June 2014 | **Volume 2 | Issue 4**

MAJLIS SUKAN NEGARA MALAYSIA

COACHING JOURNAL

AKADEMI KEJURULATIHAN KEBANGSAAN

2014

KE ARAH KECEMERLANGAN SUKAN
Towards Excellence in Sports

ISSN 2180-3773

NATIONAL COACHING ACADEMY2014 SPORTS SCIENCE COURSES CALENDAR

Organised by
NATIONAL SPORTS COUNCIL OF MALAYSIA

KE ARAH KECEMERLANGAN SUKAN
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NOTES:

* For more information, please visit the National Sports Council Website: www.nsc.gov.my
  ---> Search: Coaching Academy
  * For participants who wish to pursue a course please refer to procedure and complete the application form and submit it to the organizer of your choices listed below.

FRONT COVER PICTURES-
Malaysian Winning Wushu and Karate Team
- 2013 Sea Games

2013 Sea Games Muaythai 75kg gold medalist Mohd Faizal Ramli with Chief coach Bernard Radin (right) and coach Md.Hamdan Mokhtar(left)

2014 Sultan Azlan Shah Cup Runners Up . Coach Paul Revinghton and Dharma Raj.

MAJLIS SUKAN NEGARA MALAYSIA

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MESSAGE FROM EDITORIAL ADVISOR

National Coaching Academy Journal is the professional journal for coaches. The two issues annually includes regular insights into professional latest coaching practice issues as well it has open to highlight sports health care techniques, shares experiential knowledge, and provides practical application of current research. The papers presented in this issue provide rich insights into a range of key issues that inform current theory and practice in the field of sports.

Although we have entered a new sports millennium, the single greatest concern of athletes and coaches in sports has not changed. In fact new awareness that the right kind of training can produce dramatic changes has increased emphasis on the improvement and application of Sports Science in sports. The editorial staff encourages submission of articles of professional to those working in the sports training arena.

Coaches increasingly recognize the importance of sports science and their role in helping athletes learn how to master the game. This journal helps, to coaches, who want to develop a more in-depth understanding of sports science to enhance their coaching success.

Once again I would like to take this opportunity to thanks each and every individual who had worked hand in hand with me to produce this Volume 2 Issue 4 Coaching Journal. I trust that this double edition of the journal sustains the coaches throughout the year and supports the coaches to deepen their knowledge and refine their approaches to coaching in our learning area for the coming year

I am deeply indebted to all those who had been helping me since day one of establishing the Academy. I wish to take this opportunity to convey my deepest thanks and gratitude to Dato'Seri Zolkples Embong our Director General National Sports Council of Malaysia for allotting me this space to deliver my message.

EN. AHMAD ZAWAWI ZAKARIA
Editorial Advisor
COACHING JOURNAL
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COACHING JOURNAL is published twice a year by the NATIONAL SPORTS COUNCIL OF MALAYSIA. Contributors are welcome to submit related articles at any time throughout the year. Article should be submitted via email to **lboonhooi62@gmail.com** | **hockey-vive@yahoo.com** and be submitted in English. Each article will be reviewed and edited if necessary and authors will be notified of acceptance within 6 to 8 weeks from the date of submission.

Article

CONTRIBUTION FOR COACHING JOURNAL AKADEMI KEJURULATIHAN KEBANGSAAN

We have endeavoured to make the Coaching Journal a much better read. To a certain extent we have succeded in streamlining the content, but overall are still far from satisfied. As part of our efforts to further improve the Journal, we are continuously accepting article contributions from interested parties.We invite submissions from sports associations, academicians, sports adminitrators as well as coaches on topics ranging from academic to on field applied areas of interest. It can be an original research, technical commentary, knowledge base update or even association report; as long as it is related to coaching matters – it will be considered. Below are some guidelines to submitting an article:

OBJECTIVE OF THE JOURNAL

To keep the coaches abreast of the latest developments in coaching related areas of interests.

TARGET AUDIENCE

Coaches - the Journal will be distributed to coaches (grassroots right up to elite level). The other possible readers would be the athletes.

CONTENT

All articles submitted must be in English. It should be straight forward and easy to understand. The methods and statistic section need not be too detailed. It is alright to use previous published work with the relevant permissions acquired. More importantly, instead of a general conclusion please add a section "Practical Application for Coaches". In this section, explain how coaches can utilize the content of your article in their everyday work. We also recommend that you highlight important lines/paragraphs in your article. As with any printed work, please cite the relevant sources should the article include any external content/picture/table/figures.

