Model and Effectiveness of Endurance Exercise to Increase Physical Fitness in Intellectual Disability Subjects with Obesity: A Randomized Controlled Trial

Tirza Z. Tamin[1], F.H. Idris[1], M. Mansyur[2], Sidartawan Soegondo[3]

[1] Department of Physical Medicine and Rehabilitation, Faculty of Medicine Universitas Indonesia - Cipto Mangunkusumo Hospital, Jakarta, Indonesia.
[2] Department of Community Medicine, Faculty of Medicine Universitas Indonesia - Cipto Mangunkusumo Hospital, Jakarta, Indonesia.
[3] Department of Internal Medicine, Faculty of Medicine Universitas Indonesia - Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Correspondece mail:
Department of Physical Medicine and Rehabilitation, Faculty of Medicine Universitas Indonesia - Cipto Mangunkusumo Hospital. Jl. Diponegoro 71, Jakarta 10430, Indonesia. email: tirzaediva.tamin@gmail.com.

ABSTRAK

Tujuan: *merancang model dan efektivitas latihan endurans untuk peningkatan kebugaran pada penyandang disabilitas intelektual (DI) dengan obesitas.* ***Metode:*** *penelitian ini menggunakan desain true – experimental design. Penelitian dilakukan terhadap penyandang DI dengan obesitas berusia 10-30 tahun di seluruh SLB C dan C1 di wilayah DKI Jakarta dan dilakukan alokasi random menjadi 3 kelompok, yaitu kelompok A, B, dan C. Kemudian dirancang 3 tipe latihan endurans. Kelompok A melakukan latihan tipe I berupa latihan endurans otot tungkai bawah 20 RM dilanjutkan latihan endurans kardiorespirasi 24-25 menit, kelompok B melakukan latihan tipe II berupa latihan endurans otot tungkai bawah 10 RM, dilanjutkan latihan endurans kardiorespirasi 26-27 menit dan kelompok C melakukan latihan tipe III (kelompok kontrol) dengan melempar bola tenis pada jarak 10 meter selama 10 menit. Latihan endurans otot tungkai bawah dan endurans kardiorespirasi tersebut dilakukan dengan frekuensi 3 x dalam seminggu selama 4 bulan. Penilaian efektivitas latihan dilakukan dengan cara mengukur beban maksimal yang dapat diangkat dengan 10 RM dan uji jalan 6 menit bentuk empat persegi panjang serta dimasukkan ke dalam rumus prediksi* VO_2 *maks. Analisis dilakukan menggunakan uji Kruskal Wallis.* ***Hasil:*** *terdapat 212 subyek yang memenuhi kriteria penelitian dan dilakukan alokasi random menjadi 3 kelompok latihan, yaitu kelompok A (tipe 1), B (tipe 2), dan C (tipe 3). Model latihan endurans Tipe II terbukti memberikan respons yang lebih baik terhadap peningkatan tingkat endurans otot tungkai bawah dibandingkan Tipe I dan Tipe III pada penyandang DI dengan obesitas (p<0.05). Model latihan endurans Tipe I terbukti memberikan respons yang lebih baik terhadap peningkatan tingkat endurans kardiorespirasi dibandingkan Tipe II dan Tipe III pada penyandang DI dengan obesitas (p<0.05).* ***Kesimpulan:*** *latihan endurans otot tungkai bawah yang dilanjutkan dengan latihan endurans kardiorespirasi dapat digunakan untuk meningkatkan kebugaran pada penyandang DI dengan obesitas.*

Kata Kunci: *penyandang disabilitas intelektual, obesitas, latihan endurans otot tungkai bawah dan kardiorespirasi, tingkat endurans otot tungkai bawah, tingkat endurans kardiorespirasi.*

