

# What are the physiological differences between male and female athletes? essay sa...

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## Male and Female differences

Cardio-Respiratory endurance is made up of the following components:

- \* Heart
- \* Lungs
- \* Blood Vessels
- \* Skeletal Muscle

These components allow the exchange of gases in the lungs, transport gases to bodily organs and exchange gases at the muscles. The greater the bodies' capacity to perform these functions, the greater is cardio respiratory endurance. There is evidence that there is a gender difference in pulmonary function.

Women have a smaller lung volume and smaller pulmonary capillary volume. Therefore overall they have lower maximal pulmonary ventilation.

Women have:

- \* Smaller hearts
- \* Lower Filling Volume
- \* Lower SV
- \* Lower Q
- \* Lower Hb

\* Lower total blood volume

Therefore they have a definite disadvantage for transporting oxygen to skeletal muscles during exercise.

The fact that women have a lower cardiovascular capacity than men does not mean that they are less able to adapt to endurance training. Research shows that males and females adapt on similar levels.

#### Skeletal Muscle Structure and function

There is limited data that compares the muscle fibre types of males and females. The only data that is available is of elite athletes. Research has shown that women tend to have a smaller amount of slow twitch fibers in the gastrocnemius than men. Despite the difference, there is no evidence of gender difference in lactate thresholds.

#### Maximal and Submaximal O<sub>2</sub> consumption

VO<sub>2</sub> Max is very different between equally trained men and women. It is higher in male athletes and after adjusting for fat free mass and training status there is a 15% difference. In real terms, in a 10,000 meters race this amounts to a time difference of 4 Minutes and 42 Seconds, OR A 13% performance advantage for men.

#### Muscular Strength and Power

The males greater lean body mass is a major determinant of their greater muscular strength. However these differences are removed when either

measure is expressed relative to lean body mass. It has been widely accepted that women show less response to strength training than men, although research does not support this claim.

Research has shown that there is Very little difference seen in the response to different modes of progressive resistance strength training. Men and women experience similar relative strength gains when training under the same programme. The evidence on body composition changes that occur with strength training is equivocal at this point. Researchers, however, suggest that there appears to be less muscle hypertrophy with strength improvement in women when compared to men.

The data suggest that there are no differences between genders in central or peripheral cardiovascular adaptations to aerobic training. However, women in general have a reduced O<sub>2</sub> carrying capacity. Another factor that may be responsible for the sex differences seen in the metabolic responses to exercise may be the greater, essential sex specific fat of women. Sparling and Cureton (1983) have shown that differences in similarly trained male and female distance runners are due largely to percentage body fat, less to cardiorespiratory fitness and least to running economy. Pate et al. (1985) determined that men and women who are capable of similar performances, in this case a 15 mile race, do not differ in body composition, cardiorespiratory response or metabolic response. There appear to be no differences in relative increases in VO<sub>2</sub>max for men and women when they are trained under the same intensity, frequency and duration. Mode of training also appears to elicit no sex difference.

Males generally possess a greater muscle mass than females, probably due to the effect of the male hormone, testosterone.

Weight training programmes can result in roughly similar percentage strength gains in males and females, although the absolute gains are greater in males than females as a result of the initial superior male muscle mass due to the testosterone hormone levels.

### Body Composition

Females have a larger percentage of body fat (approximately 27%) compared to males (approximately 15%), which is a disadvantage in virtually all weight bearing events.

Fat is dead weight', in that, although it provides an energy reserve store, it requires energy to transport it during sporting events. As a result, females tend to have smaller maximal oxygen uptake values than males, and the greater subcutaneous fat stores tend to reduce the efficiency of the body's temperature regulatory system

### % Composition

#### Body Tissue

Male

Female

Muscle

45%

36%

Bone

15%

12%

Essential Fat

3%

12%

Storage Fat

12%

15%

Other Tissues

25%

25%

Total

100

100

This table shows the percentage of body fat for male and female's athletes.

The male skeleton is generally larger and heavier, with broader shoulders and a narrower pelvis.

