Man In India, 98 (1) : 261-278

EFFECT OF "S & E TRAINING MODEL" TO INCREASE STRENGTH AND ENDURANCE IN MARTIAL ATHLETES; (EXERCISE PHYSIOLOGY STUDY)

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This study aims: (1) to prove the effect of S & E exercise model on strengthening, (2) to prove the effect of S & E training on increasing endurance athletes of Pencak Silat Teenagers. This research is an experiment with two group prettest-posttest design. The population of the study were teenage adolescents totaling 20 athlete. Data collection using tests conducted before and after treatment. Data analysis technique using t-test. Strength test using wall sit test, push-up test, sit-up test, chin-up test, back-up test, and endurance test using balke test. The results of the research analysis showed that strength (group 1) with wall sit test increased by the right limb support á 12,9 and the left limb support á 13,4; push-up test increases by á 9.4, crunches test increases by á 10.5, back-up test increases by á 13.6; pull-up test increases by á 2. Endurance (group 2) using balke test increase by 2.28. Based on the above results it can be concluded that the S & Edapat exercise model improves strength significantly with p: 0,000 and endurance training can significantly increase endurance by p: 0,000.

Keywords: exercise model, biomotor strength and endurance, adolescent athlete

PRELIMINARY

Pencak Silat is a form of martial art sport. History of the birth of pencak silat is not known for sure, but martial arts pencakiri already known by the people since ancient times, which in its development can be contested. The fighters in performing the match must have a good biomotor component. the biomotor components needed in martial arts for the fighters include strength, speed, power, flexibility, resilience and coordination. In addition, the psychic aspect of emotional mastery, motivation and intelligence and other elements related to psychology is needed to be more supportive to be a good fighter.

Improvement of physical condition is the first element in training, because the elements in this coaching both during heating, playing and others must be accompanied by physical formation. In addition to reducing the occurrence of injury to the athlete when performing techniques and simple tactics to the complex (Nugroho, A., 2001). The two biomotor components of strength and endurance are important to the trainer to the adolescent athlete, because the strength as a foundation in forming other biomotor components. While endurance will affect the fighter in order not easy to experience fatigue and can be more quickly in

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recovery, and to the peak of achievement should be started from the development of aerobic ability, anaerobic excitatory threshold, anaerobic exercise, and the peak is the speed to achieve the highest achievement (Hariono, 2006). Everything is required in the category of matches, art category (single, double, team).

In parallel to the above explanation, research related to strength and adolescence, Rashid, A. (2014) whose research used the age group of 15-19 years resulted that "plyometric training had a significant effect on the effectiveness of strengthening and leg muscle strength in badminton sport" . That is, plyometric exercises can improve the ability of biomotor strength and power, plyometric is a biomotor component of the combination of basic strength (maximum strength) and speed (maximum speed) components with concentric and eccentric motion always cyclical contraction (continuous) and use of age group 15 - 19 years of age indicate an increase in plyometric training. Siswantoyo (2014) found that "there was an increase in the ability of the adolescent limb power of 6.6 cm. Changes in increased limb power occur with increasing-decrease-increase pattern back ". That is, modified plyometric exercise can improve the ability of limb power and adolescent athlete indicated there is an increase. Soethama, Silakarma, Dedi., & Wiryanthini (2016) resulted in "an increase in pectoralis major muscle mass and bicep in adolescents after weight training. There is an increase in pectoralis major muscle mass and bicep in adults after weight training ". There is an increase in pectoralis major and bicep muscle mass greater in adults than in adolescents after weight training. That is, weight training can already be given to adolescents in increasing muscle mass even though the mass increase is greater than in adults because of age factors related to the principles of readiness, individuality, adaptation and variation.

In addition Uliyandari's (2009) study found that "there was an increase in VO2max in girls aged 11-13 years who received programmed physical exercise". That is, At the age of 11 - 11 years on female students can already be given physical exercise programmed proved an increase in VO2max value. The Brøgger, Mathisen, Pettersen (2013) study found that "children can raise their VO2max after five weeks of practice with two sessions at high intensity per week. The study also revealed that children can exercise up close to their average heart rate peak in a time period lasting up to four minutes ". That is, that the age of children ie 10 years of age in boys or still at the multilateral stage of the training pyramid is able to respond to aerobic activity training program in 5 weeks with 2 sessions per week. While Ulum's research (2013) concludes this research that "short interval training can increase anaerobic endurance in hockey players ". That is, it is known that short interval training when applied regularly, programmed, continuous, and high discipline proven to increase anaerobic endurance in adolescents aged (15-18 years) high school. Some of the above research shows that strength and endurance can be given in adolescence.

