

**HIF-1 $\alpha$  CONCENTRATION AND  
HEART MUSCLE HISTOPATHOLOGY  
OF WISTAR RATS INDUCED BY AN  
AEROBIC AND ANAEROBIC  
ACTIVITIES**

# Background

## Physical exercise is :

- regular physical activity performed in certain period of time and intensity
- aims to maintain the body always in good condition of health and fitness
- recommended for preventive, curative, and rehabilitative programs in order to maintain and enhance health, especially the health of the cardiovascular system

## Physical Activities

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graph TD; A[Physical Activities] --> B[Aerobic physical activities]; A --> C[Anaerobic physical activities];
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### Aerobic physical activities

- utilize ATP energy generated by oxidation process of glycogen phosphorylase and free fatty acids.
- Metabolism process depends on oxygen availability.

### Anaerobic physical activities

- Physical activities that do not utilize oxygen in the metabolism process of energy production.
- The energy is generated by ATP production originating from creatine phosphate and glycogen as source

- 25-30% Aerobic physical activities
- 70-75% Anaerobic physical activities



Sprint run chasing a ball and hitting ball with full power are anaerobic physical activities

If there is impaired heart function and the oxygen supply during the sprint could not meet cardiac oxygen demand



acute heart attack



I  
G  
N  
O  
R  
I  
N  
G

sudden death



Sudden death in athletes frequently occurs during the competition

It is assumed that performing high intensity exercise without taking rest days for the upcoming competition has great impact in cardiac muscle damage and sudden death during the competition.

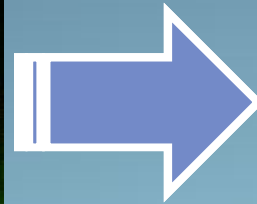
## Sudden death



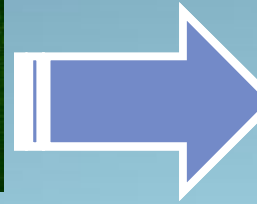
if the heart successfully adapts with such condition so that it may compensate the load taken during physical exercise.

Therefore, the cardio-protective effect exerted by the physical exercise can be achieved

Need to understand the mechanism of cardiac adaptation when we perform physical exercises



The molecular adaptation ???



Hypoxia ???



protection effect on cardiac muscle  
VS  
cardiac muscle cell damage



Role of HIF-1 $\alpha$



- Glucose metabolism
- Angiogenesis



Based on the above mentioned explanation, a study should be performed, in order to recognize the mechanism of molecular adaptation in cardiac muscle during physical exercise with a loading of aerobic and anaerobic physical activities.

Experimental animal model is an appropriate choice to develop the molecular study; thus, the basic molecular adaptation of physical activities on the cardiovascular health could be known

## Material and Methods

### Animal model and instrument



- male Wistar rats
- aged 6-8 weeks
- with weight of 60-100 gram



*Animal Treadmill* for rat



9 Groups  
(P1-P9)

P 1 : the control group  
P2-P9 : groups that were treated with aerobic and anaerobic physical activity for 1, 3, 7 and 10 days

The treatment for physical activity was performed by putting the rats on animal treadmill and setting the treadmill on the speed rate of :

- 20 m/minute about 30 minutes (aerobic physical activity)
- 35 m/minute about 20 minutes (anaerobic physical activity)





The observed and measured parameter in this study could be categorized into 2 groups of parameters :



Parameters on hypoxia :

measurement of HIF-**1 $\alpha$**   
concentration by ELISA method  
using kit of Surveyor™ IC  
Human/Mouse Total HIF-**1 $\alpha$**   
Immunoassay



Parameter on altered  
cardiac muscle cell  
structure :

