



P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (RJI): 5.38
IJPESH 2024; 11(5): 145-151
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<https://www.kheljournal.com>
Received: 04-07-2024
Accepted: 11-08-2024

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The effect of squat, lunges, calf raise and core stability on taekwondo athlete balance, Kyorugi category

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DOI: <https://doi.org/10.22271/kheljournal.2024.v11.i5c.3502>

Abstract

This research aims to determine the effect of squats, lunges, calf raises, and core stability on the balance of Kyorugi Taekwondo athletes.

This research used a pre-experimental research method with a research design of "one group pre-test-post-test". The setting of this research was in Dojang Sawunggalih, Magelang. The research population was the taekwondo athletes in the Kyorugi category of Magelang Regency, with the total of 7 male athletes and 8 female athletes with the age range of 18-23 years old. The research sampling used the total sampling technique. The treatment was given by doing squats, lunges, calf raises, and core stability exercises for 16 meetings held 3 times a week. The research instrument was a modified bass with a validity of 0.46 and a reliability of 0.75. The data analysis technique used the multiple regression analysis and t-test with SPSS 23 for windows data processing software.

The results of the research show that the results of the samples that are given exercises with the squat, lunges, calf raise, and core stability methods have such increase as seen from the results of the t-test which has a value of $p = 0.001$ less than 0.05. The results of these values can be proven that the effect of squats, lunges, calf raises, and core stability on balance has meaning for the Kyorugi taekwondo athletes of Magelang Regency. Simultaneously, squats, lunges, calf raises, and core stability have an influence on balance with an R value of 0.597 or 59.7%.

Keywords: Balance, squat, lunges, calf raise, core stability

Introduction

Taekwondo is a self-defense art that predominantly uses kicking techniques ^[1]. In its competition, taekwondo has several categories that are competed in, namely, kyorugi and poomsae. The kyorugi category is a match between two athletes who attack and defend each other using techniques that are allowed to gain points to win the match. The poomsae category is a match category that displays a series of punching, kicking, blocking and stance techniques used to attack and defend against an imagined enemy ^[2].

Taekwondo sports in its matches have rules that have a direct impact on the athletes competing. One of the rules that must not be violated is Gunjoem (violation). This has a direct impact on points in the match. If an athlete gets too many Gunjoem, it can result in defeat for the athlete because each match is only allowed 10 violations. Violations in matches that often occur are falls. Given the techniques in taekwondo are very attractive, an athlete often falls when kicking. In order not to fall, an athlete is required to have better balance ^[3].

Taekwondo sport kyorugi category, taekwondo in must have a combination of speed, balance, and agility biomotor. Improving an athlete's balance will have a good impact to support achievement ^[4]. Good balance will have an impact on the biomotor components and also provide effectiveness to the kicking technique so that athletes do not fall easily in the match. Given that the kicking technique of taekwondo requires maintaining balance with one leg support, an athlete is required to have the strength to maintain stronger support. In addition, athletes will be more prepared and strong in carrying out attacks and defenses. Training the strength of the leg muscles is very necessary to maintain the athlete's balance in performing kicking techniques ^[5]. The strength training model is one of the training models used to support balance. By having good strength, an athlete will have good balance ^[6]. Strong muscles can maintain and preserve body mass to remain at the equilibrium point.

Core stability will activate core muscles as a stabilization component in the extremity movement pattern that functions in postural stabilization to create postural control [7]. So it is very good to combine them to improve functional ankle instability because the mechanisms are synergistic and help to improve the functional components of ankle instability as well as improve dynamic balance [8].

Strengthening exercises that affect the addition of leg power are squats, lunges and calf raises. Basically, physical condition training is a process of progressive development. The squat and lunges training models are training models whose training objectives have similarities to strengthen the leg muscles. Calf raise training is one of the gastrocnemius muscle strengthening exercises where in this movement there is a simultaneous movement of both legs. The benefits of calf raises are to train muscle strength and increase muscle endurance. This exercise can maximize muscle strength and affect increased muscle tone [9].

Core stability training is essential to maintain balance. These core muscles provide all the power and mobility of the human body. In the case of Taekwondo players, strengthening these core muscles will improve the movement and stability of the spine, and greatly help improve athletic performance. Fitness factors such as the ability to rotate quickly, speed, agility, and balance are required in Taekwondo because attacks and defensive maneuvers are performed in response to the opponent's movements, and at least 90% of attacks are performed with foot techniques [10].