The wider female pelvis results in a slight inward tilt of the legs, resulting in a reduction in the mechanical efficiency of the running action.

The smaller female skeleton results in the upper body being weaker in comparison to the lower body, which is a disadvantage in events requiring strength e. g. javelin, discus, and all power' events.

Hormonal factors lead to greater initial levels of high density lipoproteins in women. This appears to cause a smaller change in the total cholesterol-high density lipoprotein ratio than occurs with aerobic training in men

#### Exercise In extreme environments

The special cases of exercise in hot and cold environments present conflicting evidence. When men and women are matched for surface area, mass, VO<sub>2</sub>max and percentage body fat, the major disadvantages women have is in heat dispersal. The question of gender differences in the cold has yet to be fully explored. When the general population is compared, men appear to have an advantage over women.

#### Thermoregulation

Women sweat less than men this is due to a lower output from each sweat gland. With regards to dry heat research has shown that women may adapt

better than men. In relation to exercise intensities women tolerate and adapt to heat stress best. When referring to absolute temperatures, men tolerate heat stress better.

#### Altitude

Women have a greater potential for adapting to a high altitude environment. This is due to higher concentrations of progesterone (when released during the menstrual cycle). However it has been proven that women also retain water during the menstrual cycle, this leads to negative side effect- mountain sickness.

#### Cardiovascular and Respiratory adaptations to training

Males generally have a larger heart, and as a result, a larger cardiac output and a lower resting heart rate.

A result of the larger cardiac output is that males tend to have a greater endurance capacity than females due to the greater delivery of oxygenated blood to the body's tissues.

Males also typically have a greater blood volume, and a greater red blood cell concentration than females, which also results in males having greater endurance capacities

The adaptations which occur will depend on the nature of the training being undertaken by the athlete.

The long term effects of anaerobic training are to



increase the size of fast twitch muscle fibers' (hypertrophy), and

To convert type IIa fibers' into type IIb fibers'.

The muscle cells will be adapted to store greater amounts of creatine phosphate and muscle glycogen.

The efficiency of the energy-producing chemical reactions within the cells increases, resulting in more powerful, faster movements by the muscular system.

The long term effects of aerobic endurance training are

To increase the blood capillary supply to the slow twitch muscles,

To improve cardiac function due to hypertrophy of the cardiac muscle [bradycardia], as well as increasing the volume of the ventricles.

The myoglobin content and number of mitochondria in the muscles increase,

type IIb fibers' are converted into type IIa fibers',

There will be an increase in muscle glycogen stores.

Endurance training also enables the athlete to utilize fat reserves as an energy source sooner than the untrained person, as a result of improved biochemical pathways within the cells.

Special Concerns for Women who exercise

There is a sub group of women that have exercised who have reported a shortening in their menstrual cycle. The more intense the training, the more the cycle is shortened. If a female trains too hard the cycle can disappear. This is known as athletic amenorrhea.

There are two types of amenorrhea, these are;

\* Primary- is where menstruation has not started by age 16

\* Secondary- is when the female has begun menstruation, but her periods then stop

How does it occur?

Intense exercise and extreme thinness may reduce the levels of hormones that regulate a woman's periods. These hormones, estrogen and progesterone, are important for overall body health. Estrogen is especially vital for healthy bones.

Athletic amenorrhea is often seen in sports that stress thinness, such as gymnastics, figure skating, and long-distance running. When thinness is heavily emphasized, some young women may develop eating disorders such as anorexia or bulimia. A person with anorexia diets to excess, sometimes to the point of starving. People with bulimia binge (eat a lot at one time) and then purge, either by vomiting, using laxatives, or exercising too much.