RESEARCH METHODS

This research is a quasi-experimental research. Two-Prettest-Posttest Design. The subjects of the experiment were given pretest with strength and endurance test. This study was conducted in two experimental groups given treatment in the form of strength training and endurance training (S & E training model). Time of study conducted 12 meetings with frequency 3 times a week, research conducted for 2 months. The population in this study were martial arts athletes with the age of 14 - 17 years or juvenile cateori, with the number of 20 athletes and divided into two groups. Group one is 10 people for strength training and group two is 10 people for endurance training. Variables in this study consist of independent variables that is strength training model and endurance. Dependent variables are strength and endurance capability. Data analysis techniques used: normality test, homogeneity test, and t test. The analysis results revealed that there is a difference if the significance value is less than 0.05 ($P < 0.05$). Data obtained from pretest and final test (posttest) will be analyzed statistically descriptive using t test by using SPSS program with 5% significance level.

RESEARCH RESULT AND DISCUSSION

From this research process obtained data relevant to the purpose and hypothesis research. The data of this research is obtained from pretest and posttest which is given a treatment that is strength training effect and endurance. Initial tests were taken to determine strength and endurance capabilities. After the treatment is given strength training and endurance training in accordance with the appropriate dose of exercise, then the next stage performed the final test. This posttest aims to determine the effect of the treatment that has been given during the exercise. The way is done to determine the ability of strength with wall sit, sit-up test, push-up test, back-up test, chin-up test. While the ability of endurance with balke test. Full exposure of pretest and posttest result data can be seen in table 1 below:

TABLE 1: PRETEST AND POSTTEST RESULTS OF STRENGTH AND ENDURANCE

Uji Tes	*Pres test*	*Posttest*	*α*
Strength			
Right Wall seat	19,8	32,7	12,9
left Wall seat	19,4	32,8	13,4
Push Up	30,3	39,7	9,4
Sit Up	32,8	43,3	10,5
Back Up	53,7	67,3	13,6
Pull Up	4	6,7	2
Endurance	*Pretest*	*Posttest*	α
Balke Test	36,31	38,59	2,28

Based on the above results can be seen the average value of right wall seat for pretest value of 19.8 and posttest value of 32.7, then the difference of pretest to posttest increase of 12.9 with information increases. The average value of the left wall seat increases. The average pretest value of 19.4 and posttest value of 32.8 then the difference of pretest to posttest increase of 13.4 seconds. The average value of push up pretest 30.3 and posttest 39.7 then the difference of pretest to posttest increase of 9.4 seconds. Average sit up value for pretest value 32,8 and posttest value 43,3 hence difference of pretest increase to posttest equal to 10,5 increase. The mean value of back up for pretest value 53,7 and posttest value of 67,3 hence difference of pretest increase to posttest equal to 2 (increase). The average value of pull up pretest 4 and posttest 6.7 (increased). The average test score pretest 36.31 and posttest 38.51 then the difference of pretest to posttest increase of 2.28 (increase). conclusion is the result of strength and endurance after the treatment between pretest and posttest result of the increase significantly.The normality test results from all test items showed normal distribution strength (p> 0.05). And homogeneity test showed the result of significance of p> 0,05, thus all test result used was homogeneous. The result of variance homogeneity test with Lavene statistics shows significance value (> 0,05), then the data can be said homogeneous. Furthermore, data analysis continued with t test, while the result as follows.

TABLE 2: RESULTS OF T STRENGTH AND ENDURANCE TEST DATA

Training model		
Strength	*t*	*Significant*
Right wall seat	-17,501	0,000
Left wall seat	-11,132	0,000
Push Up	-13,695	0,000
Sit Up	-24,523	0,000
Back Up	-27,261	0,000
Pull Up	-12,650	0,000
Endurance	t	Sig.
Balke test	-10,714	0,000

Based on the data in table 4 pretest and posttest shown with significance value 0.000. It was concluded that six test items of strength occurred a significant increase. And endurance also increased with a significance of 0.000. The exercise program used in strength training is as follows.