Weight training is one method used to train strength. Leg strength training that is often used to improve balance is; squats, lunges calf raises and core stability.

Materials and methods

Methods

In this study, the researcher used the pre-experimental research method "one group pre-test-post-test". This method is a research method that uses one group of respondents without using a control group which is carried out in three stages.

Study Location

The location of the research was Dojang Sawunggalih, RT.05/RW.05, Jurangombo Village, South Magelang, Magelang City.

Subject

The population of this study was taekwondo athletes in the kyorugi category who had 15 children consisting of 7 male athletes and 8 female athletes. The age range of taekwondo athletes in Magelang Regency was between 18 and 23 years. The sampling technique used in this study was total sampling.

Instrumen

This study will conduct a 1RM test to determine the maximum strength to be used as a reference for making a training program that will be made for each research subject. Each subject will have a different training load depending on the 1RM taken. In addition, 1RM will be used as a reference in determining the contribution value to each variable. The training program has been validated by 2 experts. The instrument used is a modified bass test. This method was chosen because the characteristics of the kyorugi match are very dynamic and often change. Seeing this, the researcher chose a test that was in accordance with the conditions of the dynamic taekwondo match.

Treatment

In this study, squats, lunges, calf raises and core stability are strength training exercises aimed at increasing core and leg muscle strength. Core stability training consists of 4 forms of exercise given, namely: front plank, side plank, reverse plank and raise leg hold. The training will be given for 16 meetings conducted 3 times a week.

Statistical Analysis

Conducted by means of multiple regression analysis test. Before conducting regression analysis test and t test, the data is first processed to meet the requirements of the assumption test. From the results of the analysis test, it will be known whether the hypothesis of this study can be accepted or not. Data processing in this study was carried out using statistical data processing software (SPSS v.23 for windows). After obtaining data from SPSS processing, the regression of each variable will be calculated to calculate the amount of its contribution

Results & Discussion

Results

In this study, athletes will be given squat, lunges, calf raise and core stability training treatments. The subjects in this study were taken from taekwondo athletes in the kyorugi category in Magelang Regency. Subjects were selected using the total sampling method where the number of samples was the same as the population. Subjects have been informed that they are willing to follow the treatment that will be given in this study. The following is the data that has been taken in the study:

Gender

The following is a pie chart according to the gender of the research subjects.

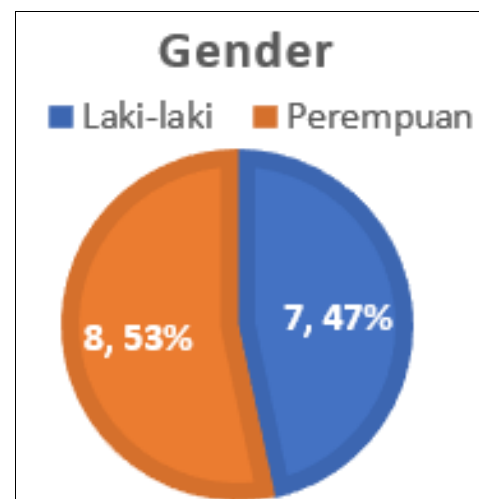


Fig 1: Gender

Based on the image above, the total subjects in Magelang district are 15 people. From the total subjects, it can be seen that the number of male subjects in the study is 7 people or 47% of the total number. The female subjects in this study have a total of 8 people or 53% of the total number of subjects.

Age

The following is a description of the characteristics of the subjects based on the age of the subjects using a graphic diagram.