[http://www.answers.yahoo.com/question/index?qid=](http://www.answers.yahoo.com/question/index?qid=20080407040503AAT4QXZ)

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## Long term consequences

- \* Infertility – a woman is unable to conceive whilst she is amenorrhoeic, but athletic amenorrhoea has no effect on long term fertility once menstruation recommences.
- \* High blood cholesterol levels – caused by an oestrogen related slump in the ratio of ‘ good’ cholesterol (high density lipoprotein or HDL) to ‘ bad’ cholesterol (low density lipoprotein or LDL).
- \* Osteoporosis – a disease characterized by brittle, honeycombed bones that break easily.
- \* Premature ageing – loss of skin elasticity due to insufficient levels of oestrogen.
- \* Less P. M. T.

## Osteoporosis

Osteoporosis is a decrease in bone mineral density. Peak bone mass is achieved between the ages of 18-25; after that bone mass is lost at a rate of 0.3%-0.5% per year. Menopausal women lose approx. 3% of bone mass per year for an average year of ten years, after which it returns back to a loss of 0.3-0.5% per year. Various research has shown that weight bearing exercise helps to increase bone mass.

## Eating Disorders

A person who has disordered eating might display the following symptoms:

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- \* Intense fear of weight gain
- \* Distorted body image
- \* Chaotic eating patterns/ strict dieting

There 2 main common eating disorders related to female and male athletes.

These are:

- \* BULIMIA NERVOSA
- \* ANOREXIA NERVOSA

#### ANOREXIA NERVOSA

ANOREXIA NERVOSA is characterized by self-starvation and excessive weight loss. It is a restriction eating disorder where the individual maintains a low body weight by restricting food intake and increasing activity.

Symptoms include:

Refusal to maintain body weight at or above a minimally normal weight for height, body type, age, and activity level

Intense fear of weight gain or being “ fat”

Feeling “ fat” or overweight despite dramatic weight loss

Loss of menstrual periods

Extreme concern with body weight and shape

## BULIMIA NERVOSA

BULIMIA NERVOSA is characterized by a secretive cycle of binge eating followed by purging. Bulimia includes eating large amounts of food—more than most people would eat in one meal—in short periods of time, then getting rid of the food and calories through vomiting, laxative abuse, or over-exercising. The person is usually of average or above average weight. It can be very hard to tell if someone is suffering from this condition.

Symptoms include:

Repeated episodes of bingeing and purging

Feeling out of control during a binge and eating beyond the point of comfortable fullness

Purging after a binge, (typically by self-induced vomiting, abuse of laxatives, diet pills and/or diuretics, excessive exercise, or fasting)

Frequent dieting

Extreme concern with body weight and shape

<http://www.caringonline.com/eatdis/intro.htm#What>

## Female Athlete Triad

Female athletes who exercise too intensely are at risk for a problem called female athlete triad. Female athlete triad is a combination of three conditions: disordered eating (eating disorders), amenorrhea, and

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osteoporosis. A female athlete can have one, two, or all three parts of the triad.

#### Triad Factor #1: Disordered Eating/ Eating disorders

Female athletes who try to lose weight primarily to improve their athletic performance; The disordered eating that accompanies and is in part to the female athlete triad can range from avoiding certain types of food the athlete thinks are “ bad” (such as foods containing fat) to serious eating disorders like anorexia nervosa or bulimia nervosa.

#### Triad Factor #2: Amenorrhea

A female athlete who is suffering from female athlete triad is simultaneously exercising intensely and not eating enough calories, when her weight falls too low, she may experience decreases in estrogen, the hormone that helps to regulate the menstrual cycle. As a result, the athlete’s periods may become irregular or stop altogether.

A female athlete who participates intensively in sports may never even get their first period because they’ve been training so hard. Other females may have had periods, but once they increase their training and change their eating habits, their periods may stop.

#### Triad Factor #3: Osteoporosis

Low estrogen levels and poor nutrition, especially low calcium intake, can lead to osteoporosis, the third aspect of the triad. Osteoporosis is a weakening of the bones due to the loss of bone density and improper bone

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formation. This condition can ruin a female athlete's career because it may lead to stress fractures and other injuries.

Usually, the teen years are a time when girls should be building up their bone mass to their highest levels - called peak bone mass. Not getting enough calcium during the teen years can also have a lasting effect on how strong a girl's bones are later in life.

