The Power Clean

Project by: Kamil Okroj
What is it?

- Explosive, Olympic-style lift
- Emphasizes power over strength
- Used a lot in football training

- Video
Muscles Used

- The “Posterior Chain”
  - Lower Back, Glutes, Hamstrings, Calves
- Upper Back
  - Traps
- Fiber Recruitment
  - Fast-twitch fibers
Biomechanics

1st Pull | 2nd Pull | Catch Phase
1st Pull

- Pull barbell up to knees
- Keep shoulders over bar, butt back
- Slowest movement
**2nd Pull**

- Extend hips/Jump
- Shrug shoulders
- Very explosive movement (generates most of the power)
Catch Phase

- Drop under bar
- Rotate shoulders forward/stick elbows out
- Catch bar on shoulders
Slow-Mo
Physics Assumptions

- All force (tension in arms) is parallel to the motion of the bar (straight up)
- All energy produced is transferred to the bar
- Bar is in “free-fall” during catch phase
Work & Power

- Work
  \[ W = F \times dy = \Delta E \]
  \[ W = F_{\text{avg}} \cdot (h) = \frac{1}{2} m(V_f^2 - V_i^2) + mg(h) \]

- Power
  \[ P = \frac{W}{t} \]
Force Calculation

\[ \text{Work} = \Delta E = \frac{1}{2} m (v^2) + mg(h) \]

\[ = \frac{1}{2} (52.16)(3.352^2) + 0 + (52.16)(9.8)(0.9424) = 775 \text{Joules} \]

\[ F_{\text{avg}} \cdot (h) = 775 \text{J} \]

\[ F_{\text{avg}} = \frac{775 \text{J}}{(0.9424 \text{m})} = 822 \text{N} \]

\[ F_{\text{avg}} = F_T \quad mg = 822 \text{N} \]

\[ F_T = 822 \text{N} + (52.16)(9.8) = 1333 \text{N} \]
# Power Output by Pull

<table>
<thead>
<tr>
<th></th>
<th>1st Pull</th>
<th>2nd Pull</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta h$</td>
<td>$0.364 \text{ m}$</td>
<td>$0.579 \text{ m}$</td>
</tr>
<tr>
<td>$V_i$</td>
<td>$0 \text{ m/s}$</td>
<td>$0.854 \text{ m/s}$</td>
</tr>
<tr>
<td>$V_f$</td>
<td>$0.854 \text{ m/s}$</td>
<td>$3.352 \text{ m/s}$</td>
</tr>
<tr>
<td>$\Delta t$</td>
<td>$0.531 \text{ s}$</td>
<td>$0.356 \text{ s}$</td>
</tr>
<tr>
<td>Work</td>
<td>$205 \text{ J}$</td>
<td>$570 \text{ J}$</td>
</tr>
<tr>
<td>Power</td>
<td>$386 \text{ W}$</td>
<td><strong>1601 \text{ W}</strong></td>
</tr>
</tbody>
</table>
The Deadlift

- Very similar to clean
- Includes 1\textsuperscript{st} and 2\textsuperscript{nd} pulls
- No explosion in 2\textsuperscript{nd} pull
- No catch phase
- Emphasizes strength over power
<table>
<thead>
<tr>
<th>Power Clean</th>
<th>Deadlift</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work</strong> = ( \Delta KE + \Delta U )</td>
<td><strong>Work</strong> = ( \Delta U )</td>
</tr>
<tr>
<td>[ = \frac{1}{2}m(v)^2 + mg(h) ]</td>
<td>[ = mg(h) ]</td>
</tr>
<tr>
<td>[ = \frac{1}{2}(52.16)(3.352)^2 + (52.16)(9.8)(0.9424) ]</td>
<td>[ = (52.16)(9.8)(0.7102) ]</td>
</tr>
<tr>
<td>= 775 Joules</td>
<td>= 363 Joules</td>
</tr>
<tr>
<td><strong>Power</strong> = ( \frac{W}{\Delta t} )</td>
<td><strong>Power</strong> = ( \frac{W}{\Delta t} )</td>
</tr>
<tr>
<td>[ = \frac{775 \text{ J}}{.887 \text{ s}} ]</td>
<td>[ = \frac{363 \text{ J}}{.812 \text{ s}} ]</td>
</tr>
<tr>
<td>= 874 Watts</td>
<td>= 447 Watts</td>
</tr>
<tr>
<td><strong>Force</strong></td>
<td><strong>Force</strong></td>
</tr>
<tr>
<td>( F_{avg} = 1333 \text{ N} )</td>
<td>( F_{avg} = 1022 \text{ N} )</td>
</tr>
</tbody>
</table>

*Using the same weight*
Conclusions

- **Power Clean**
  - Faster Movement
    - Explosive 2\textsuperscript{nd} pull
  - Uses lighter weights
  - Recruits fast-twitch muscles in the posterior chain
  - Generates more POWER

- **Deadlift**
  - Slower Movement
    - No explosion in 2\textsuperscript{nd} pull
  - Uses heavier weights
  - Recruits slow-twitch muscles in posterior chain
  - Capable of generating more FORCE