Description, Location, and Training
Wes Adams

MUSCLE FIBER TYPES
BASIC DESCRIPTION

- Slow Twitch
- Fast Twitch
SLOW TWITCH

- Type 1
- Associated with aerobic training.
- More efficient at using chemical energy.
- Contract at a slow rate.
- Example: Marathon.
FAST TWITCH

- Type 2a
- Type 2b
TYPE 2B (FAST TWITCH)

- Fast Twitch Glycolytic (FG).
- Associated with short duration anaerobic events.
- Uses the immediate source of ATP stores.
- Rapid contraction.
- Example: Sprinting or Plyometrics.
TYPE 2A OR 2X (FAST TWITCH)

- Fast Twitch Oxidative Glycolytic (FOG).
- Associated with longer duration anaerobic events.
- Buffering capacity is important.
- Sustained rapid contraction of intermediate fibers.
- Examples: Body weight exercise or wrestling.
INDIVIDUALITY

- We are all different.
- We all vary genetically.
EXAMPLE OF INDIVIDUALITY

Out of East Africa. In less than 2 decades, Kenyans came to dominate the top 20 performances in six races ranging from 800 meters to the marathon.
WHY DO KENYANS DOMINATE?

- High altitude training?
- Increased mitochondrial density?
- Increased lung capacity?
- Muscle fiber type?
- Probably a combination.
PERCENTAGE OF MUSCLE FIBER TYPE

- Slow Twitch
- Fast Twitch
- For most individuals it’s about 50/50.
- Based on genetics.
- Mesomorphs have a higher percentage of fast twitch.
- Ectomorphs have a higher percentage of slow twitch.
PERCENTAGE OF SLOW TWITCH BY LOCATION

- Deltoid
- Rectus Abdominis
- Gastrocnemius
PERCENTAGE OF FAST TWITCH BY LOCATION

- Pectoralis Major
- Latissimus Dorsi
- Trapezius
- Quadriceps
- Hamstrings
- Gluteus Maximus
ENERGY SYSTEM AND MUSCLE FIBER TYPES

- ATP-PC system
- Glycolysis
- Aerobic Oxidative
ATP PC SYSTEM

- Supplies energy for about 10-12 seconds.
- Supplies the energy demands for short duration rapid contraction.
- Associated with Type2b.
- Fast Twitch Glycolytic (FG).
- Example: 100 yard sprint.
GLYCOLYSIS

- Supplies energy for about 2-3 minutes.
- Supplies the energy demands for long duration rapid contraction.
- Associated with Type 2a Type 2x.
- Fast Twitch Oxidative Glycolytic (FOG).
- Example: Pushups for 2 minutes (ROTC) example.
AEROBIC OXIDATIVE

- Supplies energy for events greater than 2-3 minutes.
- Supplies the energy demand for long duration, sustained (slow) contraction.
- Associated with Type 1, Slow Twitch.
- Example: Marathon and/or Triathlon.
THE IMPORTANCE OF UNDERSTANDING MUSCLE FIBER TYPES

- Teaching
- Coaching
- Personal Training
- Athletic Performance
POOR COMBINATIONS

- Type 2b (FG) with aerobic events.
- Example: Body builder running long distance.
- Excess muscle mass starves the body of oxygen.
- Type 1 with high intensity, rapid contraction.
- Example: Long distance runner performing power lifting.
APPROPRIATE COMBINATIONS

- Type 2b and sprinting or power lifting.
- Type 2a and 2x and wrestling or boxing.
- Type 1 and marathons or triathlons.
TRAINING AND TESTING MUSCLE FIBER TYPES

- Pre/Post Testing
- Sport Specific Training
- Muscle Biopsy
PRE AND POST TESTING

- Teaching and/or Personal Training Example:
- Muscle Strength
- 1 RM
- Type 2b
- Fast Twitch Glycolytic
PRE AND POST TESTING

- Muscle Endurance
- Push-ups or Sit-ups for 2 minutes.
- Type 2a and 2x.
- Fast Twitch Oxidative (FOG).
PRE AND POST TESTING

- Cardiovascular Endurance
- 12 minute run or 3 minute step test.
- Type 1
- Slow Twitch
Most training should be as close to the movements used in a particular sport as possible.

Example: If you are a wrestler the majority of your time training should be on the mat, all other training is supplemental.

If you run long distance, the majority of your time should be running long distance.
CHICKEN EXAMPLE

- Fast twitch
- Slow twitch
CLINICAL EXAMPLE

- Remember the Chicken?
- Chicken Breast
- Type 2b (FG)
- White
- Very few capillaries
- Can fly about 10 seconds
CLINICAL EXAMPLE

- Type 2a (FOG)
- Pinkish
- Increased capillary density.
- Increased oxidative component.
CLINICAL EXAMPLE

- Remember the Chicken?
- Chicken Leg
- Dark Red
- A lot of Capillaries.
- Increased blood supply.
- Increased oxygen to the muscle.
- Can run all day.
Genetic manipulation of mice.

Gene: peroxisome proliferator-activated receptor delta (pparδ).

Genetically altered and were able to run greater distances than wild-type littermates.
INCREASED MYOGLOBIN INCREASED REDNESSNESS
## Characteristics of the Three Muscle Fiber Types (Karp, 2007)

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Slow Twitch (ST)</th>
<th>Fast Twitch A (FT-A)</th>
<th>Fast Twitch B (FT-B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction time</td>
<td>Slow</td>
<td>Fast</td>
<td>Very fast</td>
</tr>
<tr>
<td>Size of motor neuron</td>
<td>Small</td>
<td>Large</td>
<td>Very large</td>
</tr>
<tr>
<td>Resistance to fatigue</td>
<td>High</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>Activity used for</td>
<td>Aerobic</td>
<td>Long term anaerobic</td>
<td>Short term anaerobic</td>
</tr>
<tr>
<td>Force production</td>
<td>Low</td>
<td>High</td>
<td>Very high</td>
</tr>
<tr>
<td>Mitochondrial density</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Capillary density</td>
<td>High</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>Oxidative capacity</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Glycolytic capacity</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Major storage fuel</td>
<td>Triglycerides</td>
<td>CP, Glycogen</td>
<td>CP, Glycogen</td>
</tr>
</tbody>
</table>
CONCLUSION

- Important to understand muscle fiber types for…..
- Teaching
- Coaching
- Training
REFERENCES


Andersen, JL; Schjerling, P; Saltin, B. Muscle, Genes and Athletic Performance. Scientific American. 9/2000

REFERENCES