Muscle strength is defined as the ability to generate strength to the load and is rated as the maximum removable load or maximum torque that can be generated during movement "(Signal, N.E.J., 2014). In this case the development of muscle

TABLE 3: STRENGTH TRAINING PROGRAM

Model training	*Dosage*		*purpose*
Weight training	Intensity	: 70% – 90% of	Develop strenght
	1 RM Volume	: 3 – 5 set / 6 – 10 repetition	
	T. Recovery	: 2 – 5 menit	
	T. Interval	: 2 – 5 menit	
	Irama	: 2:1:2	
	Frequency	: 3 kali week	
	Periodization	: 4 week	

strength in sports body contact, body builder can use the target practice and maximum strength hypertropy because this exercise suits the needs of sports. Hypertrophy and maximal strength are joint exercises with eccentric and concentric base motion with angular type of joints. Implementation of hypertropy exercises using moderate intensity of 67% - 85% of 1 RM, Repetitions 6 - 12, 3 - 6 sets, and breaks between sets 30 - 1.5 minutes (Binkley, HM, 2014) and maximum strength training exercises using weight using the heavy intensity of 80% - 100% of 1 RM, reps 1 - 8, set 3 - 5, and rest between sets 2 - 5 minutes (Hariono, A., 2006).

Combining the use of the hypertropy practice method of maximum strength, based on Sharkey's opinion that At age 10-12 years for daughters and 12-14 years for boys there is dramatic growth and development, increased secretion of testosterone hormones for men and progesterone for women. At the peak of muscle and bone growth, there is a balance disorder. At this time the exercise is aimed at improving muscle strength and heart lung fitness. Resistance exercises can increase oxygen by 33% or more. Various skill exercises and correct techniques begin to be trained on athletes and begin to be prepared for more strenuous exercise. At the age of 15-19 years to improve the functional capacity of the muscles and heart lung fitness done with more severe exercise, for example with weight training in accordance with the needs of the sport (Sharkey, 1986) .. This means teenagers are complex, multi-process transition system that involves the development from immaturity and social dependence in childhood to adult life with the goals and expectations of fulfilled development potential, and social accountability (Curtis, 2015). In this case, adolescents aged 14-17 years are said to be provided with moderate intensity training both in developing strength and endurance capability remain in the supervision of the coach

The results showed a greater statistical increase in high intensity than moderate intensity in squatting strength. Or, a statistically greater increase in lateral thigh muscle thickness is noted for moderate than weight. These findings suggest that weight training is superior to the goal of maximal strength when moderate load training is more suitable for hypertrophy-related goals when the same number of sets is performed between conditions (Schoenfeld, BJ, Contreras, B., Vigotsky, AD, et al ., 2016). However, in the research conducted the researchers combine an

alternative dose of exercise between hypertropy and maximum strength. Namely reps between 6 - 10, 3 - 5 sets, 70 - 90 intensity, rest between sets 2 - 5 minutes. And the results obtained increased by p: 0,000.

Improvement from pretest to posttest Right wall seat is shown with t value of -17,501 at significance 0,000. It is concluded that the increase of Right Wall seat value before and after training has increased significantly. The increase from pretest to posttest left wall seat is shown with a t value of -11.132 at a significance of 0.000. It is concluded that the increase of pre-and post-training values has increased significantly. The results are measured using the sit sit test. There are several studies that support the test results sit sit. The results of other studies have a significant effect on the squat and leg press exercises for increased strength and hypertrophy of the leg muscles. The squat exercise is greater than the leg press and control group on increased strength and hypertrophy of the leg muscles (Rachman, A., 2014). In addition, obtained by doing treatments on leg muscles or lower extremities. In the research conducted by Anggraeni, Jubaedi, & Nuseto (2013), this study aims to find out a clear picture about the relationship of arm muscle strength and legs with the achievement of 25 meter freestyle pool on the students of 2012 class year 2012/2013. Instruments used strength test of arm muscles (pull and push strenght test), leg strenght test, and 25 meter swimming test. The result of research is there is a significant relationship between arm muscle strength and leg muscle strength to freestyle pool with contribution of 41,86%. That is, leg muscle strength contributes to freestyle pool achievement. When associated with sports achievements of martial arts, the dominant work of muscles using legs or lower extremities is certainly very supportive of the athlete's ability to perform kick movements, clippings, sweeps.