ABSTRACT

Aim: *to design a model and assess the effectiveness of endurance exercise to increase physical fitness in intelectual disability (ID) patients with obesity.* ***Methods:*** *a randomized-controlled clinical trial was performed*

in ID patients with obesity aged 10-30 years old from all Special School in DKI Jakarta, which were randomly allocated into 3 groups and then given 3 different type of exercises: lower extremity muscles endurance exercise for 20 RM followed by cardiorespiratory endurance exercise for 24-25 minutes (type I), lower extremity muscles endurance exercises for 10 RM followed by cardiorespiratory endurance exercises for 26-27 minutes (type II), and threw a tennis ball with 10 m distance for 10 minutes as control (type III). These program was performed 3 times a week for 4 months. Assesment of the exercise effectiveness was done by measuring maximum load that can be lifted and six-minutes walking test on rectangular track which was converted with the VO_2 max prediction formula. Analysis was perfomed with Kruskal Wallis test. ***Results:*** *two hundred and twelve (212) subjects were included in the study, randomly allocated into three types (I, II, and III) of exercises groups. The type II of endurance exercise model was proved to be more effective in increasing lower extremity muscles endurance level compared to type I and III for ID patients with obesity ($p<0.05$). Meanwhile, type I of endurance exercise model was proved to be more effective in increasing cardiorespiratory endurance level compared to type II and III for ID patients with obesity ($p<0.05$).* ***Conclusion:*** *lower extremity muscles endurance exercise followed by a cardiorespiratory endurance exercise can be used to increase physical fitness in ID patients with obesity.*

Key words: *intelectual disability patient, obesity, lower extremity muscles and cardiorespiratory endurance exercise, lower extremity muscles endurance level, cardiorespiratory endurance level.*

INTRODUCTION

Problems that can occur in intellectual disability (ID) subjects are obesity and endurance level which are expected to be low. Obesity in ID subjects may be caused by decrease in aerobic capacity and lack of physical activity. It occurs due to inactive lifestyles, poor work performance and quality of life including low basal metabolism rate (BMR). When BMR is low, ID subjects will release less energy for a day than those without low BMR, thus increasing the risk for obesity. The prevalence of ID patients with obesity is 16-29%.[1] Tamin TZ[2] found that the prevalence of ID patients with obesity at Special School type C and C1 in Jakarta is 16%.

It is estimated that lower extremity muscles and cardiorespiratory endurance levels on ID patients with obesity is low. Pitetti et al.[3] found that physical capacity on young adults with ID measured by 20 m running test was lower compared with non-ID. This can cause limitations to perform daily activities with excessive fatigue and decreasing the quality of life. Based on this, methods of exercise that increase the levels of lower extremity muscles endurance and cardiorespiratory endurance are needed, and the results are measured objectively.

Exercises to improve lower extremity muscles endurance and cardiorespiratory endurance levels follow the rules of low tension, high repetition which means low intensity and frequent repetition in large muscles. The intensity which affect lower extremity endurance is above 10 RM (Maximum Repetition).[4] We estimated that ID patient with obesity would be able to do 10 RM and 20 RM lower extremity endurance exercises with modification tools.

Patients with ID and obesity is expected to be able to do walking exercise.[5] Exercises to enhance cardiorespiratory endurance level is submaximal intensity, which means the heart rate is around 60-80% (200–Age).[4] We estimated that walking for 24-25 minutes and 26-27 minutes with submaximal intensity will be able and effective for ID patients with obesity. This study aims to design model and assess the effectiveness of endurance exercise to increase physical fitness in ID patients with obesity. Its purpose is to improve physical fitness, prevent disability and limitations to perform daily activities with excessive fatigue, including preventing impairment on social integration. Finally, the quality of life for ID patients with obesity may increase.[6-8]

METHODS

Study Subjects

This research is a part of Tamin's research to increase physical fitness on ID patients with obesity.[2] Study population was ID patients

aged 10-30 years old from all Special School type C and C1 in DKI Jakarta on 2008-2009, which was approved by Jakarta Education Bureau of Primary and Secondary Education (DIKMENTI). The subject's weight and height were measured to confirm obesity. Afterwards their intelectual level was measured with The Wechsler Test Intelligence Scale for Children (WISC) for group age 10-17 years old and The Wechsler Test Intelligence Scale for Children (WISC) for 18-30 years old.[9,10]

