# Differences in VO2 Max Based on Age,

*by* Drg. Bayu Indra

**Submission date:** 19-Jul-2020 01:55PM (UTC+0700)
**Submission ID:** 1359262102
**File name:** Differences_in_VO2_Max_Based_on_Age,_Gender.pdf (291.09K)
**Word count:** 4360
**Character count:** 22208

Sys Rev Pharm 2020; 11(4): 09 – 14
A multifaceted review journal in the field of pharmacy
E-ISSN 0976-2779 P-ISSN 0975-8453

# Differences in $VO_2$ Max Based on Age, Gender, Hemoglobin Levels, and Leukocyte Counts in Hajj Prospective Pilgrims in Hulu Sungai Tengah Regency, South Kalimantan

Huldani[1*], Harun Achmad[2], Aryadi Arsyad[3], Aminuddin Prahatama Putra[4], Bayu Indra Sukmana[5], Dwi Laksono Adiputro[6], Julia Kasab[7]

[*1]Department of Physiology, Medical Faculty, Lambung Mangkurat University, Banjarmasin, Indonesia
[2]Pediatric Dentistry Department, Faculty of Dentistry, Hasanuddin University, Makassar, South Sulawesi, Indonesia
[3]Department of Physiology, Medical Faculty, Hasanuddin University, Makassar, South Sulawesi, Indonesia
[4]BiologyEducation Department, FacultyofTeacherTrainingand Education, LambungMangkuratUniversity, Banjarmasin
[5]Departement of Oral Radiology, Dentistry Faculty, Lambung Mangkurat University, Banjarmasin, Indonesia
[6]Departement of Cardiology, Ulin Hospital, Banjarmasin, Indonesia
[7]Public Health Center, Tabalong, South Kalimantan, Indonesia
E-mail: huldani@gmail.com

Article History: Submitted: 20.01.2020 Revised: 09.03.2020 Accepted: 03.04.2020

**ABSTRACT**

**Background:** VO2 max is the maximum volume of oxygen that is processed by the body during intensive activities and is an indicator of the basic concepts of physical fitness. VO2 max has milliliters per minute per kilogram of body weight. Factors that determine VO2 max include heart lung function, age, aerobic muscle metabolism, body fatness, state of exercise, genetics, gender, multivitamin.

**Purpose:** To determine the difference in VO2 max between prospective pilgrims based on age (adult and elderly), gender, hemoglobin level, and the number of leukocytes.

**Methods:** The total sample consisted of 60, each of 30 for gender and age variables. Sampling uses a purposive sampling method with inclusion criteria, namely age 36-55 years, has a normal BMI (18.5-24.9 kg / m2), physically fit, cooperative, does not consume stamina enhancing multivitamins, mild physical activity to moderate. VO2 Max is measured by the Rockport method.

**Result:** Obtained the number of samples with VO2 max fit in the adult group of 20 people (66.7%) and VO2 max not fit 10 people (33.3%). In the elderly group sample with VO2 max fit 11 people (36.7%) and less fit 19 people (63.3%). In the male group there were 20 people (66.7%) with VO2 max fit and 10 people (33.3%) less fit. Whereas in the group of women found 11 people (36.7%) fit and 19 people (63.3%) less fit. The differences in each variable were analyzed using the Chi Square test, p = 0.02 was obtained so that it can be concluded that there were significant differences in VO2 max in the age and gender variables. The average hemoglobin level in the fit group was 14, g / dl, and the unfit group was 13.8 g / dl. Data were analyzed by t-test unpaired test, the results obtained p = 0, 008, which means there are significant differences in blood hemoglobin levels in groups with VO2 max fitter and less fit. The average number of leukocytes in the group with VO2 max fit was 7.83 thousand / µl and 7.27 thousand/µl in the less group. Data were analyzed by unpaired t test obtained p value = 0.69, which means there is no significant difference in the number of leukocytes in the fit and less fit groups.

**Conclusion:** There is a significant difference in VO2 max between prospective pilgrims who are adults and elderly, between men and women, blood hemoglobin levels in the group with VO2 max fitter and less fit, and there is no significant difference in the number of leukocytes in the fitter and less fit groups.