In addition, in the study who want to know how much influence the press exercise to increase the ability leap in a jump serve on the game volleyball in high school. So it can be concluded there is a positive influence between leg press exercises on the ability of the top service on the game volleyball (Saleh, H.U., 2013) .As of this research problem the importance of leg muscle strength in supporting the technical skills on the martial arts branch. There are studies that compare the effect of effective exercise between leg curl and leg extension on the ability to kick the ball. Based on the results of this study can be concluded that leg curl exercise and leg extension exercise are equally improve the kicking of the ball, but according to statistical calculations leg extension exercise is better than leg curl exercise in improving the results kick the ball. For that it is recommended: 1) The players should do leg extension exercises to improve long-distance kicks. 2) Trainers should provide leg extension and leg curl exercises to extracurricular participants in improving long-distance kicks (Bahar, A.T.I., 2012). While in another study to determine the difference of hamstring curl on swiss ball training with lying leg curl exercise to increase the strength of hamstring muscle in futsal players.

The conclusion of the research is the difference of hamstring curl on swiss ball training with lying leg curl training to increase hamstring muscle strength in futsal players (R, Khoiriyah, 2014).

The increase from pretest to posttest sit up test is indicated by a t value of -24.523 at a significance of 0.000. It was concluded that the increase in pre- and post-training values experienced a significant increase. The result is measured using push up test. There are several studies that support the results of push up test.Terapat research that the conclusion that sit up exercise can improve the ability heading in the game sepak takraw at sepak takraw athletes. (Marselina, M., Baan, A., & Appe, U., 2015). There is also research that the purpose of this research is to know the effect of sit up and medicine ball practice on throwing ability in class XI soccer game in SMA. The conclusion of this research is that the sit up and medicine ball exercises can improve throw in ability and it can be concluded that both of these exercises can be concluded that medicine ball practice is more dominant than the result obtained in throwing ability (Suhendra, TA, Jumain, & Marhadi, 2015). This means that the two researches that sit up exercises can give good results to the skills in the sports. In research conducted by the researchers are very synergistic with the above research, because the ability of pencak silat techniques supported by abdominal muscle strength, because abdominal muscles are central or part of the core muscle, which is responsible for helping all daily activities. And strength training can already be given to adolescent athlete but it is necessary to be given carefully dose of exercise, principles of practice, dominant biomotor and energy in sport of martial arts. And proved in the table results above the presence of significant results typed t test done, using sit up test.

The increase from pretest to post test push up is indicated by a t value of -13.695 at a significance of 0.000. The results are measured by using a push up test. There are several studies that support the results of the push up test. In a study aimed to prove the effect of physical exercise programmed on muscle endurance. Treatment is the amount of push-up modifications without a break that can be done at week 0 (pretest) and 12 (post test) is assessed with a table of muscle endurance Mc Ardle. The conclusion is 12 weeks of programmed physical exercise in girls aged 9-12 years can improve muscle endurance (Parahita, A., & Hardian. 2009). In addition, there is a study aimed at identifying and identifying push-ups and triangle push-up exercises for arm muscle explosive strength. The conclusion of the research is better push-up triangle exercises compared to the push-up cluster training on the muscle power of the arms in the students of Junior High School (Munanda, Ferdinan, Hermawan, R. & & Suranto, 2016). There is also research that aims to be achieved in this research is to know the effect of bench press and full over training program on the result of over head pass basketball in the class X students in high school. The results showed: first, t arithmetic = 13,140> t table = 2,131 means there is a significant influence on the bench press exercise program

of 133%. Second, t count = 27,843> t table = 2,131 there is significant influence on training program full oversebesar 115,15% (Armaica, M.R., Sitepu, A., & Suranto, 2013). At that point, there is a research aim is to know the influence of bench press exercises and push-up exercises against free throw shots in basketball games, and whether there are differences in results from both forms of exercise. The conclusion is that there are significant effects of bench press exercises and push-up exercises on free throw shots in basketball games, and there are differences in results from both forms of exercise (Taryono, 2010.). And there is research that aims to know: 1) difference of influence between bench press angle 45 ° and bench press angle 135 ° to result of repulsive force O'Brien style, 2) difference of influence between normal weight of lean and normal weight of fat against the outcome of the O'Brien style bullet, 3) the interaction between bench press exercises and weight loss against the O'Brien style shot force. In conclusion There is no interaction between bench press exercises and weight loss against O'Brien style shot-strike. It is expected that the results of this study can be useful for teachers of Physical Education and trainers who are interested to develop a shot putter, when preparing the exercise program should be the bench press exercise of 135 ° angle is incorporated as an alternative exercise, because the bench press exercises at 135 ° angle give better influence compared to bench exercises press angle 45 ° to the outcome of the O'Brien style ball beam, and pay attention to weight factor, because in this research proved that the weight of normal fat give better influence compared with the normal weight of lean against the outcome of the shotgun style O'Brien (Muhlisin. 2007).

