

SIPS | SURABAYA
2017 | INTERNATIONAL
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SEMINAR

**PROCEEDINGS OF
THE SURABAYA
INTERNATIONAL PHYSIOLOGY
SEMINAR**

Surabaya, October 12-14, 2017

Editors:

Soetjipto

Muhammad Miftahussurur

Ferry Efendi

Purwo Sri Rejeki

Bambang Purwanto



Gestrindo



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sipsiaifi2017@gmail.com

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INVITED SPEAKERS

Cheng Hwee Ming
University of Malaya
Malaysia

Daniel John Green
University of Western Australia
Australia

Fadzil Hamzah
Sport Center of Changi General Hospital
Singapore

Deanne Helena Skelly
Griffith University
Australia

ORGANIZING COMMITTEES

SCIENTIFIC COMMITTEE

Cheng Hwee Ming, Department of Physiology, Faculty of Medicine, University of Malaya, Malaysia

Daniel John Green, University of Western Australia, Australia

Fadzil Hamzah, Changi Sports Medicine Centre, Changi General Hospital, Singapore

Deanne Helena Skelly, University of Western Australia, Australia

R. Soedarso Djojonegoro, Universitas Airlangga, Indonesia

Paulus Liben, Universitas Airlangga, Indonesia

Elyana Asnar STP, Universitas Airlangga, Indonesia

Choesnan Effendi, Universitas Airlangga, Indonesia

Harlina, Universitas Airlangga, Indonesia

Tjitra Wardani, Universitas Airlangga, Indonesia

Gadis Meinar Sari, Universitas Airlangga, Indonesia

Purwo Sri Rejeki, Universitas Airlangga, Indonesia

Lilik Herawati, Universitas Airlangga, Indonesia

Bambang Purwanto, Universitas Airlangga, Indonesia

Kristanti Wanito Wigati, Universitas Airlangga, Indonesia

Hayuris Kinandita Setiawan, Universitas Airlangga, Indonesia

Irfiansyah Irwadi, Universitas Airlangga, Indonesia

Sundari Indah Wiyasihati, Universitas Airlangga, Indonesia

Eka Arum Cahyaning Putri, Universitas Airlangga, Indonesia

Misbakhul Munir, Universitas Airlangga, Indonesia

FOREWORD

Dean of Faculty of Medicine, Universitas Airlangga

Assalamu'alaikum Wr. Wb.

Distinguished Guests, all the Participants, Ladies and Gentlemen

On behalf of Faculty of Medicine, Universitas Airlangga, it is my great pleasure to welcome all the speakers, moderators, and participants on **Surabaya International Physiology Seminar 2017 (SIPS 2017)**, which will be held from today, October 12th until October 14th, 2017. I would like to express my hearty welcome to all the international speakers, **Prof. Cheng Hwee Ming**, from University of Malaya, Malaysia; **Prof. Daniel John Green**, from University of Western Australia; **Dr. Fadzil Hamzah**, from Sport Center of Changi General Hospital, Singapore and **Dr. Deanne Helena Skelly**, from Griffith University, Australia.

The aim of SIPS 2017 is to provide a platform for academicians, educators, researchers, practitioners, undergraduate and postgraduate students to share and discuss the knowledge of the recent issues, opinions, researchers about the development and innovation of physiology in medical science, dentistry, veterinary, plants and agriculture, sports and sciences.

I believe this event is a great purpose in order to develop knowledge, experiences and best practices that can be applied for the good, especially in the field of healthcare as a whole.

Finally, I would like to express my sincere acknowledgements to those who take part and especially for Department of Medical Physiology, Faculty of Medicine, Universitas Airlangga for their effort in holding this event and wishing all to have success.

Wassalamu'alaikum Wr. Wb.

Prof. Dr. Soetojo, MD.

Faculty of Medicine, Universitas Airlangga

Chair of Committee / Head of Physiology Department, Faculty of Medicine, Universitas Airlangga

Assalamu 'alaikum Wr. Wb

Greetings,

On behalf of SIPS committee and Physiology Department, Universitas Airlangga, we are welcoming to Surabaya, City of Heroes.

This year, the annual meeting of Indonesian Physiology Society (IAIFI) is hosted at Surabaya, entitled "**Surabaya International Physiology Seminar Workshop (SIPS)**". We present some update workshop and lectures in order to bring physiology research from basic to clinical application on humanities, animal welfare and good environment. All participants have opportunities to publish their research in presentation, poster and ISBN proceeding. Selected papers will be submitted to SCOPUS indexed proceeding/ journal and awarded as Best Poster and Best Oral Presentation.