**Keywords:** VO2 max, Age, Gender, Hemoglobin Levels, and Number of Leukocytes for Hajj Prospective Pilgrims.

**Correspondence:**
Huldani
Department of physiology, Medical Faculty, Lambung Mangkurat University, Banjarmasin, Indonesia
E-mail: huldani@gmail.com

**DOI:** 10.31838/srp.2020.4.03



## INTRODUCTION

Maximum aerobic capacity or maximal oxygen consumption (VO2 max) is an indicator of the basic concepts of physical fitness. VO2 max is the maximum amount of oxygen that can be delivered from the lungs to the muscles in millimeters, or in minutes per kilogram of body weight. Someone who has good stamina has a higher VO2 max value, can do heavier exercises, and has higher concentration power compared to someone who is in poor stamina.[1]

Hajj requires good stamina, because the Hajj requires more physical activity compared to other worship. The series of pilgrimage is mostly done on foot, to the mosque, tawaf, sa'i, to places of pilgrimage, throwing pilgrimage, and other activities carried out on foot.[1,2]

Indonesian pilgrims are now able to perform the hajj on average after waiting for about 11-29 years. Based on data from the Ministry of Religion, until February 2017, South Sulawesi Province has the longest waiting period, which is 29 years. Then, followed by South Kalimantan with a waiting period of 28 years. That means if someone signs up for Hajj at the age of 17, and waits for 28 years, he will leave at the age of 45.[3,4]

Age 20-30 years is the peak age of heart and lung endurance and will then experience a decrease, this is due to increasing age so that a person will reduce various sports activities and tend to choose to work a lot, in addition there are also factors that decrease heart contraction heart muscle mass, total capacity.[5,6]

Based on the above explanation related to the length of the pilgrimage waiting list, then the possibility of pilgrims will leave at the age of 40 years and over. And according to data released by the Ministry of Religion of the Republic of Indonesia, for 2017, it was recorded that more than 50 percent were in the 41-70 year age group. -60 years old.

Male and female max VO2 are different, this difference in VO2 max is not apparent at a young age and is most evident during adulthood or middle age. Differences in VO2 max for men and women are related to differences in composition and body size because the physiological bodies of men and women are different. In addition to body composition the difference in VO2 max is also due to the

different hemoglobin concentrations of men and women. The composition of a woman's body is more fat than muscle compared to men which causes women to have a smaller VO2 max. The concentration of male hemoglobin is also higher than in women. The concentration of hemoglobin binds closely to the binding of oxygen needed by the body for the process of burning energy, so that men can optimally produce energy.[7]

## MATERIALS AND METHODS

The method used in this research is analytic descriptive observational with cross sectional approach to determine differences in VO2Max based on age, sex, hemoglobin level, and the number of leukocytes in the prospective pilgrims in 2018 Hulu Sungai Tengah Regency, South Kalimantan. The sampling process was carried out using a purposive sampling technique according to the inclusion criteria. Minimum sample sizes of 30 samples per group in accordance with Gay & Diehl guidelines. Samples of elderly pilgrim candidates who meet the inclusion criteria are 64 prospective pilgrims, so a random sampling is done to get a total sample of 30 samples. The sample is a prospective Hajj pilgrims to Hulu Sungai Tengah district with inclusion criteria: 1) aged 26-65 years, 2) Has a Normal BMI, 3) Physically healthy and able to carry out research until completion, 4) Does not consume multivitamins, 5) Has a low level of activity - Medium, 6) Cooperative and willing to fill informed consent. The independent variables in this study were age, sex, hemoglobin level, and the number of leukocytes in the prospective pilgrims. The dependent variable in this study was VO2 max. VO2 Max is measured by the Rockport method with a simplified classification of being fit and less fit.

## RESULTS AND DISCUSSION

Samples obtained in this study amounted to 60 people, namely 30 prospective female pilgrims and 30 prospective male pilgrims aged 26-65 years. The detailed characteristics of the samples obtained can be seen in Tables 1 and 2.

**Table 1:** Frequency Distribution of Sample Characteristics According to Age Group and Gender

| Number | Variable | N | Respondent | % |
|---|---|---|---|---|
| **1** | **Gender** | 60 | | |
| | Women | | 30 | 50 |
| | Man | | 30 | 50 |
| **2** | **Age** | 60 | | |
| | 26-45years | | 30 | 50 |
| | 46- 65 years | | 30 | 50 |

In this study the age of the sample was categorized into two groups, namely the young adult group aged 26-45 years and the elderly group 46-65 years. From the table data above, it can be seen the number of samples based on age characteristics obtained 30 people each (50%) in each group.