From some of the above research, it is concluded that push-up exercise is very influential to increase strength in chest and arm muscles, especially given bench press exercises more support such strengthening research, bench press is very influential on the technique skills over head pass on basketball, when on martial arts sports will help against the technique of kickback, blow technique. In addition, the results of bench press exercises can be maximized not only the dose of exercise alone, but based on research bench press exercises can be maximized when adjusted angle of practice. And proved in the table results above the existence of significant results typed t test done, using push up test. The increase from pretest to posttest back up is shown with a t value of -27.261 at a significance of 0,000. The results are measured using back up test. There are several studies that support the results of back up test. While the purpose of research to be achieved is to know and examine the presence or absence of the influence of back up training on the ability of heading in the game of football on the students. Based on these results then the hypothesis states There is an influence of back up exercises on the ability of heading in the game of football on students (Reval, 2013). That is, back-up exercises when given correctly and appropriately in accordance with the dosage that has been adjusted to the rules of practice will have an impact on the increased technical

skills and not only that, physical, tactical and mental can be achieved well. And evident in the results table above the presence of significant results.

The increase from pretest to posttest pull up is indicated by a t value of -12.650 at a significance of 0.000. The results are measured using a pull up test. There are several studies that support pull up test results. This study aims to find out which is more effective between the influence of push up and pull-up exercises on improving the service accuracy of youth athlete volleyball men. The test results showed the pull experiment group experiments better than the push-up experimental group on improving the accuracy of volleyball service, as indicated by the posttest value difference of 2.4, meaning that the experimental group of pull-up experiments is more tested than the experimental group of push-ups (Merrydian, O. 2012). In addition, there is research with the aim of knowing the effect of pull up and dumble biceps curl exercises in increasing the stroke arms swimming on vocational students. Frequency of practice as much as 3 times in semingu, as many as 2-4 sets with 8 times each set and break time 2 minutes each set. The training program is given for 6 weeks. The difference in effect suggests that the pull-up exercises are better at improving straighter breaststroke armor than the practice of dumble biceps curl and control exercises (fcount 3,420> ttable 3.23 (Arismunandar, Y., Husin, S. & & Hermawan, R. 2013) .The conclusion that pull-up exercises are more effective is evident from the above research, from comparative pull-up exercises to push-to-service precision, in addition to the pull-up and bicep curl pull-downs of the freestyle pool, all of which conclude that pull-up exercises are more effective at improving skills on the sport. So in the sport of martial arts pull-up strength training is useful to support the technique of kickback, that is when someone pulls the opponent's leg to do. shown in the results table above the presence of significant results typed t test.

TABLE 4: ENDURANCE TRAINING PROGRAM

Training model		*Dosis Latihan*	*Tujuan Latihan*
Endurance training	Intensity	: 85% – 90% maks	Training for *aerobic* & *anaerobic*
	Duration	: 2 – 5 menit	
	Repetition	: 6 rep	
	Set	: 1 set	
	T. interval	: 1:1/2 -3	

The increase of pretest to posttest balke test is shown with t value of -10.714 at 0.000 significance. It is concluded that the increase of balke test value of athlete before and after training has increased significantly. Other research results show that the experimental results for two weekly sessions of maximal strength training are enough to increase the maximum strength. The increase in tethered pool strength correlates with a 400 m freestyle increase and hence it is concluded that strength training is important for improving swimming medium distance. Adding two weekly

sessions-high intensity interval training for high volume training situations is not enough to improve VO2peak in swimming (Aspenes, S., Kjendlie, P.L., Hoff, J., Et al., 2009). endurance is a condition or condition of the body that is able to practice in a long time, without experiencing excessive fatigue after completing the exercise "(Kardjono: 2008). If an athlete has good endurance ability, the quality in the cardiovascular system, respiratory, and circulatory system works well so that the fulfillment of energy during activity can take place smoothly. The advantage will be owned by athletes at the time of competing athletes will be faster in mererecovery himself, athletes will be able to work longer in high work intensity because it is not easy to get tired quickly.

