

Physical and Psychological Factors Affecting Athletic Muscular Performance

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• **Muscle Strength**

- Muscle strength has mechanical & neural components :
- **(1) Mechanical strength** : the maximum force a muscle can exert.
- This depends upon the muscle cross-sectional area .
- So if after a period of training, an athlete increases his muscle size by 50 % , he will also increase the force the muscle can develop by 50% .
- **(2) Neurological strength** : meaning how many of the AHC motor neurons supplying that muscle are recruited + frequency of action potentials in them.
- In diseases involving the AHCs (e.g., poliomyelitis , MND) the number of active AHCs may be considerably reduced .
- A severely depressed person (or athlete) , who lost his motivation , may , unconsciously , recruit less AHCs than normal → decreased performance

- **Muscle Power**

- When muscles contract or stretch in moving a load they do **work** , and energy is transferred from one form to another.
- The “ **power** ” of muscles refers to how quickly the muscles can do this work and transfer the energy.
- **Work** = Force X Distance , &
- **Power** = Work/Time
- The shorter the time used to perform a piece of work , the more power is needed
- Hence , if a weightlifter lifts a given weight explosively over a short time (say 0.5 seconds) he needs his muscles to produce much more power than if he did that while taking more time .

- **Energy Availability**

- When humans utilize energy to perform muscular exercise , the energy is expended to (1) doing work , & (2) generating heat .
- For short-term , intense exercise e.g., when the person is jumping up from a squatting position , energy expenditure can be much more than for long-term exercise .
- Energy Sources
- (1) Energy needed to perform short-lasting, high-intensity bursts of activity is derived from anaerobic sources within the cell , whereas
- (2) Longer –lasting , less intense exercise (Aerobic Exercise) utilizes oxygen & depends on aerobic respiration .
- The quick energy sources consist of the →
 - (1) Phosphocreatine system .
 - (2) Glycolysis , &
 - (3) Adenylate Kinase
- The most rapid source, but the most readily depleted of the above sources is the Phosphocreatine .

- **Glucose Availability**

- Plasma glucose is maintained by an equal rate of glucose appearance (entry into the blood) and glucose disposal (removal from the blood).
- In the healthy individual, rate of appearance and disposal are essentially equal during exercise of moderate intensity and duration;
- However, prolonged , intense exercise can result in a fall in blood glucose level and the onset of fatigue .
- During exercise , rate of glucose appearance depends mainly on the liver (glycogenolysis & gluconeogenesis) , and to a lesser extent , on absorption from the gut .

- **Oxygen Availability**

- Which depends upon →
- (1) cardiac output (the quantity of blood distributed by the heart) ,
- (2) the ability of the lung to oxygenate the blood ,
- (3) arterio-venous (a-v) oxygen difference (i.e., the ability of the exercising muscle to take up oxygen from blood).

- **Degree of Hydration**

- Intense prolonged exercise produces metabolic waste heat . The heat is removed by sweating which , if intense , may cause dehydration .
- A male marathon runner loses each hour around 0.8 L in cool weather and 1.2 L in warm weather.
- A female marathon runner loses about 70% of what the male loses .
- However , in hot weather , heavy exercise can cause much more losses of fluid from the body → dehydration .
- Dehydration leads to constant rise in body temperature , increase in heart-rate , and decreased stroke volume and cardiac output .

- **Blood Catecholamines & Ammonia**

- Plasma catecholamine concentrations can increase by 10 times .
- Ammonia , which is produced by the exercising muscles from ADP is released into the bloodstream , leading to increased circulating levels .

- **Age**

- youth are better in sport performance than elderly e.g., a footballer getting old may retire or be a coach

- **Gender**

- (i) Because of difference between genders of in body build and physical ability , men can perform better than women in contact sports such as boxing , rugby and wrestling .
- (ii) Menstruation : women may perform differently at different times during their menstrual cycle .

- **Drugs**

- (1) Anabolic steroids (e.g., Testosterone) :
- These are used by some athletes (of both sexes) to increase their muscle mass and thereby enhance their physical performance . They have harmful side-effects such as raised blood pressure and increased facial hair in female athletes . Their use in sport competitions is illegal .
- (2) Stimulants
- Stimulants increase reaction speed (i.e., decrease reaction-time) , reduce perception of pain and raise aggression
- They are highly addictive and have side-effects including high blood pressure, cardiac problems , strokes, and liver disease .
- (3) Narcotic analgesics
- These are pain killers which athletes use to mask pain from an injury or overtraining .
- They are also highly addictive and cause withdrawal symptoms when the athlete stops using them.

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- **Sleep**

- Sufficient , restful sleep is important for physical and mental health .
- Lack of sleep makes the athlete nervous and irritable , & deteriorates physical performance

- **Disease**

- Musculoskeletal disease e.g., sprain , disk etc , or
 - General disease e.g., bronchial asthma , colds , flu , etc
- All may affect muscular exercise performance .

- **Personality type**

- (i) Introverts
- Tend to like sports which require:, precision , self-motivation , need low arousal levels & Individual performances e.g., archery, golf and snooker
- (ii) Extroverts
- Prefer team sports, which are exciting , need high arousal level and require large, simple motor skills e.g. rugby and boxing

The Overtraining Syndrome

- This is an important , mixed , psychosomatic/musculoskeletal condition being increasingly observed in competitive sport .
- With increasing competitiveness in local , national & international sport, it may be on the rise .
- Overtraining occurs when the athlete, while stale (with impaired in vigor and effectiveness) is pushed/forced (e.g. by a coach) to continue training at high intensity → leading to development of “Overtraining Syndrome ”
- This syndrome is a chronic , debilitating (body-weakening) condition
- Overtraining syndrome may impair an athlete during training or daily work, with signs of
 - (1) decreased concentration,
 - (2) irritability and increased anger,
 - (3) slowed mental function, and
 - (4) diminished self-esteem.
- Symptoms of overtraining include fatigue (feeling of tiredness) , inability to exceed former levels of performance, and a decreased ability to recover are typical symptoms of overtraining

- Disadvantageous incremental stages of overtraining include
- (a) overreaching, →(b) overtraining, → (c) staleness, → (d) burnout, and → (e) injury/withdrawal
- These conditions are not limited to mature adult athletes.
- Young athletes are continuously confronted with increasing expectations, often resulting in unrealistic demands on time and physical performance
- This may lead to early withdrawal from the sport environment.

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