**Table 2:** Characteristic Frequency Distribution of Samples based on Hemoglobin Levels.

| Variable | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| LevelHb(g/dl) | 14.43 | 1.73 | 10.3 | 19.9 |

Each sample in this study was taken data on hemoglobin (Hb) levels and the number of leukocytes. Based on table 2 it can be seen that the average sample has a normal Hb, which is 14.4 g / dl with the lowest Hb distribution in the sample that is 10.3 g / dl and the highest Hb is 19.9 g / dl. Graph 1 shows the distribution of hemoglobin in this study.

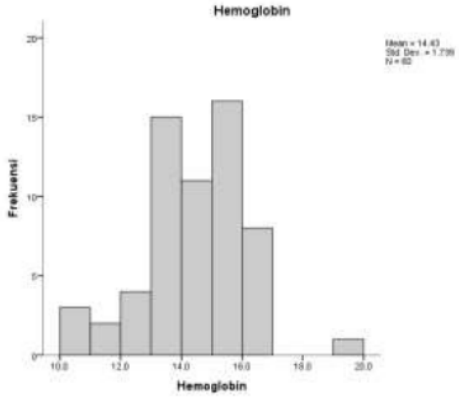


**Fig. 1:** Frequency distribution of hemoglobin in study samples.

The average number of leukocytes in the whole sample is 7,925 thousand / µl, which is also the normal value of the number of leukocytes. The highest number of leukocytes obtained in the sample was 12,900 thousand / µl, and the lowest number of leukocytes obtained in this study sample was 3,800 thousand / µl. Graph 2 shows the frequency distribution of leukocytes in this study sample.

**Table 3:** Characteristic Frequency Distribution of Samples based on Leukocyte Amounts.

| Variable | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Leukocyte count(thousand/ µl) | 7.925 | 1.91 | 3.800 | 12.900 |

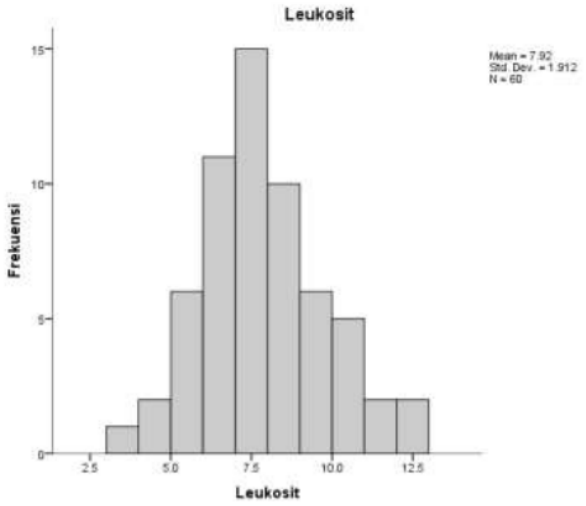


**Fig. 2:** Leukocyte frequency distribution of study samples.

To assess whether there is a significant difference in the distribution of VO2 Max fit and not fit in the adult and elderly age groups, a Chi Square test was performed. The significance value of the Chi Square test on this variable is 0.02. Then it can be concluded that there is a significant difference between VO2 max prospective pilgrims in the adult and elderly groups. This is in accordance with the researcher's hypothesis.

**Table 4:** Distribution of VO2 Max fit and unfit for Prospective Pilgrims for Adults and Seniors.

| Age | Total | VO2max | | p-value |
|---|---|---|---|---|
| | | Fit | Less fit | |
| 26-45 | 30 people | 20people (66,7%) | 10people (33,3%) | 0,02 |
| 46-65 | 30 people | 11 people(36,7%) | 19 people(63,3%) | |

The results of this study are supported by the research of Firman on Nganjuk district soccer athlete who stated that VO2 max has a strong relationship with age. The Word study uses the Spearman test with a relationship strength of 0.732. The results of the analysis also mentioned that the physical fitness risk of athletes aged 18-35 years had a 42 times fitter risk compared to athletes aged over 45 years.[8]