Evident in the training center IPSI Surabaya with research analysis of physical condition of adolescent athlete showed that the condition of physical condition component of young men in training center IPSI branch of Surabaya city as a whole in less category (Pujiantoro, T.: 2014). This can be examined how to provide endurance training to develop endurance for adolescent athlete ?. The trainer should pay attention to the athlete's physiological ability in principle individually, because an athlete in responding to the training load for each athlete will vary, so that the training burden for each person can not be equated with one another, that is from heredity, maturity, , rest time, fitness level. Adaptation principle is one important factor that must be considered by the trainer because it is related to human organs that tend to be able to adapt to environmental changes. The principle of overload needs to be applied in training development in developing endurance capability. On this principle, the training load must reach or exceed slightly above the excitatory threshold. Because the burden is too heavy will result in not able to be adapted by the body, while if too light does not affect the physical quality improvement, so the burden of training must meet the principle of moderate. There are still some principles of practice that must be applied by the trainer, the need for endurance exercise measurable, planned, progressive based on the principles of principles and methods of physical exercise.

Selection of physical exercise method on the sport of pencak silat one of them must pay attention to predominant energy system. By knowing the predominant energy system used, can be used as a basis for consideration in choosing and determining the method of improvement. Based on simple observation, predominant of pencak silat energy system is ATP-PC: 73,75%, LA-O2: 16,25%, and O2: 10% "(Hariono, A .: 2005). By paying attention to these predominances, it will result in measurable exercise that ultimately obtained athletes who can display the results of the exercise at the time of the game with a brilliant performance because of its excellent durability.

After knowing the energy predominant at the sport of pencak silat. It requires appropriate training to improve the quality of exercise. Interval training methods, because interval training is the most appropriate method to improve the physical

quality of the athletes. In interval training, it is preferred to give time interval (break) during inter sets, with the form of activity among others can be by running and swimming. In a study that high intensity aerobic training interval resulted in a significant increase in VO2 max compared to long-range intensity and lactate-threshold. Percentage increase for 15/15 and 4? 4 minimum groups were 5.5 and 7.2%, respectively, reflecting an increase in VO2max 60.5-64.4 mLIkg j1Imin j1 and 55.5-60.4 mLIkg j1Imin j1. Stroke volume (SV) increased significantly by approximately 10% after interval training. In conclusion, high-intensity aerobic exercise intensity resistance interval was significantly more effective than doing the same total work in both lactate threshold or 70% HR max, in increasing VO2 max (Helgerud, J., K. Hkydal, E. Wang, et al .: 2007) . This suggests that developing endurance training by providing high-intensity interval training methods to the athlete will have a significant impact on the increase in VO2 max provided that the interval training method is in accordance with the rules of practice, if it is not in accordance with the rules of practice then not will have a significant impact on what is trained to the athlete. The dominance of low intensity, long practice in fewer combinations, highly intensive attacks may be complementary in terms of optimizing adaptive signals and technical mastery at acceptable levels of stress (Yuliastrid, D .: 2010). This means that the stages in the interval training with high intensity should be initiated with the intensity of light, medium, and high with the aim that the body is ready to adapt to changes in the burden of pressure from outside that causes changes to the physiological factors and psychological that gives a person strong against the pressure that will given next.

In the other research results obtained the average endurance in pre test of 41.8 ml / kg / min and at post test 44.4 ml / kg / min. Based on normality test of pre test data obtained table bigger than count (9,488> 2,8319) and post test (9,488> 3,2628), so that data is normal distribution. The calculation of difference test of resistance duration before and after being given physical exercise using the ball obtained t arithmetic equal to 10.4 and t value table with significance level 0,05 with df = 19 is 2,093. Since t is greater than t table (10,4> 2,093), Ho is rejected which means there is difference of mean endurance before and after being treated or physical exercise using ball (Roziqin, A. K., & Widodo, A .: 2013). In this study, using a circuit training model with an interval method with high intensity is also consistent with the results of research indicated that regular aerobic exercise can increase VO2 max by making the heart and respiratory system more efficient, thereby channeling O2 to more active muscles. The exercise muscles themselves become increasingly able to use the O2 distributed to them (Siler, S .: 2010). Aerobic exercise runs for 30 minutes with a weekly dose of 4 times for 4 weeks. VO2 max is measured by using cooper test. The results showed that the effect of aerobic exercise on maximal VO2 increase in adolescents aged 18-20 years (Kumarudin, A. 2013). And this is in accordance with the research conducted

with the provision of a circuit training model to develop endurance capabilities in adolescent athlete.