We hope that all participants will get some interesting experiences for next 3 days, 12-14 October 2017. Enjoy our lectures and workshops, taste the culinary and take your time to sightseeing around Surabaya.

Wassalamu 'alaikum wr. wb.

Dr. Bambang Purwanto

Chairman of Committee / Head of Physiology Department
Faculty of Medicine, Universitas Airlangga

Welcome Address - Surabaya International Physiology Seminar Workshop (SIPS)

Dear fellow Physiologists and Participants,

On Behalf of the Indonesian Physiological Society (IAIFI) and the Physiology Department Faculty of Medicine Universitas Airlangga, I would like to welcome you all to Surabaya International Physiology Seminar (SIPS), held on 12-14 of October 2017.

Finally after long-awaited Surabaya gets a turn again to host and organize the International Physiology Seminar. Hence the Steering- and Organizing Committee consisting of young energetic physiologists are determined to make the Seminar a successful one. The theme of the seminar is:

"The Role of Physiology in Translation Research: From Basic to Application"

This annual meeting covers a wide range of topics of Physiology on Medicine, Dentistry, Veterinary, Plants and Agriculture, Sports and Sciences. We sincerely hope that SIPS 2017 enable to provide a platform for academicians, educators, researchers, practitioners and postgraduate students to present and discuss researches, development and innovations in wide range of topics as mentioned above. It will provide all participants to share knowledge, exchange new ideas and their experiences in many research topics, for then it will enhance future collaborations.

With great interest and enthusiasm I look towards the success of this Seminar, and wish all of you every success and a pleasant stay in Surabaya.

May Allah Swt. bestow upon us His Blessings.

On Behalf of the Steering and Organizing Committee Senior Physiologist,
Prof. R. Soedarso Djojonegoro

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VO2MAX of Ergocycle Astrand Test Differs from 12-Minutes Cooper Running Test on Medical Students' Physical Fitness Level

Bella Anggi Afisha¹, Atika² and Lilik Herawati³

¹Medical Program, Faculty of Medicine, Universitas Airlangga, Jl. Mayjen. Prof. Dr. Moestopo, Surabaya, Indonesia

²Department of Public Health, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

³Department of Physiology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
lilik_heraw@fk.unair.ac.id

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Abstract: The level of physical fitness is a body health parameter. It can be measured by several methods. The 12-minutes Cooper running test and ergocycle Astrand test for VO₂max calculation are the most common in Indonesia. The aim of this study was to compare the cardiorespiratory physical fitness level between the 12-minutes Cooper running test and the ergocycle Astrand test. The subject of this study consisted of 20 male students of the Faculty of Medicine, Universitas Airlangga, aged between 19 and 22 years old with normal to overweight body mass index (BMI). Based on the ergocycle Astrand test, 25% of students showed very good category, 20% of students good, 20% of students moderate, and 35% of students poor. The average of VO₂max was 41.01% mlO₂/kgweight/minute. The 12-minutes Cooper running test revealed that 5% of students showed good category, 15% of students moderate, 25% of students poor, and 55% of students very poor. The average of VO₂max was 32.34 mlO₂/kgweight/minute. The 12-minutes Cooper running and ergocycle Astrand test on VO₂max had a significant difference (p=0.002). The selection of measurement type and the result of physical fitness level should be considered further because they may have significant difference, e.g. the ergocycle Astrand test is a non-weight-bearing test and the 12-minutes Cooper running test is a weight-bearing test.

1 INTRODUCTION

Indonesia is still unaware of the importance of healthy living. Public health needs to be created to achieve better health levels and improvement in physical fitness. Exercising is an activity that commonly uses muscle, which makes organs systems and bodies work better (Sumaryanto, 2012). Without exercise there is a reduction in the quality of health and an increase in the manifestation of disease. Maximal aerobic capacity is an indicator of physical fitness (Cooper, 1968). The measurement of certain people was conducted. In China middle school students were measured (Duan et al., 2015). In Sweden the middle-aged population was measured (Lindgren et al., 2016). The study on Italian diabetes mellitus investigated the correlation between physical activity and sedentary behavior (Balducci et al., 2017). The correlation between

physical fitness and a sedentary lifestyle was conducted in America and the result showed that physical fitness has an inverse association with a sedentary lifestyle (Kulinski et al., 2014). However, the measurement methods varied. In Indonesia, measurements were carried out on the navy Indonesian army, which compared several methods (Afriyanto, 2011). Nevertheless, VO₂max data have not been performed for sedentary, e.g., students. Therefore, the aim of this study was to ascertain the differences in the fitness index comparing ergocycle and running methods in sedentary medical students in Surabaya.

