2. Relationship between actual 1 repetition maximum and load at zero velocity (LD0) of all 3 study groups.
Following table shows changes in velocities at given 1RM after 1RM increased $9.3 \pm 6.7\%$
MOVEMENT VELOCITY AS A MEASURE OF LOADING INTENSITY IN RESISTANCE TRAINING, GONZALEZ-BADILLO, SANCHEZ-MEDINA. INT J SPORTS MEDICINE. 2010, 31: 347-352

<table>
<thead>
<tr>
<th>Load (%1RM)</th>
<th>T1</th>
<th>T2</th>
<th>Difference (T1–T2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 %</td>
<td>1.33 ± 0.08</td>
<td>1.33 ± 0.08</td>
<td>0.00</td>
</tr>
<tr>
<td>35 %</td>
<td>1.24 ± 0.07</td>
<td>1.23 ± 0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>40 %</td>
<td>1.15 ± 0.06</td>
<td>1.14 ± 0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>45 %</td>
<td>1.06 ± 0.05</td>
<td>1.05 ± 0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>50 %</td>
<td>0.97 ± 0.05</td>
<td>0.96 ± 0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>55 %</td>
<td>0.89 ± 0.05</td>
<td>0.87 ± 0.05</td>
<td>0.01*</td>
</tr>
<tr>
<td>60 %</td>
<td>0.80 ± 0.05</td>
<td>0.79 ± 0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>65 %</td>
<td>0.72 ± 0.05</td>
<td>0.71 ± 0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>70 %</td>
<td>0.64 ± 0.05</td>
<td>0.63 ± 0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>75 %</td>
<td>0.56 ± 0.04</td>
<td>0.55 ± 0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>80 %</td>
<td>0.48 ± 0.04</td>
<td>0.47 ± 0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>85 %</td>
<td>0.41 ± 0.04</td>
<td>0.40 ± 0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>90 %</td>
<td>0.33 ± 0.04</td>
<td>0.32 ± 0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>95 %</td>
<td>0.26 ± 0.03</td>
<td>0.25 ± 0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>100 %</td>
<td>0.19 ± 0.04</td>
<td>0.18 ± 0.04</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

Determined from a paused bench press
Fig. 1  Relationship between relative load (% 1RM) and MPV directly obtained from 1596 raw data derived from the 176 incremental tests performed in the BP exercise. Solid line shows the fitted curve to the data, and the dotted lines indicate limits within which 95% of predictions will fall.

MPV = 0.00003 Load^2 - 0.0204 Load + 1.889

R^2 = 0.98; SEE = 0.06 m s^{-1}; N = 1.596
• Equation for Concentric Mean Velocity
  • $7.5786* MV^2 + 75.865*MV + 113.02 \ (R^2 = .979, \ SEE \ 3.77\%)$
WHAT ABOUT VOLITIONAL VELOCITY?
CURRENTLY UNPUBLISHED DATA

Volitional Velocity Bench Press
CURRENTLY UNPUBLISHED DATA

Volitional Velocity Squat
ACCOUNTS FOR OUTSIDE STRESSORS

- When the ANS is depressed or excited, motor recruitment is either down or up
- When ANS is depressed, lower motor recruitment, lower mass moved
- When ANS is elevated, higher motor recruitment, higher mass moved
ACCOUNTING FOR STRESS- JOVANOVIC ET AL
STRESS AND INJURY RESTRICTIONS
STRESS AND INJURY RESTRICTIONS

![Bar graph showing the total number of injuries per week.

- High Physical Stress (Training Camp): Approximately 20 injuries per week.
- High Academic Stress (Examination Periods): Approximately 10 injuries per week.
- Low Academic Stress: Approximately 5 injuries per week.](image-url)
Table 3. Results from hierarchical logistic regression using A. all subjects (n=101), B. only subjects that played (n=46) and C. subjects that did not play (n=51)

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio (OR)</th>
<th>95% Confidence Interval</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPS/HAS</td>
<td>2.05</td>
<td>(1.39, 3.03)</td>
<td>0.0003</td>
</tr>
<tr>
<td>HPS/LAS</td>
<td>3.65</td>
<td>(2.50, 5.32)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>HAS/LAS</td>
<td>1.78</td>
<td>(1.16, 2.74)</td>
<td>0.0088</td>
</tr>
<tr>
<td><strong>B.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPS/HAS</td>
<td>1.13</td>
<td>(0.55, 2.32)</td>
<td>0.7505</td>
</tr>
<tr>
<td>HPS/LAS</td>
<td>2.84</td>
<td>(1.49, 5.42)</td>
<td>0.0016</td>
</tr>
<tr>
<td>HAS/LAS</td>
<td>3.19</td>
<td>(1.61, 6.34)</td>
<td>0.0009</td>
</tr>
<tr>
<td><strong>C.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPS/HAS</td>
<td>2.315</td>
<td>(1.340, 3.996)</td>
<td>.0026</td>
</tr>
<tr>
<td>HPS/LAS</td>
<td>1.710</td>
<td>(1.039, 2.815)</td>
<td>.0348</td>
</tr>
<tr>
<td>HAS/LAS</td>
<td>1.376</td>
<td>(2.504, 6.258)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

HPS = High Physical Stress; LAS = Low Academic Stress; HAS = High Academic Stress
INTEGRATION OF VBT INTO ANNUAL PLAN

• VBT is simply replacing %’s.
• Traditional Periodization Phases during off-season:
  • Anatomical Adaptation
    • Large ROM, low intensity, slow movements. Velocity and % of 1RM nearly irrelevant
  • Hypertrophy/Endurance
    • Hypertrophy & TUT- Velocity irrelevant
  • Strength
    • Working from .5m/s on down
  • Strength/Power
    • Strength- below .5m/s (realistically .4m/s on squat, .25m/s on bench press)
    • Power- Break down into strength-speed or speed-strength
## VELOCITY PERIODIZATION EXAMPLE - BENCH PRESS 12 WEEK CYCLE

