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RESEARCH ARTICLE

Differences in Physical Activity, Lactic Acid Concentration, and Quality of Life between Gender among First Year Medical Students

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Abstract

Medical students have fewer opportunities to do physical activities (PA) that may increase the risk for chronic diseases. The aim of this study was to assess the correlation between PA, as assessed using the International Physical Activity Questionnaire (IPAQ), and Lactic acid (LA) concentration, as well as the differences in IPAQ, LA, and quality of life (QoL) between genders. This was a cross-sectional study conducted in April - November 2017 by a private university in West Jakarta. Subjects of the study were selected using simple random sampling approach with female subjects as the more dominant gender (n=76, 60%) from the 126 subjects recruited. The median of IPAQ, La^-1, and La^-2 in male and female were 707 (474–944) vs 423 (392–501) Mets (p=0.7), 4.6 (3.8–5.4) vs 2.8 (2–3) mmol/L (p=0.001), and 8.4 (7.7–8.9) vs 10 (9.3-10.5) mmol/L (p<0.001) respectively. The higher the IPAQ, the lower of the La^-2 concentration (p=0.012) was when analyzed using Kruskal-Wallis test. Total score of QoL in males and females were 2628.6 (2,496-2757) and 2,765 (2,687–2,859) (p=0.067), respectively, while the concepts of Role Limitation due to Physical Health was higher in female (p=0.006), as shown by Mann-Whitney test. In conclusion, subjects arephysically inactive with females are less active and have a higher La^-2 concentration than males. However, the QoL concept of the RLPH is better in female students.

Key words: Lactic acid, medical students, physical activity, quality of life

Perbedaan Aktivitas Fisik, Asam Laktat, dan Kualitas Hidup antara Jenis Kelamin pada Mahasiswa Kedokteran Tahun Pertama

Abstrak

Mahasiswa Fakultas Kedokteran memiliki sedikit kesempatan untuk melakukan aktivitas fisik yang dapat meningkatkan terjadi penyakit kronis. Tujuan penelitian menemukan korelasi aktivitas fisik (PA) yang dinilai menggunakan *the International Physical Activity Questionnaire* (IPAQ) dengan kadar asam laktat (LA), serta perbedaan IPAQ, LA dan kualitas hidup (QoL) antar jenis kelamin. Desain penelitian adalah potong lintang, seleksi subjek secara acak sederhana, pada April–November 2017, pada universitas swasta di Jakarta Barat. Hasil penelitian diperoleh 126 subjek, 76 (60%) perempuan. Rerata IPAQ, LA $^-1$, dan LA $^-2$ pada laki-laki dan perempuan secara berurutan adalah; 707(474–944) vs 423 (392–501) Mets (p=0,7), 4,6 (3,8–5,4) vs 2,8 (2–3) mmol/L (p=0,001), dan 8,4 (7,7–8,9) vs 10 (9,3-10.5) mmol/L (p<0,001). Semakin tinggi IPAQ, semakin rendah LA (p=0,012), dengan Uji Kruskal-Wallis. Skor total QoL pada pria dan wanita adalah 2.628.6 (2496–2.757) vs 2.765 (2.687–2.859) (p=0,067), sementara nilai konsep *Role Limitation due to Physical Health* (RLPH) pada perempuan lebih tinggi (p=0,006) dengan Uji Mann-Whitney. Simpulan, subjek memiliki PA tidak aktif, sementara perempuan lebih tidak aktif dan memiliki LA^-2 lebih tinggi. Namun, QoL pada konsep RLPH lebih baik pada mahasiswa perempuan.

Kata kunci: Aktivitas fisik, asam laktat, kualitas hidup, mahasiswa kedokteran

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Introduction

Medical students are faced with a higher demand for various academic activities that take a lot of their time. Therefore, they have fewer opportunities to do physical activities (PA) compared to other students from other majors. This raises a concern because many studies have proven that physically inactivity accompanied by other poor lifestyle, such as poor diet and smoking, is a risk factor for many chronic diseases. The Center for Disease Control and Prevention (CDC) concluded that the physical activity level of adults in the US is categorized as inactive.[1] Furthermore, the physical activity is also expected to have a correlation with academic performance.[2] Physically inactivity correlates with chronic diseases, i.e, coronary heart disease, malignancies, stroke, chronic lower respiratory disease, diabetes, Alzheimer's, and kidney failure.[2,3,4,5,6] Moreover, an inactive person has a higher risk to become obese.[2,5] There are currently very limited data available on the intensity of PA among first year medical students in Indonesia, both in general and by gender. The physical activities of medical students are predicted to be the same as the PA of inactive young adults, especially among female medical students that have smaller muscle mass, reflecting a lower PA.