Subject's eligibility was based on inclusion and exclusion criterias. Inclusion criteria in this research is ID patients with obesity who is willing to participate in this research with signed informed consent by parents/guardians. Whereas, exclusion criteria were cardiovascular disease, neuromusculosceletal disease, vision and hearing impairment, an athlete, have activities with MET's >5, as well as having regular exercises within 3 times a week. Sample size was determined based on a single sample calculation for mean difference analytical study, minimum sample coupled with the possibility of dropouts was 174 subjects. There were 212 subjects who met the inclusion criteria to participate in this research. The research obtained ethical clearance from the Research Ethics Committee of the Faculty of Medicine of Universitas Indonesia Cipto Mangunkusumo Hospital, Jakarta.[2]

Study Design and Intervention

This research is a true-experimental design. We designed 3 types of endurance exercises, type I was a lower extremity muscles endurance exercise for 20 RM followed by a cardiorespiratory endurance exercise for 24-25 minutes, type II was a lower extremity muscles endurance exercise for 10 RM followed by a cardiorespiratory endurance exercise for 26-27 minutes, and type III (control group) threw a tennis ball with 10 m distance for 10 minutes. Futhermore, we performed random allocations stratified by age and sex. Subject were randomly allocated into group A (Type I), group B (type II), and group C (type III) as control.

Exercise was performed three times a week for 4 months and supervised by the researcher who was assisted by the health-team, the schools's principal, teacher, especially physical education teacher, and parents/guardians. Training procedure consists of 3 stages, that is preparation phase with measurement of vital sign and warming up, core training phase, and cooling down phase with re-measurement of vital sign. During exercise, subjects were given verbal encouragement by the coach.

Before starting the exercise program, we first determine the maximum load that can be lifted as much as 10 repetition maximum (RM) by subjects in group A, B, and C with low to high load gradation. Then, we measure cardiorespiratory endurance level with six-minutes walking test on rectangular track. The result were showed in distance (meters) and would be converted with VO_2 max prediction calculation formula.

Lower extremity muscles endurance exercise were performed by group A by lifting a load that have been measured previously as much as 20 RM. They did the exercise by lifting 50 % for 1st set, 75% for 2nd set, and 100 % for 3rd set of 20 RM load, workout set: 3, set rest : 1 minute. At the beginning of each month, the maximal load of 20 RM was determined again. Then, subjects did the same procedure as the previous exercise, using a 20 RM load specified at the beginning of that month. While, group B did the similar procedure with group A but using 10 RM load. Whereas, subjects in group C did not do lower extremity muscles endurance exercise. They were asked to throw a tennis ball at 10 meters for 10 minutes.

Then, subjects in group A did the cardiorespiratory endurance exercise by brisk walking using a rectangular, triangle, and circle track that changed every month with 24-25 minutes duration. The distance was firstly determined by brisk walking for 20 minutes. Every beginning of the 4th week, the distance was re-measured. Then, subjects use this distance to walk for the next 24-25 minutes. Subjects in group B did cardiorespiratory endurance exercise procedure similar with group A, but for 26-27 minutes. While, group C did not do cardiorespiratory endurance exercise. They were asked to throw a tennis ball at 10 meters for 10 minutes.

At the beginning of each month, effectiveness

of the exercise on group A, B, and C was evaluated through determining the lower extremity muscles and cardiorespiratory endurance level using the same measurement procedure as with the begining of the program which was lifting a load of 10 RM to measure a lower extremity endurance level and perform a six-minute walking test on rectangular track which was converted using VO_2 max prediction formula for measuring cardiorespiratory endurance level on ID patients with obesity.

During the study, we did not regulate their food intake, but advised them to take food constantly based on their food record. Parents / guardians must collect the 3 days estimated food record every week which represent 2 school days and one day off. Then we took the average from the data. Three days etimated food records data was processed into exchanger food ingredients with Nutri Survey computer program. We were aided by nutritionists in its implementation.

Statistical Analysis

Data were analyzed using SPSS 11 Windows program. Anova test was performed to analyze the effectiveness of exercises model type I (group A), type II (group B), and III (group C) with lower extremity muscles and cardiorespiratory endurance level.