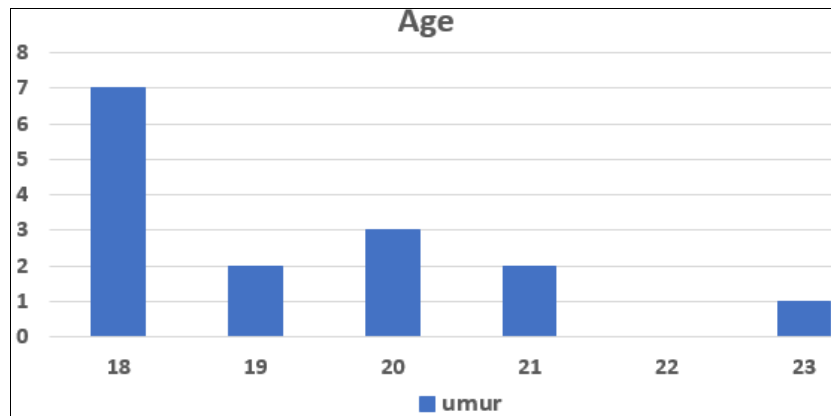


Fig 2: Age

Based on the diagram above, it can be seen that the subjects in this study have an age range from 18 years to 23 years. The number of research subjects who are 18 years old is 7 people, subjects aged 19 years in the study are 2 people, 20 years old

are 3 people, 21 years old are 2 people, and 23 years old are only 1 person.

Maximum Repetition

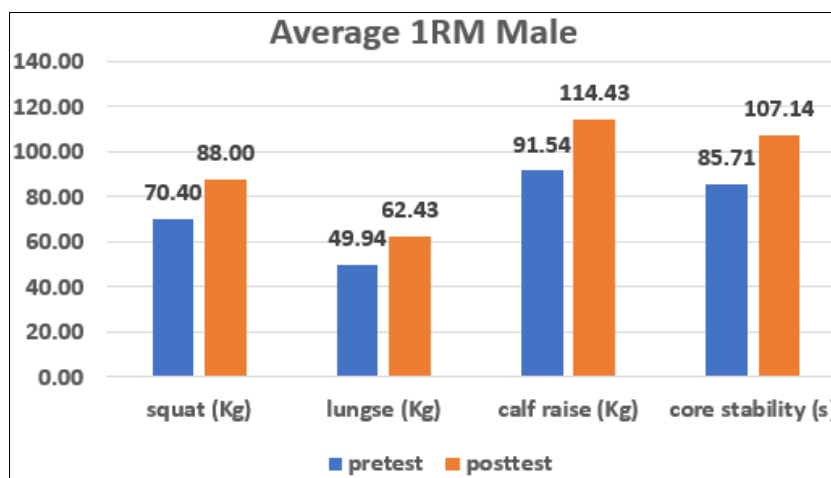


Fig 3: Average 1RM Male

Based on the average maximum strength image above, it can be seen that male subjects have an average maximum strength value of the squat movement technique weighing 70.40 kilograms at the beginning of the exercise and 88.00 kilograms at the end of the exercise. Squat exercises in this study increased by 17.60 kilograms. Lunges technique, the average value of the maximum repetition measurement at the beginning of the exercise was 49.94 kilograms and at the end of the exercise was 62.43 kilograms. In lunges exercises there

was an increase of 12.49 kilograms. Calf raise exercises, have an average maximum strength at the beginning of the exercise weighing 91.54 kilograms and at the end of the exercise was 114.43 kilograms. Calf raise exercises have an increase of 22.89 kilograms. At the beginning of the exercise the average core stability time was 85.71 seconds and at the end of the exercise the average time was 107.14 seconds. Core stability has an increase of 21.43 seconds in the next measurement.

