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The Differences Of The Effectiveness of Muscular Endurance Exercise And Conventional Exercise To Acid-Base Balance (pH, PaO2, PaCO2 and HCO3) of The Sprinter Novita Sari Harahap1, Ambrosius Purba2 1Lecturer, Department of Sports Science, Faculty of Sports Sciences, State University of Medan, Email: novitahrp74@gmail.com. 2Departement of Physiology, Faculty of Medicine University of Padjajaran, Bandung Abstract.

Muscular endurance exercise will increase the muscle physiological function in the form of the increasing of mioglobin and mitochondria. The increasing of mioglobin and mitochondria will cause the ability of the muscle to catch the oxygen in the more maximum muscle contraction. Energy Source of a sprinter comes from predominant anaerobic alactacid and anaerobic lactacid.

The increasing of lactic acid level will influence pH and change the acid-base balance. However, by giving exercise, the influence of muscular endurance to acid-base balance of a sprinter has not been reported yet. The aim of this research is to find out the different influence between the group with muscular endurance exercise and the other group with conventional exercise to the changing balance of acid-base of a sprinter. Subjects were 20 men who had not been trained as sprinters. Sprinters, divided into two groups.

Group (i) is the group which is given muscular endurance exercise by doing resistence-training of 15-25 RM about 3 sets. The training was done 3 times in a week. Group (ii) is the control group that follows the conventional exercise. Then after the subject sprints are measured changes in acid base balance (pH, PaO2, PaCO2 and HCO3).

The results showed that there was a significant difference in the increase of pH and a significant increase in HCO_2 ($p < 0.05$), but there was no difference in the increase in PaO_2 and a significant decrease in $PaCO_2$ ($p > 0.05$). The conclusion of this study is that muscle endurance exercises are more effective in increasing the pH and HCO_3 so that there is a change of acid base balance near normal than conventional exercise.

Key word : Muscular endurance exercise, Conventional exercise, Acid-base balance, Sprinter Introduction The accumulation of lactic acid in the blood becomes a fundamental problem in physical performance, because it causes the pH to decrease resulting in changes in acid base balance and cause disruption of oxidative enzyme activity in muscle cells, resulting in the production of ATP disturbed 1,2,3.

The results of the study by Street et al (2001) showed that the decrease in pH after exercise was related to the intensity of the exercise, the higher the intensity of exercise the pH would decrease and the decrease in pH occurred in the first minute after exercise4 . Research conducted by Baron et al. (2008) to determine the physiologic response during exercise was performed until fatigue at the intensity of exercise corresponding to the maximum steady state lactate (MLSS). The results showed that the arterial carbon dioxide pressure ($PaCO_2$) decreased significantly while the pH and base excess increased significantly ($p<0.05$)5 . Decreased $PaCO_2$ is a respiratory compensation in the form of alkalosis respiration in the state of metabolic acidosis caused by excess lactic acid6.

Muscle endurance exercises can improve the physiological function of muscles in the form of increased myoglobin and mitochondria. Increased myoglobin and mitochondria will cause the ability of the muscle to capture oxygen at the time of maximal muscle contraction7 . The purpose of this study was to investigate the differences in effect between groups who were given muscle endurance exercises with groups following the conventional exercise of acid-base balance changes in sprint runners. Methods This study is an experimental study using Experimental Randomized Pre and Post test group design.

Subjects were 20 men who had not been trained as sprinters. Sprinters, divided into two groups. Group (i) is the group which is given muscular endurance exercise by doing resistence-training of 15-25 RM about 3 sets. The training was done 3 times in a week. Group (ii) is the control group that follows the conventional exercise.

Subjects in each group sprinted, then measured acid base balance (pH, PaO_2, $PaCO_2$ and HCO_3), the result of this measurement is called pre test data. Furthermore, muscle endurance training group and conventional group practiced for 8 weeks, after which sprint back and measured pH, PaO2, PaCO2 and HCO3, the result is post test data.

Normality test with Kolmogorov-Smirnov test, if normal distributed data (p>0,05) followed by t-independent test (p <0,05) to know difference of influence between muscle endurance exercise with conventional exercise to change acid base balance (pH, PaO2, PaCO2 and HCO3). Result Based on the results of data analysis with the test of Normality (Kolmogorov-Smirnov), p> 0,05, showing data of normal distribution as in table 1. Table 1.