<table>
<thead>
<tr>
<th>Week</th>
<th>Phase</th>
<th>Sets/Reps</th>
<th>Vel 1 \ Vel 2</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strength</td>
<td>3x6</td>
<td>.48m/s</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>Strength</td>
<td>3x5</td>
<td>.41m/s</td>
<td>85%</td>
</tr>
<tr>
<td>3</td>
<td>Strength</td>
<td>5x3</td>
<td>.37m/s</td>
<td>87%</td>
</tr>
<tr>
<td>4</td>
<td>Strength</td>
<td>3x5</td>
<td>.45m/s</td>
<td>82%</td>
</tr>
<tr>
<td>5</td>
<td>Strength</td>
<td>5x3</td>
<td>.41m/s</td>
<td>85%</td>
</tr>
<tr>
<td>6</td>
<td>Strength</td>
<td>4x2</td>
<td>.33m/s</td>
<td>90%</td>
</tr>
<tr>
<td>7</td>
<td>Strength</td>
<td>5x3</td>
<td>.41m/s</td>
<td>85%</td>
</tr>
<tr>
<td>8</td>
<td>Strength</td>
<td>4x2</td>
<td>.32m/s</td>
<td>90%</td>
</tr>
<tr>
<td>9</td>
<td>S/P</td>
<td>3x2/5x3</td>
<td>.29m/s \ .97m/s</td>
<td>92/50%</td>
</tr>
<tr>
<td>10</td>
<td>S/P</td>
<td>5x3/5x3</td>
<td>.48m/s \ .97m/s</td>
<td>80/50%</td>
</tr>
<tr>
<td>11</td>
<td>S/P</td>
<td>5x3/6x2</td>
<td>.41m/s \ .89m/s</td>
<td>85/55%</td>
</tr>
<tr>
<td>12</td>
<td>S/P</td>
<td>4x2/6x2</td>
<td>.33m/s \ .80m/s</td>
<td>90/60%</td>
</tr>
</tbody>
</table>
WHAT VBT CAN DO FOR YOU-

• Can replace some % based training
• Prevention of neuro-muscular fatigue
• Prevention of overtraining
• Can take place of some % based training
  • Getting VERY close to being able to predict 1RM off of volitional or max intended velocity
  • VERY tight relationships between % of 1RM and velocity
    • Test—retest difference was .01m/s on the greatest difference
  • Hypertrophy work though, irrelevant
• Prevention of overtraining

  • Velocity is a neural capability (Fry)
  
  • Training to repetition failure does not necessarily improve the magnitude of strength gains and that it may even be counterproductive by inducing excessive fatigue, mechanical and metabolic strain for subsequent sessions as well as undesirable transitioning to slower fiber types

    • Train by velocity, lower weights on a given day = low NMS availability. May overtrain if going too heavy

      • Can always grind, it's either their or not for speed.

  • Understand when velocity is greatly decreased, deload may be in order
  
  • Relationship between velocity and % of 1RM on any given day
VBT-STRENGTHS

- Exactness of work
  - Speed-strength, absolute strength (Jandacka Et Al)
- Instant Feedback
- Nurtures competitive nature
VBT ISSUES

- Variables to account for
  - Height
  - Technical Proficiency
    - Poor form may give a higher velocity
      - Must always coach form. Form before weight and speed
  - Work Ethic
VBT CAUTIONARY

- In the research, note if it’s mean propulsive velocity (MPV) or mean velocity (MV) being reported.
  - MPV- the mean of only the propulsive phase of the movement
    - Accelerative phase
    - Deceleration phase is disregarded
  - MV- the mean of the entire concentric phase
    - Accelerative phase and deceleration phase both accounted for.
  - Over 80%, the two are very close.
  - All units I have ever seen only have MV, no MPV capabilities.
<table>
<thead>
<tr>
<th>Exercise</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snatch Power Shrug</td>
<td>1.45 m/s</td>
</tr>
<tr>
<td>Snatch Power Pull</td>
<td>1.81 m/s</td>
</tr>
<tr>
<td>Snatch-from floor</td>
<td>1.52-1.67 m/s</td>
</tr>
<tr>
<td>Hang Snatch</td>
<td>1.35-1.96 m/s</td>
</tr>
<tr>
<td>Power Clean</td>
<td>1.2-1.32 m/s</td>
</tr>
<tr>
<td>Hang Clean</td>
<td>1.3-1.4 m/s</td>
</tr>
<tr>
<td>Power Shrug</td>
<td>1.15 m/s</td>
</tr>
<tr>
<td>Power Pull</td>
<td>1.38 m/s</td>
</tr>
<tr>
<td>Bench Press</td>
<td>0.8-1.0 m/s</td>
</tr>
<tr>
<td>Squat</td>
<td>0.8-1.0 m/s</td>
</tr>
<tr>
<td>Strength-Speed</td>
<td>0.75-1.0 m/s</td>
</tr>
<tr>
<td>Accelerative Strength</td>
<td>0.5-0.75 m/s</td>
</tr>
<tr>
<td>Absolute strength</td>
<td>less than 0.5 m/s</td>
</tr>
</tbody>
</table>
• In closing
  • Keep it simple. Don’t overthink it.
  • There is a time & place for everything
    • You need strength too
  • It doesn’t matter what you do
    • What matters is how you do it.
References

- Buddy Morris - Personal communication
- Tom Myslinski - Personal communication
- Fry, Andrew-2008 University of Missouri Clinic
- Questions?
- Contact Info:
  - mannjb@health.missouri.edu
  - 573-884-3097
- Thank you for your time