Because the data was not normally distributed, we performed a logarithmic transformation and rooting function but the results was still not normally distributed. Therefore, analysis was continued with Kruskal Wallis test to indicates the differences value of lower extremity muscles and cardiorespiratory endurance level between group A,B, and C.

Futhermore, Mann Whitney test was performed to determine the difference between lower extremity muscles endurance level with cardiorespiratory endurance level and Wilcoxon paired test was conducted to analyze the effectiveness between each group which we did a comparison at the beginning and the end of lower extremity muscles and cardiorespiratory endurance exercises. Cut-off for significancy being used in this study was 5%.

RESULTS

Recruitment was done between January 2008 and February 2009. **Figure 1** shows a flow chart for participants in the study. Outcome measures were collected at baseline and every month for 4 months.

From the 212 subjects, entirely succeed to perform the exercise program that had been designed for their group. Subjects characteristics

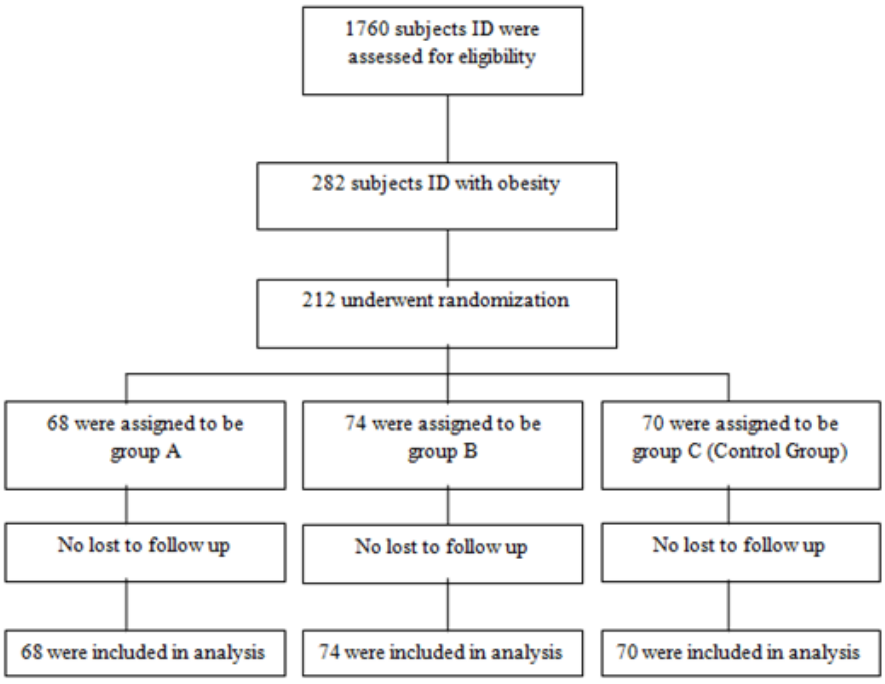

Figure 1. Participants Flow Diagram

are described based on age, gender, level of education, and Special School type. All data presented in the form of frequency. Regarding to age, group age 10-13 had the most subjects compared to others (29, 24, and 26 subjects). Based on gender and level of education, mostly were men and on Elementary Special School. Most subjects were in special school type C1. Subjects characteristics is shown in **Table 1**.

Equation Test of Initial Condition on Group A, Group B, and Group C

Kruskall Wallis test showed that there was no statistically significant results between mean age, body mass index (BMI), lower extremity muscles endurance level, and VO_2 max prediction of each group with p value >0.05 (0.61, 0.93, 0.81, and 0.62). Chi Square test for gender, level of physical activity, and intellectual level on each group also showed that the difference was not statistically significant with p value >0.05 (0.88, 0.32, and 0.64). Anova test between each group average daily dietary intake at baseline showed no significant difference with p value >0.05. The analysis is presented in **Table 2**.

Effectiveness of Endurance Exercise Based on Model for Lower Extremity Muscles Endurance Level

Equation test between lower extremity muscles endurance level for group A, B, and C was conducted with Kruskal Wallis test.