Test the normality of acid base balance (pH, PaO2, PaCO2, HCO3-) Variable _Pre test _Post test _ _ _Kolmogorov Smirnov test _P _Kolmogorov Smirnov test _p _ _pH PaO2 (mmHg) PaCO2 (mmHg) HCO3- (mmol/L) _0,158 0,147 0,108 0,153 _0,200 0,200 0,200 0,200 _0,183 0,154 0,163 0,123 _0,076 0,200 0,173 0,200 _ _ Note : p>0,05 : data of normal distribution The difference of treatment effect of muscular endurance and conventional exercise on acid base balance change (pH, PaO2, PaCO2 and HCO3) was done t-dependent test (p<0,05) as in table 2. Table 2.

Average difference of acid base balance (pH, PaO2, PaCO2, HCO3-) Acid base balance _ _Muscular Endurance Exercise _Conventional Exercise _Uji t -independent _ _ _ _ _ _p _ _pH _Pre-test Post-test Beda pre & post-test _7,144 7,238 0,094 _7,142 7,156 0,014 _ 0,001* _ _PaO2 _Pre-test Post-test Beda pre & post-test _108,6 112,6 4 _108,4 111,0 2,6 _ 0,686 _ _PaCO2 _Pre-test Post-test Beda pre & post-test _31,75 29,67 2,08 _31,15 30,85 0,3 _ 0,379 _ _HCO3- _Pre-test Post-test Beda pre & post-test _10,40 12,53 2,13 _10,38 10,97 0,59 _ 0,043* _ _Note : * = P (<0,05) : significant Table 2 shows a significant difference in mean pH (p = 0.001) and mean HCO3 (p=0.043) improvement between muscle endurance and conventional exercise (p=0,000).

Figures 1 and 2 show that muscle endurance exercises are more effective in increasing pH and HCO3 compared with conventional exercise. Table 2 shows no significant difference in mean PaO2 (p=0.686) and mean PaCO2 decrease (p=0.379) between muscle endurance exercise and significant conventional exercise (p=0.000).

Figures 3 and 4 show that muscle endurance exercises are no different in increasing PaO2 and decreasing PaCO2 compared to conventional exercise. / Figure 1. The average pH of sprint sprinters on muscle endurance exercise and conventional exercise. * = p<0,05=significant / Figure 2. The average HCO3 of sprint sprinters on muscle endurance exercise and conventional exercise. * = p<0,05=significant / Figure 3.

The average PaO2 of sprint sprinters on muscle endurance exercise and conventional exercise. P>0,05= no significant / Figure 4. The average PaCO2 of sprint sprinters on muscle endurance exercise and conventional exercise. P>0,05= no significant Discussion Sprint is a category of short-range running and most energy sources in sprint runners are an anaerobic predominant lactacid that will produce relatively high lactic acid.

Increased levels of lactic acid is due to the occurrence of hypoxia in muscle tissue resulting in anaerobic metabolism that produces lactic acid. Increased levels of lactic acid will affect the pH change so that there is a change in acid base balance 8. Increases in pH and HCO3 have more effect on muscle endurance training groups than with conventional training groups in sprint sprinters, since weight training given to muscle endurance training groups is by measurable, regular and well-programmed exercise doses that can increase tolerance against lactic acid9.

Muscle endurance exercises will improve the physiological function of muscles in the form of increased myoglobin and mitochondria. Increased myoglobin and mitochondria will cause the ability of the muscle to capture oxygen at the time of maximal muscle contraction. The availability of oxygen in the muscle is important for sprint runner performance in continuous practice 10.

In conventional exercise, it does not show an increase in pH and HCO3 which means because the dose of exercise is unmeasurable and the same exercise dose continues so that it will not improve fitness plus the weight of the workout is too heavy. The higher the physical activity the energy and oxygen demand will increase as well. Oxygen needs can be improved by improving heart and lung function.

When physical activity is higher while the intake of oxygen from the heart and lungs is not optimal, an anaerobic metabolism occurs to meet energy needs. This condition increases the levels of lactic acid in the blood and muscles 9. The low intracellular pH will cause Ca2+ binding resistance to troponin, thus inhibiting cross-bridge formation of the actin-miosin complex.

Adecrease in the number of cross-bridges will cause a decrease in muscle contraction. If the condition lasts long, then the ability of muscle contraction will be reduced or even loss of ability to continue activities that will ultimately lead to fatigue in sprint runner 11. Reduced performance of athletes can be caused by two things, namely metabolically and muscle fatigue occurs.