Inactive subjects have a lower aerobic capacity as a result from the skeletal muscle's lower ability to consume toxygen (VO_2) during activities. Since the body is no longer be able to use oxygen, the muscle cells will revert to the anaerobic metabolism which will increase the blood lactic acid level (La^-).[6,8] Many methods have been proposed to determine the VO_2 value, including calculating the heart rate while and after an exercise test and assessing the La^- levels before and after an exercise test.[9-11] The blood La^- concentration is one of the most frequently used measurement of fitness capacity during a clinical exercise testing and on athletes for routine exercise tests. This fitness capacity correlates with PA.[6,8]

Lactic acid concentration can be evaluated using a simple equipment such as an Accutrend meter. The mean lactate value obtained from the accutrend meter is 2.89 mmol/L and 2.78 mmol/L for the reference instrument. The standard deviation for Accutrend meter is 1.14mmol/L versus 1.42 mmol/L for the Beckman instrument.[9,10] Normal value of La^- before exercise is similar between males and females; however, La^- value after exercise is higher in female and in individuals with body fat of more than 15%.[9]

A higher level of the La^- concentration accompanied by a slower decrease of heart rate after exercise represents an anaerobic condition of the skeletal muscle tissue.[12] Some studies have proven that there is a correlation between the increase in La^- after exercise test and the prognosis of dyslipidemia, coronary heart disease, heart failure, chronic obstructive pulmonary disease, and diabetes.[11]

Various different methods are available to analyze PA; however, there is no consensus about the best method. Consequently, this makes comparison between countries difficult. One of the commonly used parameters to measure subjective PA intensity is by using the International Physical Activity Questionnaire (IPAQ).[12-14] This is an instrument designed for adults and has been tested in adults aged 15–69 years old. Nevertheless, it is not recommended to use IPAQ for older and younger age groups..

There are 3 PA intensity clasifications: health enhancephysical activity/(HEPA) (1,500–3,000 Mets), inactive (600–1500 Mets), and minimally active (≤600 Mets).[17] Many studies have found that physical activities have a mild to a moderate correlation with the aerobic capacity.[12-14]

Physical activities may relate to the quality of life (QoL), through good endurance in doing daily activities. The QoL is the subjective reflects from an individual's overall perception and satisfaction in their life or, in other word it is the overall enjoyment of life.[18,19] The perceptions of health may vary between individuals and may change along the different phases in life.[20] Individual assesses their the health-related quality of life (HRQoL) by comparing their expectations with their experience.[20] According to the wide range aspect of the human life; the measurement of QoL is the multidimensional concept of subjective evaluation from the positive and negative aspects of life.[18-20] The assessment of the QoL is multidimensional and is categorized into the concepts ofphysical health, mental health, social health, emotional health, and activity dimensions.[18-20] TSeveral tools are available to measure the QoL, with HR-Qol short form (SF)-36 and the World Health Organization QoL (WHOQoL) as the most frequently used tools.[17,18] Assessment of the QoL using SF-36 has proven valid and reliable in some previous studies.[19,20] Nowadays, RAND-36 is also a global survey instrument that is widely used to measure the (HR-QoL). This instrument comprises of 36 items that assess eight health concepts: physical

functioning (PF), role limitations caused by physical health problems (RLPH), role limitations caused by emotional problems (RLEP), social functioning (SF), emotional well-being (EWB), energy/fatigue (EF), pain, and general health (GH) perceptions. Physical and mental health summary scores are derived from the eight aspect of RAND-36 scales. Scores of QoL SF-36 in wellbeing and physical function in US normal population are above 70 and 80, respectively.[18,20] No data available yet for the QoL of the normal population in Indonesia.

There are several studies that discuss the correlation between PA and the QoL which conclude that there is a positive correlation between high PA and high QoL, that is the higher the PA is, the higher the QoL.[18,19] There are still no data available on the difference in QoL between gender inn young adults, particularly among first-year medical students. Data available on the difference of QoL between gender is data from fecal incontinence subjectswhere female patients are more affected by the disease and have lower QoL.[16,17] Several factors are associated with the QoL, namely motivation, depression, and impact of a health condition.[18] Other factors are also considered to influence the QoL, such as sense of responsibility, discipline, and motivation of the students. The objective of the study is to analyze PA and its correlation with blood La^- as well as the differences in PA and QoL between male and female students in first-year of medical school. The goal is, eventually, to improve the QoL in medical students.