Table 1. Subjects characteristics

Characteristics	Group		
	A (n = 68)	B (n = 74)	C (n = 70)
Mean Age (years) (±SB)	15.96(±4.94)	16.63(±5.01)	15.97(±4.99)
Age (years)			
- 10–13 (young teens)	29 (42.65 %)	24 (32.42 %)	26 (37.14 %)
- 14–16 (middle teens)	11 (16.18 %)	19 (25.68 %)	18 (25.72 %)
- 17–20 (late teens)	15 (22.06 %)	12 (16.22 %)	15 (21.43 %)
- 21–30 (adults)	13 (19.12 %)	19 (25.68 %)	11 (15.71 %)
Gender			
- Men	44 (64.71 %)	50 (67.58 %)	44 (62.86 %)
- Women	24 (35.29 %)	24 (32.42 %)	26 (37.14 %)
Level of Education			
- Elementary Special School	31 (45.59 %)	35 (47.30 %)	32 (45.71 %)
- Junior High Special School	17 (25.00 %)	12 (16.22 %)	22 (31.43 %)
- High Special School	15 (22.06 %)	16 (21.62 %)	5 (7.14 %)
- ULK	5 (7.35 %)	11 (14.86 %)	11 (15.72 %)
Special School Type			
- Special School type C	34 (50.00 %)	35 (47.30 %)	32 (45.71 %)
- Special School type C1	34 (50.00 %)	39 (52.70 %)	38 (54.29 %)
Physical Activity (METs)			
- >2-3	0	3	1
- >3-4	3	6	3
- >4-5	65	65	66
Intelectual Level			
- Mild	21	18	15
- Moderate	18	24	23
- Severe	28	33	32
BMI	30.30(±5.26)	30.39(±4.59)	29.85(±3.92)
Lower Extremity			
Muscles Endurance (kg) (±SB)	1.20 (±0.24)	1.15 (±0.37)	1.18 (±0.44)
VO2 Max Prediction (mL/kgBB/ minutes)	32.72 (±5.14)	32.22 (±5.88)	32.81 (±5.51)

Statistically, the lower extremity muscles endurance level on group A, B, and C looks equivalent prior to treatment. Meanwhile, there were significant difference between those groups after endurance exercises program on the 2nd, 3rd, and 4th month.

Kruskal Wallis analysis was conducted to assess the difference value on lower extremity muscles endurance level for each group. The results showed that group B has an increasing lower extremity muscles endurance level every month compared to group A dan C. To see the improvement of lower extremity muscles endurance level, Mann-Whitney test was performed in which an increasing was seen in group B every month rather than group A and C.

By Mann-Whitney test, appeared a significant differences in the 2nd, 3rd, and 4th month between group A and B, group B and C, and group A and C. Lower extremity muscles endurance level on 1st to 4th month were not normally distributed. Futhermore, all the four data of lower extremity muscles endurance level was tested to see the relationship between those variables with Friedman test. The result is p value <0.05 which means that further analysis is necessary to see the difference for each group.

Wilcoxon test was used to compare the lower extremity muscles endurance level on the 1st with 2nd month, 2nd with 3rd month, 3rd with 4th month, and also 1st with 4th month. The results showed that all four have a significant difference between before and after the program.

Mean value of lower extremity muscles endurance level on 1st, 2nd, 3rd, and 4th month are shown at **Table 3**. Group B had greater average value of lower extremity muscles endurance level on 1st, 2nd, 3rd, and 4th month compared to group A and C.

Effectiveness of Endurance Exercise Based on Model for Cardiorespiratory Endurance Level (VO_2 Max Prediction)

Equation test between cardiorespiratory endurance level (VO_2 max prediction) for group A, B, and C was conducted with Kruskal Wallis test. Statistically, the cardiorespiratory endurance level on group A, B, and C looks equivalent prior to treatment. Meanwhile, there were significant difference between those groups after endurance exercise program on the 2nd, 3rd, and 4th months.