Metabolically, the decrease in pH leads to inactivation of glycolytic enzyme and inefficiency of transport mechanism of nutrient membrane so that glycogen catabolism is slowed by inactivation of glycogen phosphorylase enzyme. Lactic acid also inhibits the use of fatty acids to be used as energy fuels. Because of these effects carbohydrates are used with high speed and increased catabolism of phosphokreatin, it will further inhibit the formation of ATP, so the performance of a sprint runner can decrease9. The results showed that there was an increase in PaO2 although there was no significant difference ($p < 0.05$) between treatment of muscle endurance and conventional exercise.

Increased PaO2 means hyperventilation to compensate for some metabolic acidosis due to anaerobic metabolism in sprint runners and to maintain the effectiveness of alveolar PO2. During Maximum Exercise, the combination of very low pH values and vital capacity becomes important for influencing PaO212. The results of this study indicate that there is no significant difference in all groups against the decrease of PaCO2.

In PaCO2 results found the results decreased because in physical exercise, the increasing number of lactic acid formation produces more CO2, and this causes the ventilation to increase. Response to increased physical exercise gradually, with increasing lactic acid formation, increased ventilation and CO2 formation remain balanced, so that alveolar CO2 and arterial blood are almost unchanged (isokapnik pembuferan).

The presence of hyperventilation increases the partial O2 alveolar pressure, furthermore with the accumulation of lactic acid, increased ventilation beyond CO2 formation, resulting in decreased alveolar PCO2 and arterial PCO2. The decrease in PaCO2 is a respiratory compensation in metabolic acidosis induced by excess lactic acid 13. Conclusion Muscle endurance exercises are more effective than conventional exercises in increasing pH and HCO3 in sprint sprinters so that a basic acid balance changes near normal.

References 1. Wittenberg, JB, Wittenberg, BA. 'Myoglobin function reassessed', Journal Exp Biol. 2003 vol.206, pp.2011-2020. 2. Guyton & Hall.

Textbook of Medical Physiology, 11th edition, Elsevier Saunders, Philadelphia, Pensylvania. 2008. 3. Farenia, R, Lesmana, R, Purba, A, Akbar, B, Shahib, N, Koibuchi N, et al. Perbandingan antara kadar serum mioglobin dengan laktat setelah aktifitas fisik aerobik dan anaerobik pada tikus wistar, Bagian Ilmu Faal Fakultas Kedokteran Univeritas Padjajaran Bandung. 2013. 4. Street, D, Bangsbo, J, Juel, C, 'Interstitial pH in human skeletal muscle during and after dynami cgraded exercise', Journal of Physiology.

2001. vol. 537, no. 3, pp. 993-998. 5. Baron, B, Noakes, TD, Dekerle, J, Moullan F, Robin S, Matran R et al. Why does exercise terminate at the maximal lactate steady state intensity?, Br J Sports Med. 2008. Vol. 42, no. 10, pp. 828-33. 6. Hanon, C, Lepretre, PM, Bishop, D, Thomas, C. Oxygen uptake and blood metabolic responses to a 400-m, Europe J Appl Physiol. 2010. vol. 109, pp. 233–240. 7.

Bompa, TO, Haff, G. Periodization: Theory and Methodology of Training, Fifth edition, York University, Champaign: Human Kinetics Books. 2009. 8. Foss, ML, Keteyian, SJ. Physiological basis for exercise and sport, Mc.Graw-Hill Companies, New York. 2006. pp. 59-64 9. Willmore, JH, Costill, DL. Physiology of sport and exercise, USA, Human Kinetics. 2008. pp.216-236. 10. Billaut, F, Buchheit, M.

Repeated-sprint performance and vastus lateralis oxygenation: effect of limited O2 availability, Scand J Med Sci Sports. 2013. vol. 23, no. 3. 11. Mc Ardle, WD, Katch, FI, Katch, VL. Exercise Physiology: Nutrition Energy and Human Performance, Seventh edition, Philadelphia, USA. 2010. 12. Orlando Regional Healthcare. Interpretation of Arterial Blood Gas, Orlando Regional Healthcare. 2004. p. 4. 13. Benardot, D. Advanced Sports nutrition, Human Kinetics, Champaign, IL.2006.

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