Methods

This study was approved by the Ethical Committee of the Faculty of Medicine, University of Trisakti, with the issuance of Ethical Clearance Number 118/KER/FK/X/2017. This was a cross-sectional study on subjects who were recruited using simple random sampling method who agreed to participate in the study, proven by signing the written consent for this study. The inclusion criterion was medical students who were able to walk without having to be assisted while the exclusion criteria were the presence of respiratory and/or cardiovascular diseases, and musculoskeletal problem in lower extremities. The minimum number of subjects required, based on Slovin formula, was 124 subjects.

This study was performed from April to November 2017 in West Jakarta, Indonesia. The intensity of PA was measured subjectively using IPAQ while the blood La^- concentration was measured before and 5 minutes after the exercise test. Exercise test performed was the Harvard step test with monitoring of heart rate (HR) before, during, and after the exercise test using Polar A300 series. The blood La^- was assessed using a portable analyzer operator, Accutrend plus® (Roche), that detected the blood La^- by an amperometric enzymatic detection. The interpretation is made based on the interpretation of the electrical signal resulting from the reaction of La^- in the peripheral droplet blood and the enzyme lactate oxidase on the inserted sensor. The voltage signal corresponds directly to the sample's La^- concentration. As the result, the higher number displayed on monitor indicated the higher level of La^- in the peripheral blood droplet sample. Furthermore, the QoL was analyzed by RAND (SF)-36. Data were then analyzed using Mann-Whitney U and Kruskal Wallis tests.

Results

Of the total number of subjects who agreed and met the inclusion criterion for participating in this study (n=126), 76 females were participated (60%).

Table 2 shows that the medians of body mass index (BMI) and IPAQ were normal and similar for both gender while the heart rates before exercise (HR1) and after exercise (HR2) were higher in females ($p=0.03$ and $p<0.001$). In contrast, La^- concentration before exercise (La^-1) was higher in males ($p=0.001$) but the La^- concentration after exercise (La^-2) was higher in females ($p<0.001$).

Table 3 shows that the higher value of IPAQ was linked to the lower value of La- 2 concentration ($p=0.012$) and HR2 ($p=0.021$).

Data in Table 4 presented taht the QoL total score in females was higher than males, albeit statistically insignificant ($p=0.067$). Most of QoL concepts were equal between gender, except for the concept of RLPH, which was higher in females ($p=0.006$).

Table 1 Subjects Characteristics

	n (%), mean
Male	50 (40%)
Female	76 (60%)
Age (year)	18.17±0.7

Table 2 Differences of BMI, IPAQ, Heart Rate (HR), and La⁻ Concentration by gender

	Median		p
	Male	Female	
BMI (kg/m^2)	23,3 (15.8–38)	22,2 (15–39)	0.197
IPAQ (METs)	707 (474–944)	423 (392–501)	0.7
HR 1 (times/minute)	97 (92–100)	102(99–105)	0.03*
HR 2 (times/minute)	167 (156–171)	179 (174–185)	<0.001*
La⁻ 1 (mmol/L)	4.6 (3.8–5.4)	2.8 (2–3)	0.001*
La⁻2(mmol/L)	8.4 (7.7–8.9)	10 (9.3–10.5)	<0.001*

*Mann-Whitney test

Table 3 Differences of La⁻2 Concentration and HR 2 by IPAQ group

	IPAQ (METs)	n	Mean Rank	p
La⁻2	0–599	69	71.78	
	600–1499	50	55.27	0.012*
	≥ 1500	7	40.64	
HR 2	0–599	69	71.02	
	600–1499	50	53.12	0.021*
	≥1500	7	48.43	

*Kruskal-Wallis test

Table 4 Average QoL based on SF–36 RAND

QoL	Median				p
	Male	(min–max)	Female	(min–max)	
Total	2,628.6	(2,496–2,757)	2,765	(2,687–2,859)	0.067
PF	855	(821–888)	878	(849–915)	0.11
RLPH	234	(189–275)	308	(279–332)	0.006*
RLEP	198	(171–229)	224	(204–245)	0.105
EF	287	(274–300)	286	(274–297)	0.948
EWB	376	(357–394)	373	(359–387)	0.548
SF	137	(122–147)	147	(139–154)	0.188
Pain	338	(317–358)	347	(329–366)	0.708
GH	68	(63–72)	69	(66–73)	0.708

*Mann-Whitney test; PF: physical functioning, RLPH: role limitations caused by physical health problems; RLEP: role limitations caused by emotional problems, SF: social functioning; EWB: emotional well–being, EF: energy/fatigue, Pain: pain, GH: general health perception

Discussion

This study has found that subjects had average normal BMI scores. Data of body composition was not examined in this study. It was revealed that the intensity of physical activities was inactive in both gender and that male students tend to be more active than their female counterparts. Data from this study are in line with previous studies, which stating the same results.[1-3]

Heart rate as the indicator to measure the intensity of PA was also assessed in this study