Table 2. Equation test for average daily dietary intake on each group

Composition	Group A (n=13)	Group B (n=17)	Group C (n=14)	p
Calories	1568.63 (±343.17)	2215.19 (±2214.17)	1725.84 (±434.93)	0.70
Protein	54.07 (±11.23)	57.90 (±23.69)	61.94 (±22.76)	0.47
Protein Percentage	14.05 (±1.58)	13.62 (±2.28)	14.19 (±2.40)	0.69
Fat	59.14 (±13.60)	66.82 (±27.60)	65.20 (±20.94)	0.67
Fat Percentage	43.85 (±15.32)	37.74 (±9.04)	45.60 (±10.29)	0.17
Carbohydrate	205.66 (±58.52)	216.45 (±60.01)	222.70 (±66.12)	0.83
Carbohydrate Percentage	52.71 (±6.80)	49.43 (±14.85)	52.24 (±9.39)	0.92

Table 3. Comparison between Mean Value of Lower Extremity Muscles Endurance Level on 1st, 2nd, 3rd, and 4th Month for Each Group

Group	Lower Extremity Endurance Level (kg) Mean (SD)			
	1st month	2nd month	3rd month	4th month
A (n=68)	1.20 (0.24)	1.49 (0.24)	1.85 (0.23)	2.22 (0.22)
B (n=74)	1.15 (0.37)	1.65 (0.37)	2.19 (0.37)	2.76 (0.38)
C (n=70)	1.18 (0.44)	1.28 (0.44)	1.44 (0.44)	1.58 (0.44)
	p = 0.81	p = 0.00	p = 0.00	p = 0.00

Mann-Whitney test was performed to see the difference between cardiorespiratory endurance level at the end of program. The increasing VO_2 max prediction value is greater on group A, followed by group B then C. The results showed that there were a significant difference on 1st, 2nd 3rd, and 4th month between group A with B and between group A and C, while group B and C did not have a significant difference on the 2nd month (p 0.32), but started to had significant difference (p 0.04) on the 3rd and 4th month. Prediction of VO_2 max in the 1st and 2nd month (p = 0.20 and p = 0.20) fulfilled a normal distribution data with Kolmogorov-Smirnov test, while on 3rd and 4th month were not. Because the data was not entirely normally distributed, Friedman test was performed to see the relationship between all four data of VO_2 max predicition value. It turned out that the p value = 0.00 meaning that the following analysis is needed to see whether there were significant differences for each group.

Wilcoxon test was used to compare the cardiorespiratory endurance level on the 1st with 2nd month, 2nd with 3rd month, 3rd with 4th month, and also 1st with 4th month. The results showed that all four had a significant difference between before and after the program which is shown in **Table 4**. Group A had greater mean value of cardiorespiratory endurance level on 1st, 2nd, 3rd, and 4th month compared to group B and C.

DISCUSSION

To design an exercise model, especially for ID patients with obesity, many factors must be considered. The guidelines include safety, selection, development, progression, and motivation.[7] The type, amount, and duration of exercise should be considered too. Exercise progress must be systematic and increased slowly. Because ID patients have a limited mental ability and low fitness level, we must give them a structured exercise program. This is why we distinguish exercise program from non-disability population which is the method or the way of exercise giving.[11]

Parameters for intensity of cardiorespiratory endurance exercise in this research used time parameter, which is 24-25 minutes for group A and 26-27 minutes for group B whereas the distance was performed for 20 minutes and determined at the beginning of 4th week. Furthermore, the duration was adjusted with the intensity of exercise. We used 20 minutes as a parameter because source of energy is still more dominant in aerobic (80% aerobic, 20% anaerobic).[12] In order to avoid fatigue, we designed a shorter time for cardiorespiratory endurance exercises on group A (24-25 minutes) rather that group B (26-27 minutes) so it took more energy to complete the exercise in a shorter time.[13]

The results of this study showed a higher increasing cardiorespiratory endurance (VO_2 max prediction) on group A compared to group B and C, especially in taking a certain distances which means using a higher intensity. Changes in aerobic capacity is as follow: 1. Increased myoglobin in the trained muscle group which works to help oxygen diffusion from cell membrane to mitochondria; 2. Increased skeletal muscle carbohydrate oxidation to breakdown glycogen into CO_2 and H_2O as well ATP production. This is caused by the increasing number and area of membran