Picture sourced form: [http://nsca.hkeducationcenter.com/courses/OEC\\_Previews/hf-ft303\\_preview/images/fig\\_04.gif](http://nsca.hkeducationcenter.com/courses/OEC_Previews/hf-ft303_preview/images/fig_04.gif)

### Race in Sport

There are different types of athletes, in this assignment I will be looking at the Physiological differences between:

- \* West African Athletes

- \* East African Athletes

- \* Caucasian Athletes

- \* Indian Athletes

There seems to be difference between athletes and some races are better at certain sports than another race. African athletes tend to be better at short and long distance running events; and Caucasians tend to be better swimmers.

### West African Athletes

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Athletes of West African ancestry are among the world worst distance runners. However they represent:

- \* 25% of England's premiership footballers
- \* 84% of US basketball
- \* 70% of US footballers
- \* 40% of US baseball players

They hold the top 220 times for the 100meters and the top 494 of the top 500meters times. They therefore win 95% of the elite races.

Research suggests that the physique of athletes from this region is better suited to sprint events.

These athletes generally have

- \* Lower body fat
- \* Longer legs in comparison with the rest of the body
- \* Narrower hips
- \* Greater muscle mass
- \* Higher bone mineral density
- \* Higher levels of testosterone
- \* Higher percentage of fast twitch muscle fibers



\* More anaerobic enzymes

Research strongly suggests that no amount of training can break through the percentage of genetically inherited fast twitch muscle fibers. The greater the number of fast twitch fibers an athlete has, generally the better they would be suited to sprint/power events.

Is a sprinter born or made?

Genes may not determine who the world's best runners are, but they do circumscribe possibility. Kenyans and other East Africans have an innate capacity, not an innate ability, to thrive in distance running; individual effort and courage separate the pretenders from the stars.

East African Athletes

Kenyans and other east Africans sweep 60% of the worlds distance running events. In the sprints, their fastest recorded time for the 100meters is 10. 28 seconds. It is ranked as the 5, 000th on the all time list. The top 60 times for the 3000meters steeplechase are all held by Kenyan athletes. They also hold more than half of the top times for the 5000meters and the 10, 000 meters. The vast majority of top Kenyan runners come from one area of the country, the Kalejin region. The Kalejin (1. 5m population) athletes have more than 70% of Kenya's Olympic medals for running.

Kenyan's have a distinct body type:

\* Ectomorphs

- \* Short and slender
- \* Higher RBC count
- \* Huge lung capacity
- \* High percent of slow twitch muscle fibers
- \* More energy producing enzymes in their muscles

They are the perfect biomechanical package for running

### Caucasian Athletes

Caucasian athletes tend to have, on average, more natural upper-body strength, predictably dominated weightlifting, wrestling and field events, such as the hammer (hold 46 of the top 50 performances). Evolutionary forces have shaped a population with a predilection toward a mesomorphic body type - large and muscular, particularly in the upper body, with relatively short arms and legs and thick torsos. These proportions tend to be an advantage in sports in which strength rather than speed is at a premium.

Caucasian athletes tend to dominate swimming events; very few athletes reach any swimming finals. This is due to that African athletes have heavier skeletons and smaller chest cavities. This would lead them to a disadvantage when competing in the water.

### Indian Athletes

Indian Athletes excel in a variety of sports particularly cricket. This is due to social and cultural influences rather than physiological differences. Research has shown that genetic evolution has strongly influenced the physiological make up of people living in different environments. This could determine if an individual has the chance at becoming an elite athlete. Through dedication, commitment and good fortune are also factors that play a major part in determining if an athlete will be a winner. It is also necessary to take in to account the social, cultural and economic factors of a country. These can have a great effect of choice of sport. This could help to explain why some races excel at some sports but not in others.

## References

### Class handouts

[http://nsca.hkeducationcenter.com/courses/OEC\\_Previews/hf-ft303\\_preview/images/fig\\_04.gif](http://nsca.hkeducationcenter.com/courses/OEC_Previews/hf-ft303_preview/images/fig_04.gif)

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