Figure 1 Harvard Step Test

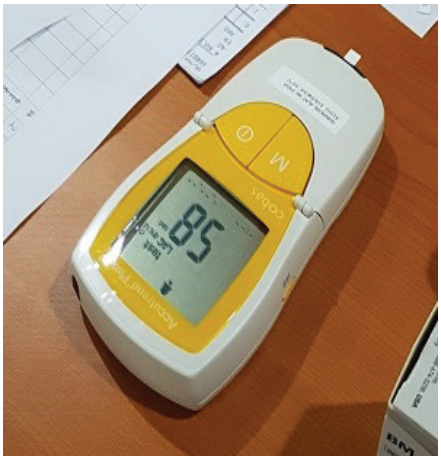

Figure 2 Portable analyzer operator ® Accutrend plus by Roche to Assess Lactic Acid

and the results showed that HR before exercise was normal in both gender; however, the HR before and after exercise were higher in females (p=0.03) and (p<0.001). The La^- 1 concentration (before exercise) in males was higher than the normal value and also higher than that of females (p=0.001). This result is in contrast with an earlier study that found the La^- in females is higher. A previous study has revealed that a body fat level of more than 15% is linked to a higher La^-.[11] Unfortunately, this study did not assess the body composition that might be able to explain why the male La^- in this study was higher. The concentration of La^- 2 after exercise increased in both gender and was higher significantly in females (p<0.001). This finding supports the theory stating that during short and high intensity PA, the skeletal muscle produces La^- more rapidly that is followed by increasing concentration in the circulation.[7,8] Previous studies have proven that increased blood lactic acid after exercise is a prognosis determinant in subjects with dyslipidemia, congestive heart disease, and chronic obstructive pulmonary disease.[3,11]

Data in Table 2 show that females have higher La^- concentration and HR after exercise. Females have smaller skeletal muscles, causing the ability to consume oxygen of these muscle lower. This result supports the findings from previous studies that blood La^- and HR increases after exercise are higher in females.[7,8] Furthermore, data in Table 3 describe that the higher the PA is, the lower the La^- concentration and HR after exercise. This supports the theory of fitness capacity, which is the ability to consume the oxygen maximally (VO_2 max) during activities. Inactive subjects have a lower ability to consume oxygen during activities and because the skeletal muscle cells no longer consume oxygen, the metabolism becomes anaerobic, leading to higher production of La^- into blood circulation. Thus, the increase of blood La^- is higher in an inactive subject and can be used as an indirect measurement of fitness capacity. Indeed, when subjects perform greater aerobic capacity, the oxygen consumed by the skeletal muscles is higher, which is then follow by lower production of La^- by skeletal muscle and lower increase of HR after exercise.[6]

The QoL as assessed by the QoL SF-36 RAND is listed in table 4. The total QoL score was higher in females, although insignificantly (p=0.067). Most of the scores of the eight QoL concepts were similar between gender, except for RLPH, which was higher in females (p=0.006). The eight concepts of QoL SF-36 RAND include the concepts of physical function, which is reflected in questions number 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12; concept of role limitation due to a physical health problem, which is reflected in questions number 13, 14, 15, and 16; concept of role limitation due to the emotional problem, which is reflected in questions number 17, 18, 19; concept of fatigue, which was reflected in questions number 23, 27, 29, and 31; Concepts

of emotional wellbeing, which is reflected in questions number 24, 25, 26, 28, and 30; concept of social function, which is reflected in questions number 20 and 32, concept of physical pain, which is reflected in questions number 21 and 22; and concept of general health, which is reflected in questions number 1, 33, 34, 35, and 36. A higher score reflects a higher quality of life.[17, 19] Data from this study has proven that females tend to have a higher QoL score and has a significantly higher score in the concept of RLPH. This result is different from the findings from the study on fecal incontinence patients that stated female patients have a lower QoL.[16] This also proves that PA alone does not determine the QoL and the QoL can be influenced by subjective factors from the subjects, such as motivation and discipline. Female subjects may have higher motivation and discipline, which may positively influence the QoL score.

Physically inactive has a correlation with chronic diseases and there is a correlation between La^- concentration increase after exercise test and the prognosis of dyslipidemia, coronary heart disease, heart failure, chronic obstructive pulmonary disease, and diabetes.[3-5, 11] This study has found that the increase in La– after exercise in both groups and inactive life style present a higher risk for subjects to experience chronic diseases.

The first-year medical student are physically inactive, with female as the less active gender. Increases in blood La^- and HR are seen after exercise in less active subjects, with female students experience a higher increase in blood La^- and HR. The mean o QoL was normal in all concepts of QoL. Although females have a lower intensity PA, they have a better QoL in the concept of the RLPH. Hence, it can be suggested that the medical school authority should give opportunities for medical students to be more active.