In addition, differences in VO2 max measurement results can be caused by many physiological factors. Because the heart lungs are different between adults and elderly people. Candidates for elderly pilgrims aged over 46 years have decreased VO2 max. This decrease occurs because the lungs, heart, and blood vessels begin to decline in function. The Word says that the age of 20-30 years is the peak age of the endurance of the heart and lungs and then will experience a decrease, this is due to increasing age so that a person will reduce various sports activities and tend to choose to work a lot, After a peak age of VO2 max then VO2 max will decrease with age. [8-10]

Dewi in her research also mentioned that the average decrease of VO2 max per year was 0.46 ml / kg / min for men, and 0.54 ml / kg / min for women. Thus, at the age of 55 years VO2 max is approximately 27% lower than the age of 25 years. In addition there are also factors that decrease heart contraction, heart muscle mass.[8, 10]

Ranto's research states that effective physical exercise that is endurance can increase the value of VO2 max. However, in prospective elderly pilgrims, physical exercise routines and activities have decreased, so that VO2 max resistance also decreases. The state of exercise in the elderly has actually

been formed as an adult, so if the state of exercise during adulthood is already high then it is likely to have an impact on aging. In addition, fatigue is also one of the causes of decreased physical endurance in carrying out activities that will affect VO2 max. The older a person is, the energy requirements also decrease, and there is a decrease in muscle strength which causes faster fatigue. [10,11]

The distribution of VO2 max fitter and unfit for prospective male and female pilgrims can be seen in the table below.

**Table 5:** Distribution of VO2 Max fit and unfit for male and female prospective pilgrims.

| Gender | Total | VO2maks | | p-value |
|---|---|---|---|---|
| | | Fit | Less Fit | |
| Man | 30 people | 20people (66,7%) | 10people (33,3%) | 0,02 |
| Women | 30 people | 11 people (36,7%) | 19 people (63,3%) | |

The results of VO2 max measurement in 30 male samples found 20 samples categorized as fit and 10 samples categorized as unfit. In the group of women, 11 samples were fit and 19 samples were less fit. The difference in distribution above was assessed as significant using the Chi Square test, obtained p = 0, 02, it can be concluded that there is a significant difference between VO2 max male and female in prospective pilgrims. This supports the hypothesis that there are significant differences between male and female max VO2 in pilgrim candidates.

The results of this study differ from previous studies studied by Augustian et al. With the subject of research of students in grade V elementary school students said that men and women did not have a significant difference in VO2 max, where in the study the value of p = 0.724 was obtained. In Huldani's research, the subjects of the Darul Hijrah Islamic Boarding School students also found no significant difference between VO2 max for men and women, where in the study the value of p = 0.321 was obtained. Whereas in this study found significant differences in VO2 max values between men and women in prospective pilgrims who were on average mature or middle-aged, VO2 max values were influenced by various factors including gender, maximal VO2 values for men and women most clearly there is a difference in adulthood or middle age.[12,13]

Differences in VO2 max for men and women are related to differences in body size and body composition because the physiological bodies of men and women are different. The composition of a woman's body is more fat than muscle compared to men which causes women to have a smaller VO2 max. Besides these differences are also caused by differences in maximum muscle strength where in general male muscle strength is greater than women. In terms of body composition of women in general, more layers of fat compared to men. The difference in VO2 max between men and women apart from body composition is partly due to the different hemoglobin levels of men and women. This difference in VO2 max values between men and women is related to higher hemoglobin levels and also lower body fat in men than women. Higher hemoglobin levels in men than women cause differences in blood transport capacity which causes men to get far more oxygen during the exercise process so that their aerobic capacity is better. Hemoglobin levels in adult men normally range from 13.5 to 18.0 gr% and in women ranging between 11.5-16.5 gr%, differences in blood volume and hemoglobin levels between men and women are only slightly at a young age and there is a significant difference a puberty, because of the lower oxygen transport and a higher percentage of body fat, women tend to exhibit lower VO2 max values than men..[14-17]

**Table 6:** Mean ± standarddeviation (SD) and 95% confidence intervals for hemoglobin levels in the VO2 group are fitter and fitter.

| Variable | $VO_2$ Max | | | | p-value |
|---|---|---|---|---|---|
| | Fit | | Less Fit | | |
| | Mean±SD | 95% Confidence intervals | Mean | 95% Confidence intervals | |
| Hemoglobin (g/dl) | 14,9 ±1,67 | 14,5-15,6 | 13,8 ±1,62 | 13,2-14,4 | 0, 008 |

Saphiro-Wilk data normality test was performed on the Hemoglobin and Leukocyte variables, each p value> 0.05, which means the data on both variables were normally distributed. The average hemoglobin level in the fit group was 14, g / dl, and the unfit group was 13.8 g / dl. The mean of the two groups was assessed for differences with the unpaired t-test, the results obtained p = 0, 008, which means there was a significant difference in blood hemoglobin levels in groups with VO2 max fitter and less fit.