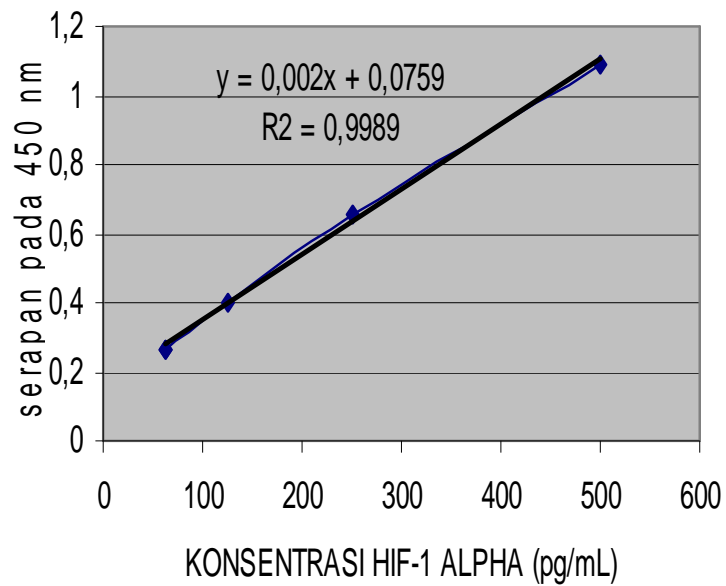
histopathological  
examination of cardiac  
muscle by H&E staining



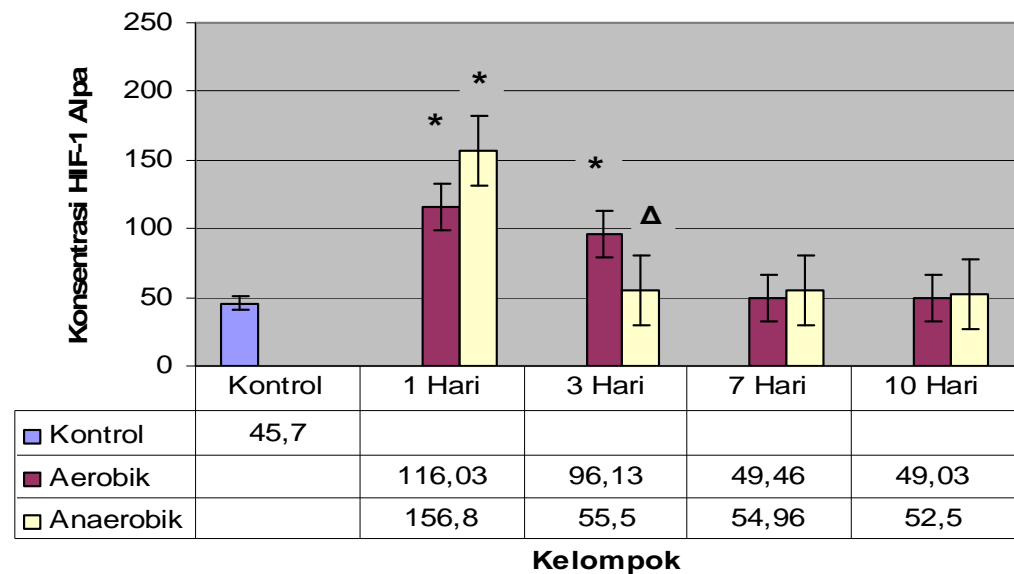
RESULT

# Parameter on hypoxia

KURVA STANDAR HIF-1 ALPHA



Konsentrasi HIF-1 Alpha  
Kelompok Aerobik dan Anaerobik



The concentration of HIF-1 $\alpha$  in heart muscle tissue

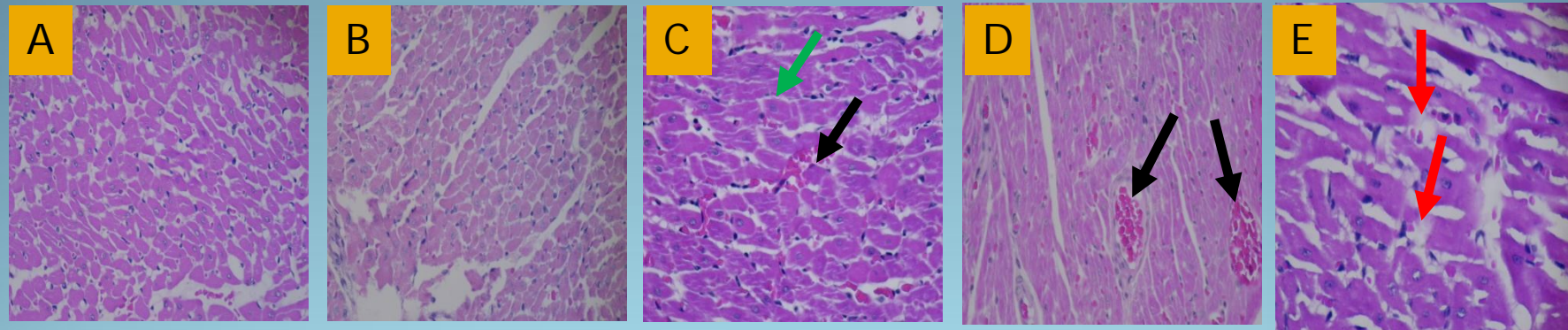
\*Significant difference compare with control group ( $p < 0,05$ )