This was a cross-sectional study; thus, no explanation regarding the direction of effect between PA and QoL can be offered. A further study using cohort design is needed to be able to explain it.

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by Dian Mediana

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Differences in Physical Activity, Lactic Acid Concentration, and Quality of Life between Gender among First Year Medical Students

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Abstract

Medical students have fewer opportunities to do physical activities (PA) that may increase the risk for chronic diseases. The aim of this study was to assess the correlation between PA, as assessed using the International Physical Activity Questionnaire (IPAQ), and Lactic acid (LA) concentration, as well as the differences in IPAQ, LA, and quality of life (QoL) between genders. This was a cross-sectional study conducted in April - November 2017 by a private university in West Jakarta. Subjects of the study were selected using simple random sampling approach with female subjects as the more dominant gender (n=76, 60%) from the 126 subjects recruited. The median of IPAQ, La-1, and La-2 in male and female were 707 (474–944) vs 423 (392–501) Mets (p=0.7), 4.6 (3.8–5.4) vs 2.8 (2–3) mmol/L (p=0.001), and 8.4 (7.7–8.9) vs 10 (9.3-10.5) mmol/L (p<0.001) respectively. The higher the IPAQ, the lower of the La-2 concentration (p=0.012) was when analyzed using Kruskal-Wallis test. Total score of QoL in males and females were 2628.6 (2,496-2757) and 2,765 (2,687–2,859) (p=0.067), respectively, while the concepts of Role Limitation due to Physical Health was higher in female (p=0.006), as shown by Mann-Whitney test. In conclusion, subjects arephysically inactive with females are less active and have a higher La-2 concentration than males. However, the QoL concept of the RLPH is better in female students.

Key words: Lactic acid, medical students, physical activity, quality of life

Perbedaan Aktivitas Fisik, Asam Laktat, dan Kualitas Hidup antara Jenis Kelamin pada Mahasiswa Kedokteran Tahun Pertama

Abstrak

Mahasiswa Fakultas Kedokteran memiliki sedikit kesempatan untuk melakukan aktivitas fisik yang dapat meningkatkan terjadi penyakit kronis. Tujuan penelitian menemukan korelasi aktivitas fisik (PA) yang dinilai menggunakan *the International Physical Activity Questionnaire* (IPAQ) dengan kadar asam laktat (LA), serta perbedaan IPAQ, LA dan kualitas hidup (QoL) antar jenis kelamin. Desain penelitian adalah potong lintang, seleksi subjek secara acak sederhana, pada April–November 2017, pada universitas swasta di Jakarta Barat. Hasil penelitian diperoleh 126 subjek, 76 (60%) perempuan. Rerata IPAQ, LA -1, dan LA -2 pada laki-laki dan perempuan secara berurutan adalah; 707(474–944) vs 423 (392–501) Mets (p=0,7), 4,6 (3,8–5,4) vs 2,8 (2–3) mmol/L (p=0,001), dan 8,4 (7,7–8,9) vs 10 (9,3-10.5) mmol/L (p<0,001). Semakin tinggi IPAQ, semakin rendah LA (p=0,012), dengan Uji Kruskal-Wallis. Skor total QoL pada pria dan wanita adalah 2.628.6 (2496–2.757) vs 2.765 (2.687–2.859) (p=0,067), sementara nilai konsep *Role Limitation due to Physical Health* (RLPH) pada perempuan lebih tinggi (p=0,006) dengan Uji Mann-Whitney. Simpulan, subjek memiliki PA tidak aktif, sementara perempuan lebih tidak aktif dan memiliki LA-2 lebih tinggi. Namun, QoL pada konsep RLPH lebih baik pada mahasiswa perempuan.

Kata kunci: Aktivitas fisik, asam laktat, kualitas hidup, mahasiswa kedokteran

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Introduction

Medical students are faced with a higher demand for various academic activities that take a lot of their time. Therefore, they have fewer opportunities to do physical activities (PA) compared to other students from other majors. This raises a concern because many studies have proven that physically inactivity accompanied by other poor lifestyle, such as poor diet and smoking, is a risk factor for many chronic diseases. The Center for Disease Control and Prevention (CDC) concluded that the physical activity level of adults in the US is categorized as inactive.[1] Furthermore, the physical activity is also expected to have a correlation with academic performance.[2] Physically inactivity correlates with chronic diseases, i.e, coronary heart disease, malignancies, stroke, chronic lower respiratory disease, diabetes, Alzheimer's, and kidney failure.[2,3,4,5,6] Moreover, an inactive person has a higher risk to become obese.[2,5] There are currently very limited data available on the intensity of PA among first year medical students in Indonesia, both in general and by gender. The physical activities of medical students are predicted to be the same as the PA of inactive young adults, especially among female medical students that have smaller muscle mass, reflecting a lower PA.