In subsequent research, this study aimed to determine the effect of training intervals and circuit training on aerobic endurance improvement, and to determine the increase in aerobic endurance between training intervals and circuit training. From the research objectives obtained: 1) There is the effect of interval training and circuit training to improve aerobic endurance, where t values obtained between the initial test and the final test at the training interval = 8.64> t tabel = 2.12, In the circuit training obtained value t = equal to 5.02> t table = 2.12, and the initial test and the final test of the training interval and the training circuit obtained t value = 4.02> t table = 2.12. The difference in aerobic endurance increases at training intervals by 13%, and at training circuits by 8%. 2) The interval trains better influence compared to circuit training to increase aerobic power (Khotimah: 2011). It can be interpreted that training interval training and training circuit both can improve aerobic endurance, in research conducted by researchers using circuit training model with high intensity interval method can also improve the quality of endurance, proved after posttest. It is seen that there are significant differences before treatment and after treatment. Show that training interval training and circuit training or circuit training model with interval method can improve the physical quality, that is endurance.

In his other research explaining the martial arts as a fighting sport whose basic character is a free-handed fist and foot to repulse an opponent, where the match takes 2 minutes in 1 turn with a high enough intensity that the athlete is active in the attack. and counterattack during the game with energy needs and it requires good physical condition. This study involves the issue of cardiovascular endurance To use in this taekwondo sport which is treated using interval training and fartlek training on cardiovascular endurance in junior athlete's son. The results of the study concluded that: (1) training interval training had significant effect in improving Cardiovascular endurance in Junior High School Taekwondo Wild Club Medan 2006/6 (t count> t table = 7,00> 1.73), (2) Fartlek exercise significantly in increasing Cardiovascular endurance in male junior athletes (t count> t table = 6.89> 1.73). (3) Fracture training is no better than training interval training to improve cardiovascular endurance ability in Junior athletes (t count <t table = 0.22 <1.70). (Indrayana: 2012). In harmony with this research, research is motivated by a lack of awareness of trainers and students about the importance of endurance training for martial arts sports. Based on the above description, this study looks at the effect of training and fartlek training interval on increasing VO2 Max athletes of martial arts. There is a training interval training effect to improve VO2 Max. 3) The training interval training method is better than fartlek to the increase in VO2 Max, with an increase of 10.07% better than before the exercise. (Patria: 2017). Therefore, it is very much in tune with research conducted by researcher who want

to develop and improve the biomotor endurance using the exercise model, that is the endurance training model.

Results obtained by circuit training model with high intensity interval method can increase VO2max in juvenile martial arts athletes. Indeed, VO, max is very influential in everyday life, so it can increase physical activity, especially martial art players achieve maximum achievement. In order to improve the VO, max it is necessary to practice a careful, systematic and orderly exercise. Seen in futsal athletes whose research wants to know the increase in VO, max futsal players through continuous run and circuit training. The results obtained in the continuous run exercise there is the influence of the VO, max player futsal improvement. And on circuit training means there is an effect of increasing VO2max. There is a difference in the effect of circuit training on increasing VO, max futsal players. Continuous running and circuit training can improve VO, max futsal players. However, the provision of circuit training is more effective in improving VO, max than continuous running exercise. (Masdar: 2017). This means it is clear that the research developed by this research is developing a circuit training model that aims to improve and develop endurance biomotor can be used as an alternative exercise in support to physical qualities athletes because based on research on the circuit training can or very significant if do training to athletes.

Further research aimed to determine the effect of low intensity continuous circuit training and running on improving cardiovascular endurance. The type of this study was Cardiovascular endurance measured by Multistage Fitness Test (MFT). The result of data analysis showed the change of mean value on the variable of cardiovascular endurance. In the circuit training group there was an increase of 3.26 ml / kg / min, in the low intensity continuous training group there was an increase of 5.79 ml / kg / min and in the control group increased by 0.47 ml / kg / min. then the low intensity continuous training group is better than the circuit training on cardiovascular endurance improvement of 2.40000. From result of data analysis and discussion can be concluded that; (1) low intensity continuous circuit and continuous training have an effect on the improvement of cardiovascular endurance (2) there is difference of effect of circuit training and low intensity continuous run to the improvement of cardiovascular endurance where the training of low intensity continuous run better. (Sutyantara, K., Arsani, N.L.K.A., Sudarmada, I.N .: 2014). In addition there is a study aimed at measuring the effectiveness of circuit training with short-term periodization in improving the condition of stamina in athletes. The study included experimental treatment in the form of short circuit training, 75-90% training intensity of DN Max, 45-60 minutes of training duration and frequency of exercise three times per week for 6 weeks. The results showed that the average stamina condition before the treatment of 104.24 seconds was included in the condition of "moderate" stamina, more slowly than the average after treatment which was 99.88 seconds which included the

