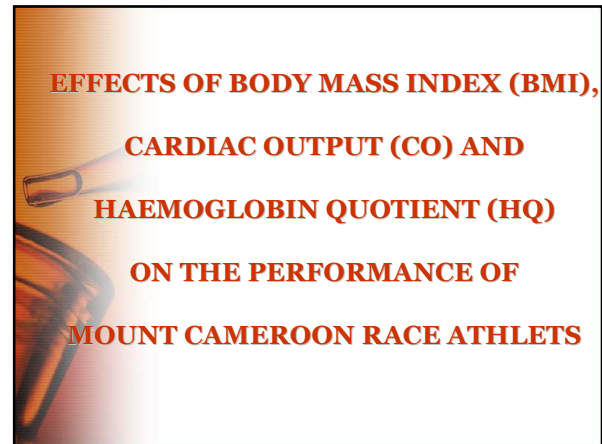


Mount CAMEROON

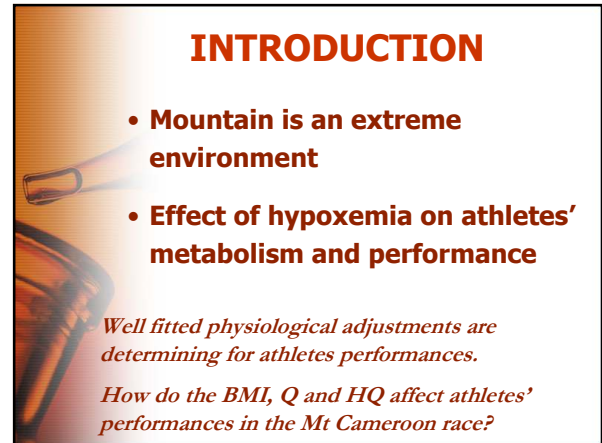


EFFECTS OF BODY MASS INDEX (BMI), CARDIAC OUTPUT (CO) AND HAEMOGLOBIN QUOTIENT (HQ) ON THE PERFORMANCE OF MOUNT CAMEROON RACE ATHLETES



PLAN

1. Introduction
2. Mount Cameroon Race
3. Body Mass Index
4. Cardiac Output
5. Haemoglobin Quotient
6. Summary

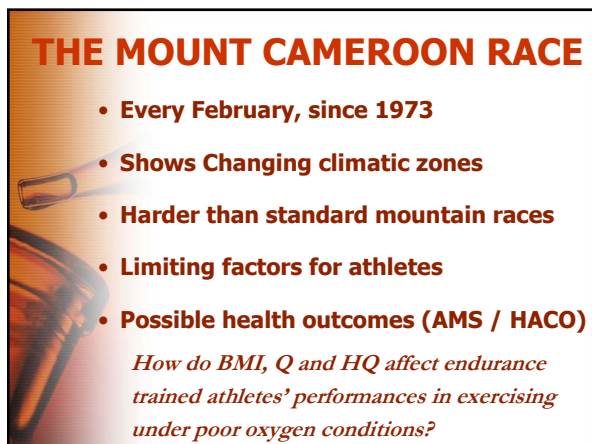


INTRODUCTION

- Mountain is an extreme environment
- Effect of hypoxemia on athletes' metabolism and performance

Well fitted physiological adjustments are determining for athletes performances.

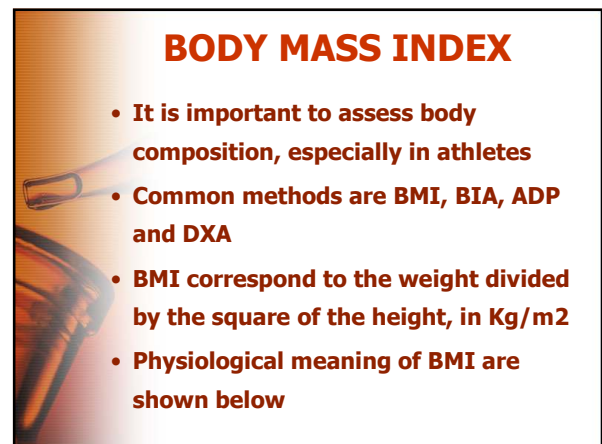
How do the BMI, Q and HQ affect athletes' performances in the Mt Cameroon race?



THE MOUNT CAMEROON RACE

- Every February, since 1973
- Shows Changing climatic zones
- Harder than standard mountain races
- Limiting factors for athletes
- Possible health outcomes (AMS / HACO)

How do BMI, Q and HQ affect endurance trained athletes' performances in exercising under poor oxygen conditions?