Inactive subjects have a lower aerobic capacity as a result from the skeletal muscle's lower ability to consume toxygen (VO_2) during activities. Since the body is no longer be able to use oxygen, the muscle cells will revert to the anaerobic metabolism which will increase the blood lactic acid level (La^-).[6,8] Many methods have been proposed to determine the VO_2 value, including calculating the heart rate while and after an exercise test and assessing the La^- levels before and after an exercise test.[9-11] The blood La^- concentration is one of the most frequently used measurement of fitness capacity during a clinical exercise testing and on athletes for routine exercise tests. This fitness capacity correlates with PA.[6,8]

Lactic acid concentration can be evaluated using a simple equipment such as an Accutrend meter. The mean lactate value obtained from the accutrend meter is 2.89 mmol/L and 2.78 mmol/L for the reference instrument. The standard deviation for Accutrend meter is 1.14mmol/L versus 1.42 mmol/L for the Beckman instrument.[9,10] Normal value of La^- before exercise is similar between males and females; however, La^- value after exercise is higher in female and in individuals with body fat of more than 15%.[9]

A higher level of the La^- concentration accompanied by a slower decrease of heart rate after exercise represents an anaerobic condition of the skeletal muscle tissue.[12] Some studies have proven that there is a correlation between the increase in La^- after exercise test and the prognosis of dyslipidemia, coronary heart disease, heart failure, chronic obstructive pulmonary disease, and diabetes.[11]

Various different methods are available to analyze PA; however, there is no consensus about the best method. Consequently, this makes comparison between countries difficult. One of the commonly used parameters to measure subjective PA intensity is by using the International Physical Activity Questionnaire (IPAQ).[12-14] This is an instrument designed for adults and has been tested in adults aged 15–69 years old. Nevertheless, it is not recommended to use IPAQ for older and younger age groups..

There are 3 PA intensity clasifications: health enhancephysical activity/(HEPA) (1,500–3,000 Mets), inactive (600–1500 Mets), and minimally active (≤600 Mets).[17] Many studies have found that physical activities have a mild to a moderate correlation with the aerobic capacity.[12-14]

Physical activities may relate to the quality of life (QoL), through good endurance in doing daily activities. The QoL is the subjective reflects from an individual's overall perception and satisfaction in their life or, in other word it is the overall enjoyment of life.[18,19] The perceptions of health may vary between individuals and may change along the different phases in life.[20] Individual assesses their the health-related quality of life (HRQoL) by comparing their expectations with their experience.[20] According to the wide range aspect of the human life; the measurement of QoL is the multidimensional concept of subjective evaluation from the positive and negative aspects of life.[18-20] The assessment of the QoL is multidimensional and is categorized into the concepts ofphysical health, mental health, social health, emotional health, and activity dimensions.[18-20] TSeveral tools are available to measure the QoL, with HR-Qol short form (SF)-36 and the World Health Organization QoL (WHOQoL) as the most frequently used tools.[17,18] Assessment of the QoL using SF-36 has proven valid and reliable in some previous studies.[19,20] Nowadays, RAND-36 is also a global survey instrument that is widely used to measure the (HR-QoL). This instrument comprises of 36 items that assess eight health concepts: physical

functioning (PF), role limitations caused by physical health problems (RLPH), role limitations caused by emotional problems (RLEP), social functioning (SF), emotional well-being (EWB), energy/fatigue (EF), pain, and general health (GH) perceptions. Physical and mental health summary scores are derived from the eight aspect of RAND-36 scales. Scores of QoL SF-36 in wellbeing and physical function in US normal population are above 70 and 80, respectively.[18,20] No data available yet for the QoL of the normal population in Indonesia.

There are several studies that discuss the correlation between PA and the QoL which conclude that there is a positive correlation between high PA and high QoL, that is the higher the PA is, the higher the QoL.[18,19] There are still no data available on the difference in QoL between gender inn young adults, particularly among first-year medical students. Data available on the difference of QoL between gender is data from fecal incontinence subjectswhere female patients are more affected by the disease and have lower QoL.[16,17] Several factors are associated with the QoL, namely motivation, depression, and impact of a health condition.[18] Other factors are also considered to influence the QoL, such as sense of responsibility, discipline, and motivation of the students. The objective of the study is to analyze PA and its correlation with blood La^- as well as the differences in PA and QoL between male and female students in first-year of medical school. The goal is, eventually, to improve the QoL in medical students.