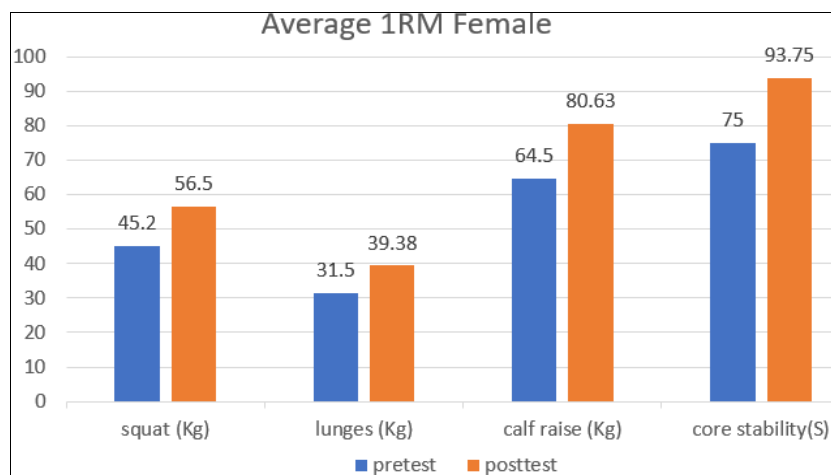


Fig 4: Average 1RM Female

For women, seen from the graph, the average value of squats is 45.2 kilograms at the beginning of the test and the average value after the test is 56.5 kilograms. Squat training in women has an increase of 11.3 kilograms. The average value of women's maximum lunges strength at the beginning of the test is 31.5 kilograms and the average after the test in women is 39.38. Lunges training in women has an increase of 7.88 kilograms. Calf raise training at the beginning of the test, the average value of the maximum repetition strength in women is 64.5 kilograms and at the end of the test has an average value of 80.63 kilograms. In calf raise training, there is an increase of 16.5 kilograms. The results of women's core stability, the beginning of the exercise has an average time of 75 seconds and at the end of the exercise has an average time of 93.75 seconds. The average increase in time in core stability is 18.75 seconds.

Percentage of Balance of Research Subjects

The description of the percentage of balance of male subjects will be presented in the following table

Table 1: Percentage of Balance of Male

No	Dynamic balance	Criteria	Pre-test		Post-test	
			Amount	Percentage	Amount	Percentage
1	14-31	Less	2	28,57%	0	0%
2	32-49	Moderate	3	42,85%	3	42,85%
3	50-68	Good	2	28,57%	4	57,14%

Based on the table above, the results of the pre-test of the dynamic balance of male subjects in this study indicate that the subjects with poor criteria have a number of subjects 2 people with a percentage of 28.57% of the total number, the subjects with moderate criteria have a number of subjects 3 people with a percentage of 42.85% of the total number, and the subjects with good criteria there are only 2 subjects with a percentage of 28.57% of the total number. The post-test data shows a very visible change in data, namely: there are no

subjects with poor criteria results or a percentage of 0% of the total number of subjects, the subjects with moderate criteria have a number of subjects 3 people with a percentage of 42.85% of the total number, and the subjects with good criteria have a number of subjects 4 people with a percentage of 57.14% of the total number.

The description of the percentage of balance of male subjects will be presented in the following table:

Table 2: Percentage of Balance of Female

No	Dynamic balance	Criteria	Pre-test		Post-test	
			Amount	Percentage	Amount	Percentage
1	14-31	Less	2	25%	0	0%
2	32-49	Moderate	4	50%	5	62,5%
3	50-68	Good	2	25%	3	35,5%

Based on the table above, the results of the pre-test of the dynamic balance of female subjects in this study indicate that the subjects with poor criteria have a number of 2 people or can be presented as 25% of the total number, the subjects with moderate criteria have a number of 5 people with a presentation of 50% of the total number, and the subjects with good criteria have a number of subjects 2 people with a percentage of 25% of the total number. The post-test data shows a very visible change in data, namely: there are no subjects who have poor criteria results or a percentage of 0% of the total number of subjects, the subjects with moderate criteria have a number of subjects 5 people with a percentage of 62.5% of the total number, and the subjects with good criteria have a number of subjects 3 people with a percentage of 37.5% of the total number.

Average Balance

The following are the results of the average dynamic balance data for male and female subjects presented in the form of a bar chart:

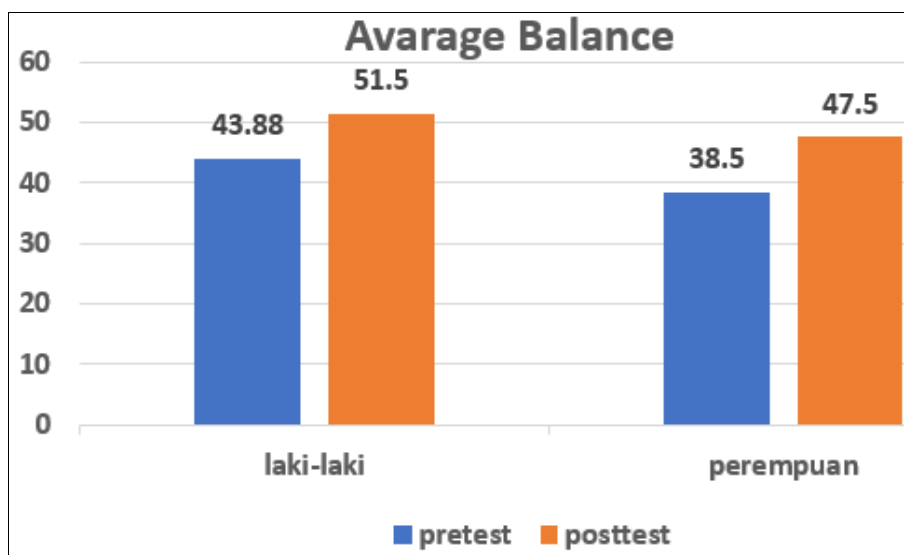


Fig 5: Avarange balance

Based on the measurement of the average results of the pre-test dynamic balance conducted in this study, male subjects had an average value of 43.88 points and the post-test average balance value was 51.5 points. The average results of the pre-test and post-test male balance had an increase in score of 7.62 points. In the average results of the pre-test dynamic balance of female subjects, the average value was 38.5 points

and the average post-test balance result was 47.5 points. The results of the average pre-test and post-test female balance had an increase in score of 9 points.

Equations

From these data, each variable can calculate the effective subsidy value as follows:

Squat

$$EC(x_1) = Beta(x_1) \times r(yx_1) \times 100\%$$

$$EC(x_1) = 0,127 \times 0,731 \times 100\%$$

$$EC(x_1) = 9,28\%$$

Lunges

$$EC(x_2) = Beta(x_1) \times r(yx_1) \times 100\%$$

$$EC(x_2) = 0,141 \times 0,709 \times 100\%$$

$$EC(x_2) = 10\%$$

Calf Raise

$$EC(x_3) = Beta(x_1) \times r(yx_1) \times 100\%$$

$$EC(x_3) = 0,220 \times 0,709 \times 100\%$$

$$EC(x_3) = 15,6\%$$

Core Stability

$$EC(x_4) = Beta(x_1) \times r(yx_1) \times 100\%$$

$$EC(x_4) = 0,352 \times 0,706 \times 100\%$$

$$EC(x_4) = 24,85\%$$

EC Total

$$EC \text{ Total} = SE(x_1) + SE(x_2) + SE(x_3) + SE(x_4)$$

$$EC \text{ Total} = 9,28\% + 10\% + 15,6\% + 24,85\%$$

$$EC \text{ Total} = 59,73\%$$

Based on the calculation with the formula above, the effective contribution of each variable to the balance will be obtained. The effective contribution of squats has a value of 9.28%. The effective contribution of lunges has a value of 10%. The effective contribution of calf raises has a value of 15.60% and core stability has an effective contribution value of 24.85%. The total effective contribution value of all these variables is 59.73% or equal to R square 0.597.

Relative contribution is used to find out the contribution of a dependent variable relatively from the independent variables totaling 100%. The relative contribution of each dependent variable is known if the effective contribution data of each variable that has been calculated previously and divided by

the R_square value that has been obtained in table 2. The following is the relative contribution data of each dependent variable obtained using the formula:

Squat

$$RC(x_1)\% = \frac{\text{effective contribution (x)\%}}{R_{\text{square}}}$$

$$RC(x_1)\% = \frac{9,28\%}{59,73\%}$$

$$RC(x_1)\% = 15.54$$

Lunges

$$RC(x_2)\% = \frac{\text{effective contribution (x)\%}}{R_{\text{square}}}$$

$$RC(x_2)\% = \frac{10\%}{59,73\%}$$

$$RC(x_2)\% = 16.74$$

Calf Raise

$$RC(x_3)\% = \frac{\text{effective contribution (x)\%}}{R_{\text{square}}}$$

$$RC(x_3)\% = \frac{15,54\%}{59,73\%}$$

$$RC(x_3)\% = 26.11$$

Core Stability

$$RC(x_4)\% = \frac{\text{effective contribution (x)\%}}{R_{\text{square}}}$$

$$RC(x_4)\% = \frac{24,85\%}{59,73\%}$$

$$RC(x_4)\% = 41.61$$

Total Relative Contribution

$$RC \text{ Total} = SR(x_1) + SR(x_2) + SR(x_3) + SR(x_4)$$

$$RC \text{ Total} = 15.54\% + 16.74\% + 26.11\% + 41.61\%$$

$$RC \text{ Total} = 100\%$$

Based on the calculation with the formula above, the relative contribution of each variable to the balance will be obtained. The relative contribution of squats has a value of 15.54%. The relative contribution of lunges has a value of 16.74%. The relative contribution of calf raises has a value of 26.11% and core stability has a relative contribution value of 41.61%. The total effective contribution value of all these variables is 100%.