There are many methods of measuring the level of fitness: 12-minutes Cooper running test and ergocycle Astrand are simple methods. The 12-minutes Cooper running test involves walking or running for 12 minutes on a 400-meter track; the ergocycle Astrand test uses a bicycle via Astrand method. The VO₂max comparison between some

physical fitness level methods have been studied. The VO₂max ergocycle is higher than the 12-minutes running test (Cooper) and treadmill (Astrand) (Afriyanto, 2011). However, the difference of methods to figure out fitness level based on the parameters of VO₂max has not been done.

2 MATERIAL AND METHODS

2.1 Participants

A total of 20 male samples within the age range of 19-22 years participated in this cross-section observational analytic study. The statistical power was at 80% while the desired significance category was 0.05. The participants were recruited from a cohort of medical students at the Universitas Airlangga, Surabaya, Indonesia. They were screened for eligibility based on the inclusion categorycategory that:they had normal or overweight body mass index (BMI) variation; they were healthy; did not have severe disease; physical exercise more than once a week; no physical restriction in terms of mobility; and they were prepared to be a participant. Participants were randomly assigned to two exercise groups, but each participant performed two physical tests: the 12-minutes Cooper running test and the ergocycle Astrand test. The 12-minutes Cooper running test and ergocycle Astrand test were performed at different times with an interval of rest of 7 days.

The first group consisted of 10 participants who performed the ergocycle Astrand test first; then the 12-minutes Cooper running test was performed after a week for physical recovery. The second group consisted of 10 participants who performed the 12-minutes Cooper running test first, followed by the ergocycle Astrand test.

All participants gave their written informed consent to participate in this study. Ethical approvals were obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Airlangga, Surabaya.

2.2 Exercise Protocols

All subjects performed warm-up exercises for five minutes before the main aerobic exercise sessions; this comprised flexibility exercises, which involved a range of motion exercises for all joints of the upper and lower limb and trunk.

The subjects in the 12-minutes Cooper running test were required to walk or run on a 400-meter track and freely to determine their speed. After 12 minutes, the distance was measured. The participants in the ergocycle Astrand were required to exercise on a bicycle ergometer; when sitting on the bicycle, participants achieved free pedaling at a workload of 0-1 kilo pound (kp) until they established a regular and steady pedaling rate. The workload was then gradually increased to 2 kp and constant velocity at 50 rpm for 6 minutes. The heart rate (HR) was recorded every minutes.

The glucose level of the participants was checked using a glucometer before and after exercise training as safety precaution against hypoglycemia. Cool-down exercise was performed by the participants for five minutes.

2.3 Data Collection

The instruments utilized for this study were the bicycle ergometer Astrand, polar heart rate monitor, stopwatch, 400-meter track, weighing scale, and height meter.

2.4 Cardiorespiratory Parameters

A resting heart rate was obtained using the polar heart rate monitor before main test. The unit of measurement was beats per minutes (bpm). After the test, the maximum oxygen uptake (VO₂max) in the 12-minutes Cooper running test for the participants was obtained by calculating the distance recorded after 12 minutes walking or running using the formula $(22.351 \times a) - 11.288$, where $a =$ distance (kilometers) (Cooper, 1968). The VO₂max of the ergocycle Astrand test was obtained by converting into the Astrand formula using a correction factor of the age table and heart rate recorded at the sixth minutes. The levels of fitness were classified into five category: very good, good, moderate, poor, and very poor, using the VO₂max parameter.

3 RESULTS

The characteristics of the 20 participants of medical students including age, body weight, body height, and BMI are below (Table 1). They had a sedentary lifestyle.

The resting heart rate (HR) was measured to validate the consistency of the two conditions when the test was performed at different times. It showed

that the resting heart rate was not significant between the two measurements ($p=0.269$). However, after performing the test, there was significant difference in the groups between pre (resting) HR and post (exercise) HR ($p=0.000$) and between groups ($p=0.000$).

Table 1: The characteristics of the participants (n=20).

	Mean	SD
Age (year)	21	0.65
Height (cm)	171.08	5.31
Weight (kg)	64.85	8.15
BMI	22.13	2.34

Table 2: The heart rate before and after the 12-minutes Cooper running test and ergocycle Astrand test.

	Rest HR (HRpre)	Exercise HR (HRpost)
Ergocycle (Astrand) Test	87.10 ± 4.66 ^a	145.15 ± 15.15 ^c
12-minutes Cooper Running Test	88.65 ± 4.06 ^a	173.20 ± 10.50 ^d

Significant differences were shown in the different superscript.

