Relative Energy Deficiency in Sports

Ashley Faller
Kate Lindeman
Ethan Wong
Shyloh Almada
Thawinee Thongprajiad

Table of Contents

01

Introduction

REDs definition, symptoms, treatment, and our mission statement

What's REDs?

- Definition: RED-S, or Relative Energy Deficiency in Sport, is a syndrome of poor health and declining athletic performance that happens when athletes do not get enough fuel through food to support the energy demands of their daily lives and training

- Treatment: Increase energy intake (food intake), or decrease energy expenditure (reduce training load), or a combination of both

Improve our understanding of RED-S and its effects on the body, with the hopes of creating a more comprehensive treatment plan

02

System Set Up

Equations, constants, assumptions, mission statement

Assumption We Made

Aerobic

Glucose glycolysis under aerobic condition

Healthy Adult

All the constants are an average taken from healthy adult

V02 Max

Exercise = 90% V02 max
Resting/No Exercise = 40% V02 Max

Aerobic Equation

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_20 + 36ATP$$

Equations

ATP Concentration

$$\frac{dP}{dt} = \beta k G O_2^6$$

# of ATP got from 1 Glucose

Glucose concentration

Oxygen consumption

Reaction Rate

Equations

OXYGEN

Oxygen uptake

$$\frac{dO_2}{dt} = \alpha B - \frac{Q}{V} O_2 - 6kGO_2^6$$

BPM

Q/V = 1

Constants

32 to 38 — **ATP per Glucose**

From one cellular respiration cycle

0.4 to 0.9 — **Alpha*Beta**

Maximum oxygen uptake at rest and during a workout

1 — **1/Tau**

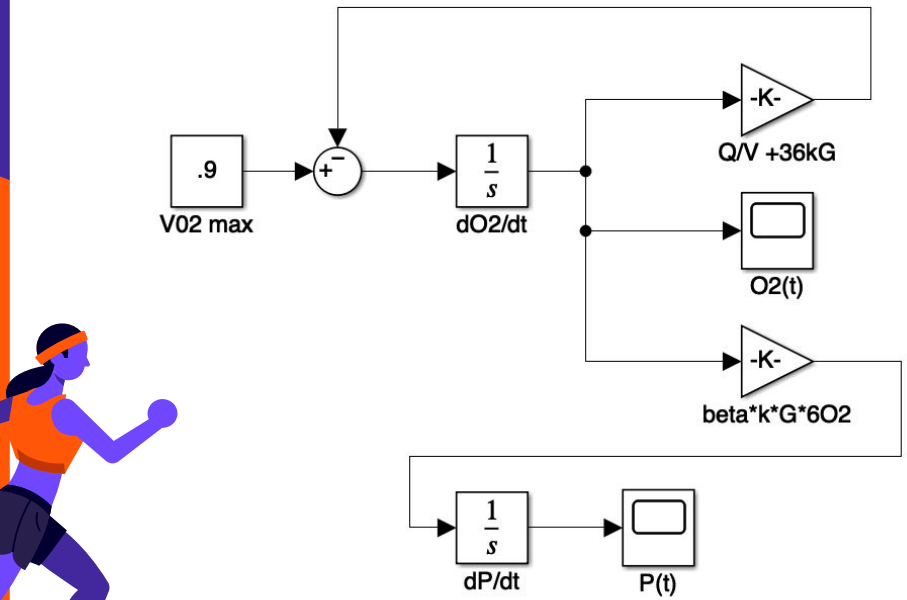
Flow rate/volume could be assumed to be 1