Discussion

Based on the research results obtained in this study, squats, lunges, calf raises and core stability have an effect on the balance of taekwondo athletes in the kyorugi category. The training will be given for 16 meetings carried out 3 times a week. In the first 4 sessions, the form of squat, lunges and calf raise exercises will be given an adaptation without using weights. After 4 training sessions, 1RM measurements will be carried out on each tool as a reference in making a training program for each subject. After the measurement, the subject is given a load of 40% of the 1RM which is done for 12 repetitions which are repeated for 3 sets. Every 3 training sessions, the load will be increased by 5%.

Dynamic balance is a condition where an athlete can move in a controlled manner and can maintain body balance in any situation^[11]. Balance is one of the important components that must be mastered, where an athlete must be able to maintain body balance in various conditions to stay balanced. One of the factors that affects balance is muscle strength^[12]. Balance control is most influenced by the strength of the pelvic muscles. Balance is controlled by the pelvic muscles, while when there is a disturbance, balance is controlled by the response of the ankle muscles. Therefore, by providing exercises that improve the pelvic and leg muscles, it can improve the dynamic balance of athletes^[13].

This study proves that squats, lunges, calf raises and core stability exercises can improve athletes' dynamic balance. These exercises are exercises that must be done because they can increase leg muscle strength to improve athletes' dynamic balance^[14]. Core muscle strength can improve dynamic balance because the core muscles are connecting muscles between the upper and lower extremities to maintain balance^[15].

Athletes who have good dynamic balance can help athletes achieve achievements. Balance is a component that must be maximized by athletes, especially taekwondo athletes, because it maintains body position so as not to fall when kicking or to move to attack and avoid opponent kicks. Good balance can provide strong self-confidence, awareness of movement, can prevent injury, make it easier to train techniques, and train agility of movement.

Conclusion

The results of this study imply that squat, lunge, calf raise and core stability exercises can be used to improve the balance of taekwondo athletes, especially in the kyorugi category. In taekwondo, improving dynamic balance is very influential on athletes in achieving peak performance. In addition, squat, lunge, calf raise and core stability exercises can be divided into exercises to maintain or prevent injuries in trained athletes.

Acknowledgments


I know this article is far from perfect, but I hope it can be useful and I would like to express my deepest gratitude to all parties who have helped in writing this article. Hopefully my

article can be an additional reference for readers.

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Appendix
Research Permit Letter



TAEKWONDO INDONESIA

PENGURUS CABANG KABUPATEN MAGELANG

Sekretariat : JL.BELITUNG NO 04 RT.01 RW.19 PANCA ARGAS 3
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gmail : pengkabtkdmgl@gmail.com Telp: 082225994922

Magelang, 6 Agustus 2022

Nomor : 207/VIII/TI.KABMGL/2022
Lampiran : -
Perihal : Perizinan Melakukan Penelitian

Kepada Yth.

Anom Dwi Kuncoro
Program Studi Pendidikan Keperawatan Olahraga
Universitas Negeri Yogyakarta


Di Tempat

Dengan Hormat,

Sehubungan dengan Surat Permohonan Perizinan Penelitian terhadap atlet Taekwondo Kabupaten Magelang Nomor : 756/UN34.16/PT.01.04/2022 tanggal 3 Agustus 2022, Pengurus Cabang Taekwondo Indonesia Kabupaten Magelang mengizinkan yang bersangkutan untuk melakukan penelitian sebagaimana yang telah ditunjukkan pada :

Tanggal : 6 Agustus – 30 September 2022
Judul Tugas Akhir : PENGARUH SQUAT, LUNGES, CALF RAISE DAN CORE STABILITY TERHADAP KESEIMBANGAN ATLET TAEKWONDO KATEGORI KYORUGI

Demikian surat pemberitahuan ini kami sampaikan atas perhatian dan kerjasamanya kami ucapkan terimakasih.

Pengcab T.I Kab Magelang
Ketua

Feni Budiyanto
DAN IV KUKKIWON