These results are in line with Sinaga's research on the relationship of hemoglobin levels with VO2 max levels of PPLM athletes in North Sumatra province in 2017. To assess the significance and correlation of differences in Hb levels in both groups the Pearson test was obtained, the p value was 0.005 and the correlation value between variables was 0.687, which shows that the higher the hemoglobin level (within normal limits) the higher the VO2 max level of PPLM athletes in North Sumatra Province.18 The research conducted by Wahyudin on the Makassar SSB soccer player in 2016 also has similar results, namely there is a significant tionship between hemoglobin levels with VO2 max.[19]

Hemoglobin (Hb) contained in red blo cells functions as a carrier of oxygen, explaining that the number of red blood cells and the amount of hemoglobin (Hb) in the blood is very important in determining the body's ability to produce energy in physical and working activities.20 The better the

hemoglobin level, the more oxygen that can be transported, so that the body will be more optimal for producing energy. But if the hemoglobin level in the body is lacking, the performance of athletes when competing will be less than optimal because the body cannot meet the oxygen requirements to produce the energy needed by the athlete.[21,22]

**Table 7:** Mean ± standarddeviation (SD) and 95% confidence intervals for leukocyte counts in the VO2 group are max fitter and fitter.

| Variable | $VO_2$ Max | | | | p-value |
|---|---|---|---|---|---|
| | Fit | | Less Fit | | |
| | Mean±SD | 95% Confidence intervals | Mean | 95% Confidence intervals | |
| Leukosit (thousand/ µl) | 7,83±1,88 | 7,14-8,52 | 8, 02±1,97 | 7,27-8,77 | 0,69 |

The average number of leukocytes in the group with VO2 max fit was 7.83 thousand / µl and 7.27 thousand / µl in the less fit group. Both of them were tested by unpaired t test, obtained p value = 0.69, which means there was no significant difference in the number of leukocytes in the fit and less fit groups, because the p value> 0.05. The results of this study are in tune with Tenorio's research in 2014 concerning the relationship of leukocyte counts, nutritional status, and fitness status in adolescents, which actually shows a negative correlation between leukocyte counts and adolescent fitness status. [23]

The human body has a complex defense system called the immune system. This system allows the body to be able to react quickly and specifically to injury, inflammation, or infection. One of the most important components is leukocytes. Therefore it can be said that leukocytes are an indicator of the body's infamation status. Leukocyte count is influenced by many things such as infection, inflammation, stress, and physical injury experienced by a person, both in acute and chronic conditions.24 VO2 max is not only used to assess fitness status, but is also a good parameter for assessing the cardiopulmonary system and risk atherosclerosis. Michishita et al. In their study of obese women, showed a negative correlation between VO2 max and monocytes. The better the fitness status, the lower the number of monocytes. From these results, it is believed that good fitness status can reduce a person's inflammatory status, so that it will have good implications for cardiovascular events.[25,26,27]

## CONCLUSION

From the results of the study it can be concluded that there are significant differences in VO2 max in the group of women and men, adults and elderly candidates for the 2018 Hajj Hajj Regency in Central Kalimantan, South Kalimantan. In addition, also found significant differences in hemoglobin levels in the VO2 max fit and less fit group. However, no significant difference was found in the number of leukocytes in the VO2 max fit and less fit group.