Table 4. Comparison between Mean Value of VO_2 Max Prediction on 1st, 2nd, 3rd, and 4th Month for Each Group

Group	VO_2 Max Prediction (mL/kgBB/minute) Mean (SD)			
	1st month	2nd month	3rd month	4th month
A (n=68)	32.72 (5.14)	38.21 (6.11)	43.12 (7.38)	48.17 (9.65)
B (n=74)	32.22 (5.88)	35.27 (6.43)	38.28 (5.76)	41.73 (7.51)
C (n=70)	32.81 (5.51)	34.09 (5.62)	35.08 (5.37)	36.09 (5.35)
	p = 0.62	p = 0.00	p = 0.00	p = 0.00

surface of mitochondrial as well as increased of activity/level enzymes that participate in Krebs cycle and the electron transport system; 3. Increased of fat oxydation into CO_2 and H_2O with ATP production. This is due to the increase of intramuscular triglycerides deposits, free fatty acids from fat tissue, and the activity of the enzymes involved. Changes in the heart including enlargerment, decreasing of heart rate, increasing of stroke volume and VO_2 max, while the changes in lung include an increase on respiratory rate in a minute, lung volume, and diffusion capacity.[12,14] That is why group A had a noticeable improvement in cardiorespiratory endurance compared to group B and C. This study combined aerobic exercises with lower extremity muscles exercises. Lewis et al.[15] stated that the combination of progressive resistance exercise with aerobic exercise performed by Down synrome patient gives a great influence to cardiorespiratory endurance level, compared to without lower extremity muscles exercise.

To improve the exercise performance, we gave an exercise regimen that engaged a heavier workload than subject's capability at the time or above their threshold of sensitivity. If the exercise load is too light and not overload then it will not increase the performance.[13] Determination of maximum load as much as 10 RM was performed once a month.

Group B had a greater noticeable improvement of lower extremity muscles endurance level than group A and C. Group B was more dominant in a large weight training with less repetition, so it will increase the strength, power, and endurance which is caused by: 1. Anatomical changes by an increase in the myofibrils number and size, the total amount of contractile protein, especially myosin, capillary density and the quality of connective tissue, tendons, and ligaments; 2. Muscle biochemical changed which increasing of creatin, phosphate creatin, ATP and glycogen concentration; 3. Changes in the nervous system which is difficult to identify accurately, but another research revealed the existence of nervous system adaptation which involved motor unit synchronization.[16,17] Because of this process, group B showed a greater improvement on lower extremity muscles endurance level than group A and C.

Exercise started with lower extremity muscles endurance exercises continued by cardiorespiratory endurance exercises to avoid fatigue cause if the early exercise is too strenuous. Exercise started if heart rate less than 100 in a minute.[13]

There seems to be an interconnection in group A which was given lower extremity muscles endurance exercise continued by cardiorespiratory endurance exercise. Combination of these two exercises results an increasing level of cardiorespiratory endurance which was greater in group A than group B and C. Meanwhile, an increasing load was greater in group B than group A and C caused by maximum repetition of 10 times (10 RM).[13]

During the implementation, there were no barriers and limitation to do the exercise, either for lower extremity muscles or cardioresiratory endurance exercise. They looked excited and highly motivated to do the exercises for 4 months. In the 3rd and 4th month, we can still see an increasing of lower extremity muscles and cardiorespiratory endurance level. So, this program is recommended to be performed continuously for ID patients with obesity.

The influence of dietary intake to the increasing of lower extremity muscles and cardiorespiratory endurance level has not be explained yet. Estimated food record were not collected properly. Only 61 of the 212 subjects were collected. Which concluded that: 1. Estimated food record can not be applied to ID patients with obesity because it is difficult for parents/guardian to keep record of the subject's dietary intake, considering that the subjects are not cooperative; 2. In the implementation, subject's dietary intake were difficult to control so there was a frequent dispute between subjects and their parents/guardians; 3. The influence between dietary intake and the increasing of lower extremity muscles and cardiorespiratory endurance level can not be explained yet because the collecting process did not run smoothly.