FORMAT

- Arial, 11 pts, single spacing
- Justified alignment, margins 2.54cm all around (letter)
- Title is Bold, include the affiliations under it.
- Reference Citation in text is (numbered) - Notes style, Vancouver
- Include a picture of the first author and his profile (Academic Qualification and present Occupation)

The Journal is a registered periodical with a designated ISSN number. This makes it easier to catalogue and cite. Consequently, we also send copies of the Journal to all the relevant libraries.

For further information and article submission, please email to lboonhooi62@gmail.com and hockey_vive@yahoo.com

DR. LIM BOON HOOI
Editor in Chief
The Official Journal of the Akademi Kejurulatihan Kebangsaan Majlis Sukan Negara Malaysia

THE EFFECT OF 4-WEEK LEG EXTENSION TRAINING ON THE STRENGTH OF QUADRICEPS MUSCLES

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TEO ENG WAH[4]

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INTRODUCTION

Weight training refers to any type of training that involves the body moving in same direction against a force that resists that movement and is supplied by some type of weight including free weights and weight machines [8]. Weight training using near one-repetition (1RM) weight at low velocity has been found to improve the muscle's ability to generate force, but the increase in strength may not be effective at velocities that stimulate the speed of sport performance [3].

Muscular strength is much different from muscular endurance. Strength is a measure of how much force your muscles can exert, while endurance is the measure of how many times your muscles can repeat a specific exertion of force. Unlike muscular endurance which is controlled by slow twitch fibers, strength is determined by fast twitch fibers which focus more on quick bursts of energy rather than long, drawn out ones.

Leg extension is a resistance weight training exercise that targets solely the quadriceps muscles, rectus femoris, vastus lateralis, vastus medialis and vastus intermedius. Leg extensions are considered a vital exercise to increase the quadriceps muscles strength. Quadriceps muscles are very important to maintain balance and leg strength. Acting as an insertion of patella, the quadriceps muscles need to be strengthening in order to make a correct move in sports which requires greater involvement of lower body.

Leg extension exercise requires the use of a machine called Leg Extension Machine. There are various manufacturers of these machines and each one is slightly different. The movement of leg extension exercise begins with choosing the appropriate weight and sit on the machine with legs under the pad (feet pointed forward) and the hands holding the side bars. The legs form a 90-degree angle between the lower and upper leg. The movement involves extension of leg to the maximum when exhale and hold the contracted position for a second. Meanwhile, the rest of the body remains stationary on the seat. Slowly lower the weight back to the normal position as inhale, ensure that do not go past the 90-degree angle limit.

Based on the principle of overload, heavier weights with fewer repetitions and longer rest are best suggested way to improve strength. The most widely used method is lifting a weight that is 70% of 1RM for 10-12 times of repetitions with 1-5 minute breaks in between sets. Strength training for a specific muscle is not advisable to perform for more than once every 48 hours. The duration of this study is 4 weeks because the total time given to conduct this research is too short and one of the purpose of this study is to get an instant result which can help in designing the training program for athletes as well as to improve the quadriceps strength in better way in a short period of time.

OBJECTIVES

Method

Experimental method was applied in this research. A weight training program was designed to the experimental group (n = 15 subjects). The weight training program was conducted in a period of 4 weeks, two sessions per week, with a total of 8 sessions of weight training.

Subjects

The subjects of this research were chosen from the students of University of Malaya. A total of 30 students (N = 30) were chosen to become the subjects of this research. These subjects were divided into two groups, the experimental group (n = 15) and the control group (n = 15) which respectively with a total of 15 subjects (8 females & 7 males) in the experimental group and 15 subjects (8 females & 7 males) in the control group. The subjects ages between 20 and 21 years (mean age, 20.53 y) were recruited for the study. Subjects were fully informed of the requirements of their participation and of the potential benefits.

Measurements

In order to assess the strength of quadriceps muscles, the Leg Extension Machine was used as the instrument of this research. The leg extension, typically performed on a leg-extension machine, is a relatively simple exercise. The movement occurs at only one joint and is a basic, limited motion. Leg extension is a measure of the strength of quadriceps muscles because this exercise particularly target a specific muscle; quadriceps. Weight machines are considered a safe, effective and easy-to-learn alternative to free weights [1].

This test was conducted twice which were pre-test and post-test to compare the strength of quadriceps muscles of the experimental group before the leg extension training and after implementation of the leg extension training and also the strength of quadriceps muscles of the control group.