condition of "good" stamina, thus stated that the circuit training with short-term periodization effectively improving the condition of athlete's stamina (Ariadi, I: 2012). This means that circuit training can also be used to improve the physical quality of stamina. Stamina is very important for an athlete, because stamina is closely related to endurance when athletes do the match in a long time with a very high intensity.

As long as the circuit training is adjusted to the sport, energy system, and practice rules that must be considered and used as guidance in the manufacture of training periodization program so that the goals and objectives that have been designed and arranged are achieved. This study also aims to prove the influence of circuit training on leg muscle strength and VO2max in adolescent boys. This study was a quacy experiment Leg muscle strength was measured with back and leg dynamometer and VO2max was measured by multistage fitness test (MFT) test. The result of limb muscle strength data analysis showed significance value = 0.001 and significance value VO2max = 0.000. From these data, the significance value of leg muscle strength and VO2max is smaller than á = 0.05 so that the research hypothesis is acceptable. Based on the results of data analysis and discussion it can be concluded that circuit training effect on increased muscle strength of limbs in adolescent boy students with less than 0.01 significant value and circuit training effect on increasing VO2max in juvenile students with a significance value less than 0.01 . It is recommended for sports actors to use this training as an alternative in improving leg muscle strength and VO2max (Hariyanta, I.W.D., Parwata, I.G.L.A., & Wahyuni, N.P.D.S: 2014). An effective circuit training model is used for defined practice purposes. Circuit training model can be used with the aim of improving physical quality. Physical quality, among others, increases strength, endurance, speed, agility. It is seen above that circuit training can be used to increase leg muscle strength while increasing VO2max, although the above research has shown that the effect of circuit training on increasing limb strength is less than the increase in VO2max.

By still based on circuit training with guidance on the rules of practice that is from the dose of exercise, the components of the exercise, the principle of exercise, energy sources used, and components of biomotor to be trained according to the sports branches in focus. This study aims to determine the effect of training intervals on physical fitness and VO2 max. The results of data analysis showed that the training interval showed a significant increase in physical fitness 15,270> 2,039. Interval training showed a significant increase in VO2 max of 5,590> 2,039. In conclusion, interval training can provide a significant effect in improving physical fitness and VO2 max. (Syaifudin, A.W .: 2015). In conclusion, the difference in effect suggests that the latter group is better than the interval training group and the control group in increasing the VO2max (Setiawati, A., Hermawan, R., & Sulistianta, H., 2013). That is, given the training interval training in accordance

with a measurable and precise dose of exercise will produce quality exercise. Although the above only use interval training training but in interval study used to be an interval method on the circuit training model which results can be applied to the exercise when trying to boost endurance or increase it VO2 max.

There are other studies that confirm that circuit training can improve VO2Max. The research aims to determine whether there is influence of circuit training and cross-country exercises on the increase of VO2Max in students who follow extracurricular activities taekwondo son. The data retrieval technique for this VO2Max test uses a 15 minute Run (Balke Test). The results showed that there were significant effects of circuit training exercise of 22.36 and cross country of 33.54 to VO2Max in students extracurricular taekwondo son (Ambarwati, R.H., & Jubaedi, A., 2014). All of the above results from both strength training and endurance exercises show strength training and endurance exercises should be given at the beginning of the exercise that includes the specialization stage because if the initial foundation is well established it will also affect the development of other biomotor so that the fighters in doing the exercise and match will be more efficient in using energy for technical movement, as well as, tactics and psychics are also better. In addition it will support the achievement of sports achievements that they do.

CONCLUSION

The S & E Training Model exercises significantly influence biomotor strength. Besides, it also affects the increased endurance before the treatments are given and after the treatments are given. Effective exercise to increase strength in adolescent athlete. in the endurance exercise also provides increased endurance capability in adolescent athlete. Thus S & E Model training can be used as one of the models to increase the strength and endurance of adolescent athletes.

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