## REFERENCES


1. Madina DS. (2007). Parudan's vital capacity value is related to the physical characteristics of various athletes in various sports. Bandung: Unpad.
2. Guyton and Hall. (2008). Medical physiology textbook. 11. Jakarta edition: EGC.
3. Ministry of Religion of the Republic of Indonesia. (2017). Hajj waiting list. Jakarta; [internet]. [cited 2017 November] Available from: https://haji.kemenag.go.id> node.
4. The Indonesian Ministry of Health. (2008). The composition of the body of the elderly. [internet]. [cited 2017 November] Available from: http://gizi.depkes.go.id/wp-content/ uploads / 2010/07 /composition-body-elderly.pdf.
5. Cengiz, Akalan, Robert, A. Robergs, Len, Kravitz. (2008). Prediction of VO2 max from an individualized submaximal cycle ergometer protocol. JEP online. 11(3).
6. Hodges ANH, Sheel AW, Mayo Jr., McKenzien, DC. (2007). Human lung density is not altered following normoxic and hypoxic moderate-intensity exercise: implications for transient edema. A physiol appl. 103: 1-8.
7. Mcardle WD, Katch, FI, Katch VL. (2006). Essentials of exercise physiology. Lippincott Williams & Wilkins.
8. Retnosari D. (2016). Relationship between the value of maximum oxygen volume and the value of breath length in choir members of Hasanuddin University students. [Scientific Papers] Makassar: Hasanuddin University.
9. Woo JS, Derleth C, Stratton JR, Levy WC. (2006). The influence of age, gender, and training on exercise efficiency. J Am CollCardiol. 47: 1049-57.
10. Word of FB. (2016). Factors related to physical fitness (VO2 max) soccer athletes. Surabaya: Unair.
11. Results of SR. (2017). The effect of jogging on increasing VO2 max in middle age in Surakarta. [Scientific Papers] Surakarta: Muhammadiyah University of Surakarta.
12. Noor KA, Huldani, Biworo A. (2013). Maximum Vo2 Comparison of Students and Students in Class V Elementary School: In Tabanio Village, Takisung District, Tanah Laut Regency, South Kalimantan. Periodical Medical Unlam. 9.1: 101-107.
13. Huldani. (2010). The influence of hemoglobin and sex levels on the maximum oxygen consumption of students from the Islamic Boarding School

DarulHijrah. Mirror of the World of Medicine. 180; 509-11.
14. Ferriyanto. (2010). Maximum Oxygen Volume. Bandung: Studio Press.
15. Hoeger, W.W.K, Haufoeger, S.A. (2010). Principles and labs for physical fitness (7th ed). USA: Wadsworth.
16. Agung, SeptianNosa. (2015). Survey of Physical Fitness Level on Lumajang Indonesian Football Association Players. Sports Coaching Education Study Program. UNESA Semarang.
17. Yunus, F. (2011). Maximum oxygen intake and pulmonary physiology of healthy male divers and non-divers. Indonesian Journal of Respirology. 31 (2): 61-71.
18. Sinaga, FA. (2017). The relationship between hemoglobin levels and vo2max levels of PPLM athletes in North Sumatra province. Campus generation 6.2.
19. Wahyudin, Wahyudin. (2016) Relationship of Endurance (Vo2max) with Hemoglobin (Hb) Levels in SSB Hasanuddin Makassar Football Players. ILARA Journal, II (1). pp. 84-91. ISSN 2086-4124.
20. Haas J, Brownlie T IV. (2001). Iron deficiency anemia and reduced work capacity: a critical review of the research to a causal relationship. J Nutr. 131: 676S-90S.
21. Rismayanthi C, et al. (2016). Profile of maximal oxygen volume (vo2 max) and hemoglobin (hb) levels in the Yongmoodo athletes of the Magelang Military Academy. Jorpres (Journal of Sports Achievement). 12.2.
22. Barik, R., Patnaik, A.N., Gulati, A.S. Fatal thrombocytopenia: A rare case with possible explanation (2012) Journal of Cardiovascular Disease Research, 3 (2), pp. 147-149. DOI: 10.4103/0975-3583.95372
23. Rahayu EP, Jaelani M. (2015). Fe intake, hemoglobin levels, and vo2 max in soccer school students. Journal of Nutrition Research 3.1: 13-18.
24. Tenório TR, et al. (2014). Relation between leukocyte count, adiposity, and cardiorespiratory fitness in pubertal adolescents. Einstein (Sao Paulo). 12.4: 420-
25. Roitt IM, Delves PJ. (2011). Roitt's essential immunology. 12th Edition. Australia: Blackwell Publishing.
26. Ishishita R, Shono N, Inoue T, Tsuruta T, Node K. (2008). Associations of monocytes, neutrophil count, and C-reactive protein with maximal oxygen uptake in overweight women. J Cardiol. 52 (3): 247-53.
27. Achmad H. Horax S, Ramadhany S, et.al. (2019). Resistivity of Ant Nest (Myrmecodia pendans) On Ethanol Fraction Burkitt's Lymphoma Cancer Cells (Invitro) Through Interleukin 8 Angiogenesis Obstacles (Il-8). Journal of International Dental and Medical Research ,.ISSN 1309-100X. Vol 12 No. (2) pp.516-523.
28. Achmad H, Sherly Horax, Sri Ramadhany, Irene Edith Rieuwpassa, Melyanti Sari, Hendrastuti Handayani, Marhamah F. Singgih, Sumintarti Sugiharto. (2019). Anti-Cancer and Anti-Proliferation Activity of Ethyl Acetate Extract From Ant Nest (Myrmecodia pendans) in Burkitt's Lymphoma Cancer Cells. Pesquisa Brasileira em Odontopediatria e Clinica Integrada. ISSN 1519-0501, 19 (1): e4325.