ΔSignificant difference compare with aerobic and anaerobic groups ( $p < 0,05$ )





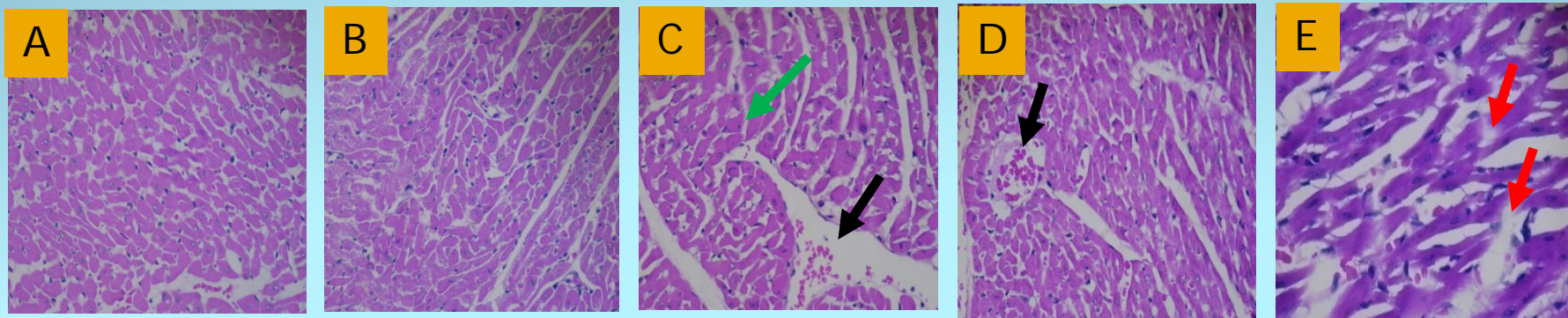
## Parameter on altered cardiac muscle cell structure



Gambar 4.3. Gambaran Histopatologi Otot Jantung Kelompok Aerobik

Ket : A : Kontrol (Normal), B : 1 Hari (Normal) C : 3Hari (Hipertrofi + iskemik)

D : 7 Hari (Iskemik) E : 10 Hari (Infark) ↓:Hipertrofi ↓:Iskemik ↓:Infark



Gambar 4.4. Gambaran Histopatologi Otot Jantung Kelompok Anaerobik

Ket : A : Kontrol (Normal), B : 1 Hari (Normal) C : 3 Hari (Hipertrofi+iskemik)

D : 7 Hari (Iskemik) E : 10 Hari (Infark) ↓:Hipertrofi ↓:Iskemik ↓:Infark

Groups	Without Treatment			1 day			3 days			7 days			10 days		
	Score			Score			Score			Score			Score		
	H	IS	IN	H	IS	IN	H	IS	IN	H	IS	IN	H	IS	IN
		%	%			%	%			%	%			%	%
Control	-	-	-												
<b>ΔAerobik</b>				-	-	-	+	10	-	+	10	-	-	10	10
Anaerobik				-	-	-	+	20	-	+	20	-	-	40	10

H : hypertrophy, IS : ischemic, IN : Infarct



# CONCLUSION

1. The result of **HIF-1 $\alpha$  concentration measurement** on cardiac muscle showed that there was significant increase on **HIF-1 $\alpha$  concentration in** the aerobic and anaerobic physical activity groups compared to the control group. It indicates that physical activity also causes hypoxia on cardiac muscle.
2. Based on the histopathological examination of cardiac muscle, we found hypertrophy, ischemia and infarct in aerobic and anaerobic group. However, the level of damage was more severe in the anaerobic group compared to the aerobic group.



THANK YOU