The results of this study can be generalized to patients with ID and obesity, because the general characteristics of the subjects corresponds to the characteristics of ID students with obesity

in Special School type C and C1 in the entire Jakarta. Moreover, generalization is possible due to the sampling process in accordance with the study design, contained clear determinations to avoid selection bias, there was a standardization of data collection, used a standard formula to determine sample size, considering the potential confounding factor, and random allocation had been done to reduce research bias.

An endurance exercise model which is appropriate, capable, and sustainable is needed to be recommended for ID patients with obesity. In particular, it is suggested to all special school in DKI Jakarta, especially type C and C1 to use this model for their curriculum, specifically in the field of sport curriculum, because it's already proven by evidence. It is hoped that ID patients with obesity can perform daily activities without excessive fatigue, social interaction in order to express their ability, and increasing their courage and confidence. Finally, to improve their quality of life.

It is advisable to the Special Olympics Indonesia (SOINA) and Special Olympics International (SOI) to incorporate this lower extremity muscles and cardiorespiratory endurance exercise model into their physical fitness program of ID patients with obesity based on evidence. Finally, the research subjects are expected to get into SOINA's athletes association.

CONCLUSION

Type II of endurance exercise model was proven to be more effective in increasing lower extremity muscles endurance level compared to type I and III for ID patients with obesity.

Type I of endurance exercise model was proven to be more effective in increasing cardiorespiratory endurance level compared to type II and III for ID patients with obesity.

REFERENCES

1. McDough JR,Kusumi F, Bruce RA. Variation in maximal oxygen intake with physical activity in middle-aged man. Circulation. 1990;41(5):743-51.
2. Tamin TZ. Model dan efektivitas latihan endurans untuk peningkatan kebugaran penyandang disabilitas intelektual dengan obesitas [dissertation]. Jakarta: Universitas Indonesia; 2009.
3. Pitteti KH, Fernhall B. Comparing run performance of adolescent with mental retardation, with and without down syndrome. Adapt Physic Act Quart. 2004; 2i:219-28.
4. Heyward VH. Design for fitness a guide to physical fitness approach and exercise prescription. New York: MacMillan Publishing Co; 1984.
5. Temple VA, Stanis HI. Physical activity and persons with intelectual disability: some considerations for Latin America. Salud Publica deMexico. 2008;50 Suppl 2:185-93.
6. Torkin R. The X factors: obesity and metabolic syndrome. Science & The Public Affairs Forum. MRC Medical Research Council. June 2005.
7. Rimmer JH. Aging, mental retardation and physical fitness. Institute on Disability and Human Development. University of Illinois, Chicago.
8. International Classification of Impairments, Disabilities, and Handicaps. A manual of classification relating to the consequences of disease. Geneva: World Health Organization; 1990.
9. Soetjiningsih. Ranuh IGNG, editor. Tumbuh kembang anak. Jakarta: Penerbit Buku Kedokteran; 1998.
10. Cohen RJ. Psychological testing and assesment. An introduction to tests and measurement. 6th ed. Boston: McGraw-Hill; 2005.
11. Hosking G. Mental retardation. In: Hosking G, Powell R, eds. Chronic childhood disorders. London: British Library Cataloging; 1985. p. 108–13.
12. Fox EL, Mathews DK. The physiological basis of physical education and athletics. Philadelphia: Saunders College Publishing; 1991.
13. Harsono. Coaching dan aspek-aspek psikologis dalam coaching. Jakarta: CV Tambak Kusuma; 1998.
14. Pollock ML. Exercise prescription. In: Principles and practice of pulmonary for prevention and rehabilitation. 2nd ed. Philadelphia: WB Saunders Company; 1990. p. 375–80.
15. Lewis CL, Fragala-Pinkham MA. Effects of aerobic conditioning and strength training on a child with down syndrome: a case study. Pediatric Physic Ther. 2005;17:30-6.
16. Astrand PO, Rodahl K. Textbook of work physiology. 3rd ed. New York: McGraw- Hill; 1992.
17. Basmajian, JV, Wolf S. Therapeutic exercise. 5th ed. Baltimore: Williams & Wilkins; 1990.