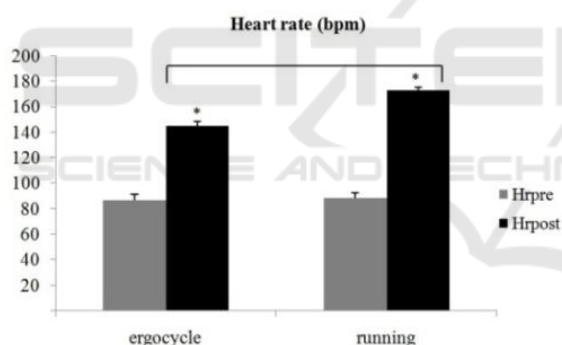


Figure 1: The heart rate before and after the ergocycle Astrand test and the 12-minutes Cooper running test.

Pre= before test; post= after test

*significant difference compared to pre ($p<0.05$);

□ significant difference between groups ($p<0.05$)

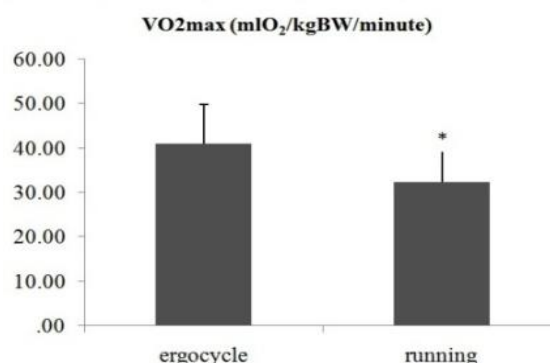


Figure 2: The VO₂max between the 12-minutes Cooper running test and the ergocycle Astrand test.

*significant difference compared to ergocycle ($p=0.002$)

The VO₂max of the ergocycle test showed more than 12 minutes running and had a significant difference ($p=0.002$). The VO₂max average of the ergocycle was 41.01±8.92 mlO₂/kgBW/minute and the 12-minutes running test was 32.34±7.78 mlO₂/kgBW/minute.

4 DISCUSSION

This study compared the cardiorespiratory physical fitness level of ergocycle Astrand and the 12-minutes Cooper running test. The principal findings suggested that the physical fitness levels were significantly different ($p<0.05$). The current findings also suggested that VO₂max were significantly different too; the VO₂max of ergocycle Astrand is higher than the 12-minutes Cooper running test. The findings in this study are in support of previous studies, which reported higher VO₂max is found on the ergocycle test, followed by the 12-minutes Cooper running test and treadmill test (Afriyanto, 2011). VO₂max on the ergocycle was higher than the step test (Skranc et al., 1970).

However, it is contrary to some previous studies, which reported on non-weight-bearing (ergocycle) physical fitness, mainly involving lower limb muscle, otherwise on weight-bearing (Cooper test) involved almost all muscle contraction. Weight-bearing aerobic exercise used most of the skeletal muscles to move than did non-weight-bearing aerobic exercise; therefore VO₂max increases 20 times (Baldi et al., 2010). The effect of weight-bearing and non-weight-bearing aerobics on the cardiopulmonary functions of Nigerians with type 2 diabetes mellitus showed that the weight-bearing

group (treadmill) increased VO₂max significantly more than the non-weight-bearing group (ergocycle) (Abigail, 2011). In that previous study, weight-bearing and non-weight-bearing aerobic exercise was combined with resistance exercise and the ergocycle test using the German bicycle ergofit; there were differences with this study.

There are many factors that affect VO₂max: age, weight, and resting heart rate. Resting heart rate on this study shows a significant difference between the 12-minutes running test and the ergocycle Astrand. Heart rate decreased significantly: 88 bpm to 80 bpm (Roth et al., 1986). Perhaps this is a limitation in this study.

Based on the ergocycle Astrand test, heart rate was evaluated every minute according to the Astrand procedure with 50 rpm velocity; in the 12-minutes Cooper running test, participants were free to determine their speed. Temperature also affects participants in performing the fitness test. The ergocycle Astrand test was performed in a 24°–26°C room; the 12-minutes Cooper running test was performed in the open air. In terms of the effect of heat and different humidity on the fitness level of aerobic and non-aerobic athletes, it is known that high temperatures can cause a reduction in maximum oxygen uptake (Zhao et al., 2013).

5 CONCLUSION

The ergocycle Astrand and the 12-minutes Cooper running test proved to be an easy way of obtaining estimates of VO₂max. In this study, the ergocycle Astrand test yielded comparable results to those of the 12-minutes Cooper running test. Significant differences in cardiorespiratory physical fitness levels were found: the ergocycle Astrand achieves a higher fitness level than the 12-minutes running test. The differences are due to different measurement methods. It may be caused by the type of weight- or non-weight-bearing exercise and the temperature variation between indoor and outdoor, it being that Surabaya has a tropical climate.

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