# Differences in VO2 Max Based on Age,

ORIGINALITY REPORT

| 9% | 6% | 3% | 5% |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | ajcn.nutrition.org<br>Internet Source | 1% |
| 2 | Eric M. Snyder, Thomas P. Olson, Bruce D. Johnson, Robert P. Frantz. "Influence of sildenafil on lung diffusion during exposure to acute hypoxia at rest and during exercise in healthy humans", European Journal of Applied Physiology, 2008<br>Publication | 1% |
| 3 | www.zora.uzh.ch<br>Internet Source | 1% |
| 4 | kclpure.kcl.ac.uk<br>Internet Source | <1% |
| 5 | www.aensiweb.com<br>Internet Source | <1% |
| 6 | Submitted to Rosny College<br>Student Paper | <1% |
| 7 | www.nejm.org<br>Internet Source | <1% |

| | | |
|---|---|---|
| 8 | Submitted to University of East London<br>Student Paper | <1% |
| 9 | Submitted to University of Abertay Dundee<br>Student Paper | <1% |
| 10 | www.sciencepublishinggroup.com<br>Internet Source | <1% |
| 11 | Submitted to Acadia University<br>Student Paper | <1% |
| 12 | sersc.org<br>Internet Source | <1% |
| 13 | karyailmiah.unisba.ac.id<br>Internet Source | <1% |
| 14 | Submitted to The Robert Gordon University<br>Student Paper | <1% |
| 15 | eprints.unm.ac.id<br>Internet Source | <1% |
| 16 | www.ektodermaldisplazi.com<br>Internet Source | <1% |
| 17 | Submitted to University College London<br>Student Paper | <1% |
| 18 | www.tandfonline.com<br>Internet Source | <1% |
| 19 | www.freepatentsonline.com<br>Internet Source | <1% |

| | | |
|---|---|---|
| 20 | Submitted to Universiti Teknologi MARA<br>Student Paper | <1% |
| 21 | www.ajol.info<br>Internet Source | <1% |
| 22 | www.researchsquare.com<br>Internet Source | <1% |
| 23 | www.surrey.ac.uk<br>Internet Source | <1% |
| 24 | www.indianjournals.com<br>Internet Source | <1% |
| 25 | "Free Communication Sessions 21-40 and Poster Sessions 17-32", International Dental Journal, 2015.<br>Publication | <1% |
| 26 | worldwidescience.org<br>Internet Source | <1% |
| 27 | Aminuddin Prahatama Putra, Muslimin Ibrahim, Huldani Huldani, Bayu Indra Sukmana, Fauziah Fauziah, Harun Achmad. "Are There Levels of Students Morales? The Effects of Biological Problem Solving on Moral Development", International Education Studies, 2020<br>Publication | <1% |
| 28 | P. Borrione, A. Mastrone, R. A. Salvo, A. Spaccamiglio, L. Grasso, A. Angeli. "Oxygen | <1% |

delivery enhancers: Past, present, and future", Journal of Endocrinological Investigation, 2014
Publication

| | | |
|---|---|---|
| 29 | Lindsay S. Jenkins, Leena J. Patel, Timothy P. Gavin. "No difference in plantar flexion maximal exercise power output between men and women", Sport Sciences for Health, 2016<br>Publication | <1% |

| | | | |
|---|---|---|---|
| Exclude quotes | Off | Exclude matches | Off |
| Exclude bibliography | Off | | |