BODY MASS INDEX

- It is important to assess body composition, especially in athletes
- Common methods are BMI, BIA, ADP and DXA
- BMI correspond to the weight divided by the square of the height, in Kg/m²
- Physiological meaning of BMI are shown below

BODY MASS INDEX

Table 1. Classification of persons according to their BMI range

Category	BMI range – kg/m ²
Emaciation	less than 14.9
Severely underweight	from 14.9 to 16.5
Underweight	from 16.5 to 18.4
Normal	from 18.5 to 24.9
Overweight	from 25.0 to 30.0
Obese Class I	from 30.1 to 34.9
Obese Class II	from 35.0 to 40.0
Obese Class III	over 40

BODY MASS INDEX

- A high BMI corresponds to a high body fat mass
- Fats are very important in endurance athletes metabolism
- There is reduced use of fat in mountain exercise
- High BMI and thus body fat mass is disadvantageous in mountain competition

Cardiac Output

- Cardiac Output = Stroke Volume x Heart Rate
- Many factors influence Q:
 - Atrial kick
 - Preload
 - Afterload
 - Frank-Starling's Law
 - Catecholamine stimulation
 - Coronary ischemia

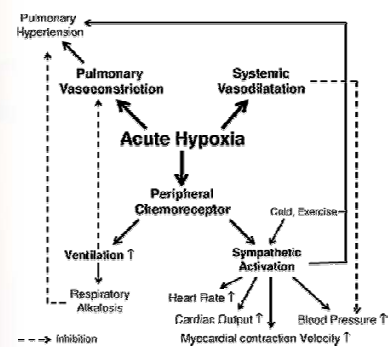
Cardiac Output

- Q is intimately related to energy production
- Muscular activity is energy consuming
- Sufficient Q is necessary to deliver adequate supplies of oxygen and nutrients (glucose) to the tissues.
- Low Q will reduce energy levels and subsequently athletic performances

Cardiac Output

- Q is adjusted in acute exposure to altitude
- The increase in Q is due to increased heart rate due to sympathetic activity and increased catecholamine release
- The full mechanism on the chart below

Cardiac Output





Cardiac Output

Q decreases in chronic exposure to altitude

- There is a drop in stroke volume
- There is reduction of plasma volume, due to
 - Chemoreceptors stimulation
 - Increased release of atrial natriuretic peptide
 - decreased synthesis of aldosterone
- There is also parasympathetic activity



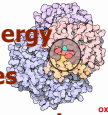
HAEMOGLOBIN QUOTIENT

- Haemoglobin is the red pigment that carries oxygen in the blood
- Haemoglobin quotient correspond to mean corpuscular haemoglobin concentration (MCHC)
- It is the quotient of haemoglobin and haematocrit, in g.dl-1
- It is commonly referred at as the "haemoglobin concentration"



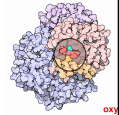
HAEMOGLOBIN QUOTIENT

- Oxygen is very important for energy production in endurance athletes
- In case of hypoxia, only an enhanced oxygen fixation and transport in blood can compensate the low PaO₂
- High haemoglobin quotient
 - Improves lung diffusing capacity
 - Enhances systemic oxygen delivery



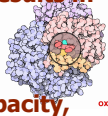
HAEMOGLOBIN QUOTIENT

- Up to 12% of athletes in this race are sickle cell trait carriers.
- This can seem threatening
- Researches on SCT carriers show that their reaction under exercise is similar to that of normal individuals



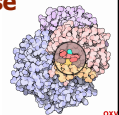
HAEMOGLOBIN QUOTIENT

- Low HQ in altitude competition results in lower performances
- High HQ enhances endurance capacity, proportional to oxygen carrying capacity
- Indirect assessment through lactate response confirms these observations



HAEMOGLOBIN QUOTIENT

- High haemoglobin concentration in altitude competition would cause
 - Good oxygen supply to the brain
 - Good leg blood flow
 - Good supply of exercising muscles
 - Higher degree of aerobic metabolism
 - Slow lactate production
 - Rapid lactate clearance in muscles
 - Slow lactate accumulation in muscles
 - Longer and better performance for athletes



HAEMOGLOBIN QUOTIENT

- An increase in haemoglobin and haematocrit has been observed with acclimatisation to altitude
- The acute stage (< 1 week) is due to plasma depletion
- The chronic stage is due to increased release of EPO

SUMMARY

- Mount Cameroon race is one of the most strenuous competitions in the world
- High HQ, high HR and a low BMI within the normal range, are advantageous for the athlete
- Serious endurance training and acclimatisation to the mountain environment should be done before engaging in the competition

THANK YOU