1 — **Cellular Respiration Rate (k)**

How fast the reaction takes place

03
System and Diagram

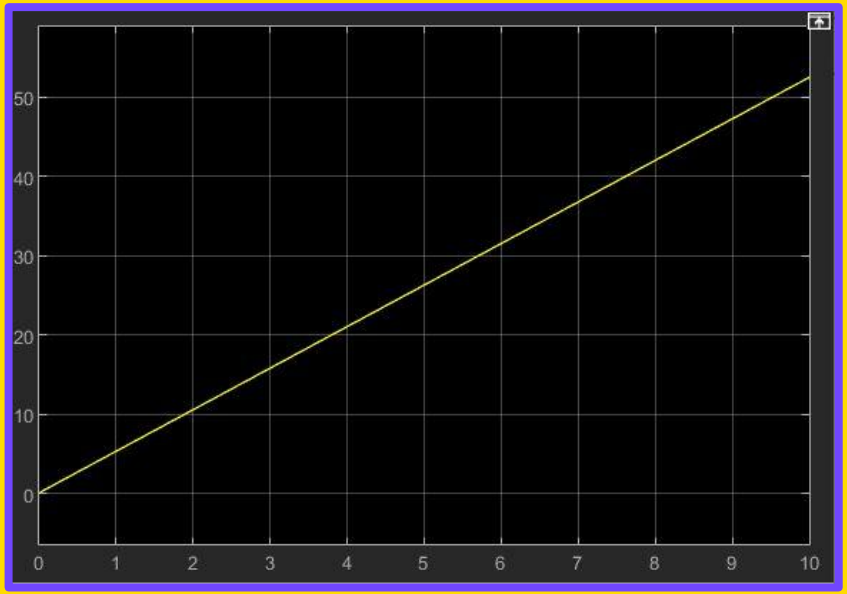
SIMULINK



ATP CONCENTRATION

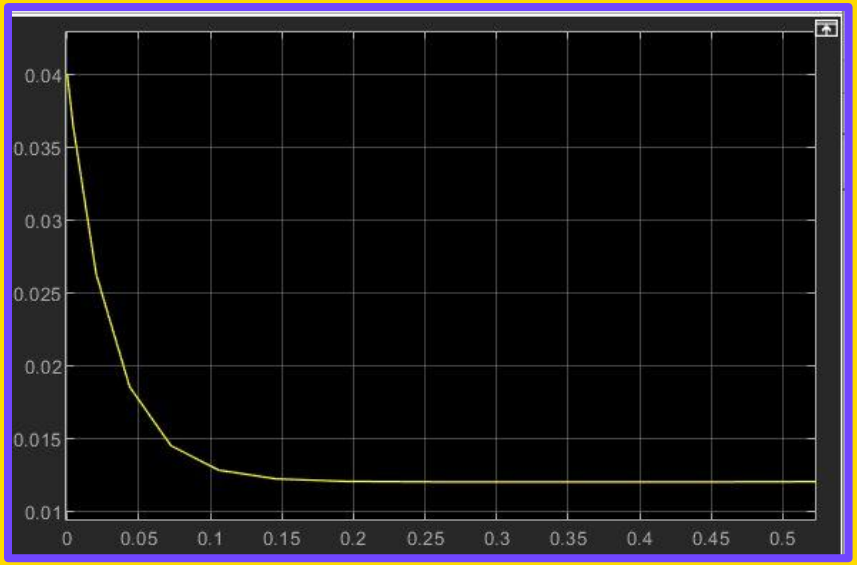
RESTING

EXERCISE

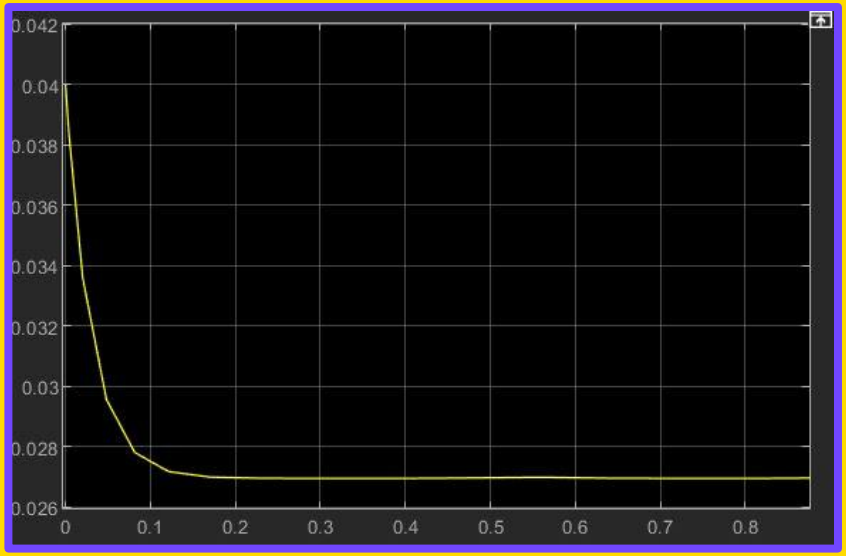


OXYGEN CONCENTRATION

RESTING



EXERCISE



04

conclusion

Future Application

GLUCOSE CONCENTRATION

$dG/dt = -(K+O_2(t))G$

ATP CONCENTRATION

$dP/dt = \beta KGO_2(t)$

Biomechanical Analysis

01

Development of program/treatment program plans

02

Health research

03 **Work for food paradigm**

THANK YOU !