Methods

This study was approved by the Ethical Committee of the Faculty of Medicine, University of Trisakti, with the issuance of Ethical Clearance Number 118/KER/FK/X/2017. This was a cross-sectional study on subjects who were recruited using simple random sampling method who agreed to participate in the study, proven by signing the written consent for this study. The inclusion criterion was medical students who were able to walk without having to be assisted while the exclusion criteria were the presence of respiratory and/or cardiovascular diseases, and musculoskeletal problem in lower extremities. The minimum number of subjects required, based on Slovin formula, was 124 subjects.

This study was performed from April to November 2017 in West Jakarta, Indonesia. The intensity of PA was measured subjectively using IPAQ while the blood La^- concentration was measured before and 5 minutes after the exercise test. Exercise test performed was the Harvard step test with monitoring of heart rate (HR) before, during, and after the exercise test using Polar A300 series. The blood La^- was assessed using a portable analyzer operator, Accutrend plus® (Roche), that detected the blood La^- by an amperometric enzymatic detection. The interpretation is made based on the interpretation of the electrical signal resulting from the reaction of La^- in the peripheral droplet blood and the enzyme lactate oxidase on the inserted sensor. The voltage signal corresponds directly to the sample's La^- concentration. As the result, the higher number displayed on monitor indicated the higher level of La^- in the peripheral blood droplet sample. Furthermore, the QoL was analyzed by RAND (SF)-36. Data were then analyzed using Mann-Whitney U and Kruskal Wallis tests.

Results

Of the total number of subjects who agreed and met the inclusion criterion for participating in this study (n=126), 76 females were participated (60%).

Table 2 shows that the medians of body mass index (BMI) and IPAQ were normal and similar for both gender while the heart rates before exercise (HR1) and after exercise (HR2) were higher in females (p=0.03 and p<0.001). In contrast, La^- concentration before exercise (La^- 1) was higher in males (p=0.001) but the La^- concentration after exercise (La^- 2) was higher in females (p<0.001).

Table 3 shows that the higher value of IPAQ was linked to the lower value of La- 2 concentration (p=0.012) and HR2 (p=0.021).

Data in Table 4 presented taht the QoL total score in females was higher than males, albeit statistically insignificant (p=0.067). Most of QoL concepts were equal between gender, except for the concept of RLPH, which was higher in females (p=0.006).

Table 1 Subjects Characteristics

	n (%), mean
Male	50 (40%)
Female	76 (60%)
Age (year)	18.17±0.7

Table 2 Differences of BMI, IPAQ, Heart Rate (HR), and La⁻ Concentration by gender

	Median		p
	Male	Female	
BMI (kg/m^2)	23,3 (15.8–38)	22,2 (15–39)	0.197
IPAQ (METs)	707 (474–944)	423 (392–501)	0.7
HR 1 (times/minute)	97 (92–100)	102(99–105)	0.03*
HR 2 (times/minute)	167 (156–171)	179 (174–185)	<0.001*
La⁻ 1 (mmol/L)	4.6 (3.8–5.4)	2.8 (2–3)	0.001*
La⁻2(mmol/L)	8.4 (7.7–8.9)	10 (9.3–10.5)	<0.001*

*Mann-Whitney test

Table 3 Differences of La⁻2 Concentration and HR 2 by IPAQ group

	IPAQ (METs)	n	Mean Rank	p
La⁻2	0–599	69	71.78	
	600–1499	50	55.27	0.012*
	≥ 1500	7	40.64	
HR 2	0–599	69	71.02	
	600–1499	50	53.12	0.021*
	≥1500	7	48.43	

*Kruskal-Wallis test

Table 4 Average QoL based on SF–36 RAND

QoL	Median				p
	Male	(min–max)	Female	(min–max)	
Total	2,628.6	(2,496–2,757)	2,765	(2,687–2,859)	0.067
PF	855	(821–888)	878	(849–915)	0.11
RLPH	234	(189–275)	308	(279–332)	0.006*
RLEP	198	(171–229)	224	(204–245)	0.105
EF	287	(274–300)	286	(274–297)	0.948
EWB	376	(357–394)	373	(359–387)	0.548
SF	137	(122–147)	147	(139–154)	0.188
Pain	338	(317–358)	347	(329–366)	0.708
GH	68	(63–72)	69	(66–73)	0.708

*Mann-Whitney test; PF: physical functioning, RLPH: role limitations caused by physical health problems; RLEP: role limitations caused by emotional problems, SF: social functioning; EWB: emotional well–being, EF: energy/fatigue, Pain: pain, GH: general health perception

Discussion

This study has found that subjects had average normal BMI scores. Data of body composition was not examined in this study. It was revealed that the intensity of physical activities was inactive in both gender and that male students tend to be more active than their female counterparts. Data from this study are in line with previous studies, which stating the same results.[1-3]

Heart rate as the indicator to measure the intensity of PA was also assessed in this study

Figure 1 Harvard Step Test

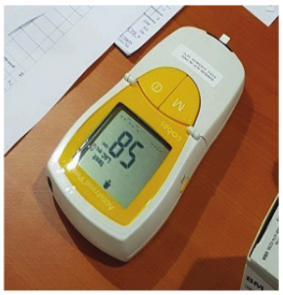

Figure 2 Portable analyzer operator ® Accutrend plus by Roche to Assess Lactic Acid

and the results showed that HR before exercise was normal in both gender; however, the HR before and after exercise were higher in females (p=0.03) and (p<0.001). The La- 1 concentration (before exercise) in males was higher than the normal value and also higher than that of females (p=0.001). This result is in contrast with an earlier study that found the La- in females is higher. A previous study has revealed that a body fat level of more than 15% is linked to a higher La-.[11] Unfortunately, this study did not assess the body composition that might be able to explain why the male La- in this study was higher. The concentration of La - 2 after exercise increased in both gender and was higher significantly in females (p<0.001). This finding supports the theory stating that during short and high intensity PA, the skeletal muscle produces La- more rapidly that is followed by increasing concentration in the circulation.[7,8] Previous studies have proven that increased blood lactic acid after exercise is a prognosis determinant in subjects with dyslipidemia, congestive heart disease, and chronic obstructive pulmonary disease.[3,11]

Data in Table 2 show that females have higher La - concentration and HR after exercise. Females have smaller skeletal muscles, causing the ability to consume oxygen of these muscle lower. This result supports the findings from previous studies that blood La - and HR increases after exercise are higher in females.[7,8] Furthermore, data in Table 3 describe that the higher the PA is, the lower the La - concentration and HR after exercise. This supports the theory of fitness capacity, which is the ability to consume the oxygen maximally (VO_2 max) during activities. Inactive subjects have a lower ability to consume oxygen during activities and because the skeletal muscle cells no longer consume oxygen, the metabolism becomes anaerobic, leading to higher production of La- into blood circulation. Thus, the increase of blood La- is higher in an inactive subject and can be used as an indirect measurement of fitness capacity. Indeed, when subjects perform greater aerobic capacity, the oxygen consumed by the skeletal muscles is higher, which is then follow by lower production of La- by skeletal muscle and lower increase of HR after exercise.[6]

The QoL as assessed by the QoL SF-36 RAND is listed in table 4. The total QoL score was higher in females, although insignificantly (p=0.067). Most of the scores of the eight QoL concepts were similar between gender, except for RLPH, which was higher in females (p=0.006). The eight concepts of QoL SF-36 RAND include the concepts of physical function, which is reflected in questions number 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12; concept of role limitation due to a physical health problem, which is reflected in questions number 13, 14, 15, and 16; concept of role limitation due to the emotional problem, which is reflected in questions number 17, 18, 19; concept of fatigue, which was reflected in questions number 23, 27, 29, and 31; Concepts

of emotional wellbeing, which is reflected in questions number 24, 25, 26, 28, and 30; concept of social function, which is reflected in questions number 20 and 32, concept of physical pain, which is reflected in questions number 21 and 22; and concept of general health, which is reflected in questions number 1, 33, 34, 35, and 36. A higher score reflects a higher quality of life.[17, 19] Data from this study has proven that females tend to have a higher QoL score and has a significantly higher score in the concept of RLPH. This result is different from the findings from the study on fecal incontinence patients that stated female patients have a lower QoL.[16] This also proves that PA alone does not determine the QoL and the QoL can be influenced by subjective factors from the subjects, such as motivation and discipline. Female subjects may have higher motivation and discipline, which may positively influence the QoL score.

Physically inactive has a correlation with chronic diseases and there is a correlation between La^- concentration increase after exercise test and the prognosis of dyslipidemia, coronary heart disease, heart failure, chronic obstructive pulmonary disease, and diabetes.[3-5, 11] This study has found that the increase in La– after exercise in both groups and inactive life style present a higher risk for subjects to experience chronic diseases.

The first-year medical student are physically inactive, with female as the less active gender. Increases in blood La^- and HR are seen after exercise in less active subjects, with female students experience a higher increase in blood La^- and HR. The mean o QoL was normal in all concepts of QoL. Although females have a lower intensity PA, they have a better QoL in the concept of the RLPH. Hence, it can be suggested that the medical school authority should give opportunities for medical students to be more active.

This was a cross-sectional study; thus, no explanation regarding the direction of effect between PA and QoL can be offered. A further study using cohort design is needed to be able to explain it.

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