The movement of leg extension exercise begins with choosing the appropriate weight and sit on the machine with legs under the pad (feet pointed forward) and the hands holding the side bars. The legs form a 90-degree angle between the lower and upper leg. The movement involves extension of leg to the maximum when exhale and hold the contracted position for a second. Meanwhile, the rest of the body remains stationary on the seat. Slowly lower the weight back to the normal position as inhale, ensure that do not go past the 90-degree angle limit.

Before undergo the test, the subjects were required to carry out a gentle warm up and light stretching exercises focusing on the lower limbs for at least 5 minutes. According to Prentice [5], the warm up routine increase body core temperature, stretches ligaments and muscles and increase flexibility. Warm up routine has been found to be important in reducing injury and muscle soreness [5].

After warm up section, the subject sits on the Leg Extension Machine. The seat was adjusted to the height of subject. Then, the subjects are required

to perform with a weight to identify their 1 repetition maximum (1RM). These tests were repeated for both experimental group (G1) and control group (G2). The results were recorded in subject's personal information sheet for data collection. The heaviest weight achieved was considered the pre-training 1RM. The 1RM was determined in fewer than five attempts with a rest interval of 3 minutes between 1RM attempts and 30 min were allowed before the start of the leg extension training for the experimental group. Following the 4 weeks of training, the 1RM was test was performed similarly to the pre-training test in order to compare the strength changes between the G1 and G2.

After the test, the subjects were required to carry out a cool down period included stretching activities as was done during the warm up routine. The cool down period prevents of blood in the arms and legs, thus maintaining blood pressure and enabling the body to cool down and return to a resting state [5]. According to Prentice [5], experience and observation indicate that people who stretch during cool down period tend to have fewer problems with muscle soreness after strenuous activity.

Procedure

The 30 subjects were informed and explained that a research entitled "The Effect Of 4-Weeks Leg Extension Training On The Strength Of Quadriceps Muscles" was conducted. They were fully informed of identified procedures prior to enrolment in the study. The subjects were equally divided into two groups using a random sampling with a draw session. All subjects had picked up a number from a box which contained no.1 or 2 where no.1 is experimental group and no.2 is control group.

Additionally, they were informed of the potential benefits and risks and signed an informed consent form. Subjects were assured that their data were going to be kept confidential. They were instructed that their participation in the study were voluntary. Both experimental group and close group of this research were instructed to do a pre-test by using Leg Extension Machine to identify their 1RM of quadriceps muscles before the experimental group started the 8 sessions of leg extension training intervention. The leg extension training intervention was only given to the experimental group of this research, whereas the control group of this research was instructed to continue their normal physical activity practices throughout the experiment.

The leg extension training started after 30 minutes break of pre-test and consistently training was given to the experimental group throughout the training intervention. Before the implementation of the designed training, the training procedures were explained to the subjects of the experimental group and the examiner determined whether the subjects were eligible to participate in the study. After the briefing session, the baseline of the training intensity was started with 50% of 1RM, which was the initial target load.

Frequency of the training program was two sessions per week with at least 48 hour rest between sessions. The experimental group were given 8 sessions of training during the 4 weeks of training period, each session

consisted of 12 repetitions of leg extension exercise, follow by 2 minutes rest between sets then end the training session after the subjects had finished 3 sets in a day. After 4 sessions, at the third week of training, principle of overload is applied where the intensities will increase to 70% (70% of initial 1RM recorded). During the training sessions, participants were verbally encouraged to perform all sets to concentric failure and the same definitions of a complete range of motion used during the 1RM testing were used to define completion of a successful repetition.

Weeks	Sessions	Intensity (% of 1RM)	Repetitions	Sets	Rest between Sets (min)	Speed of Execution
1	1	50	12	3	2	Medium
	2	50	12	3	2	Medium
2	3	50	12	3	2	Medium
	4	50	12	3	2	Medium
3	5	70	12	3	2	Medium
	6	70	12	3	2	Medium
4	7	70	12	3	2	Medium
	8	70	12	3	2	Medium

After completion of the 8 sessions of leg extension training, both subjects from experimental group (n = 15) and the control group (n = 15) were asked to perform post-test using the same Leg Extension Machine to measure their 1RM of quadriceps muscles. The results of the pre-test and post-test were recorded in the Subject's Information Sheet, therefore the effect of 4-weeks leg extension training on the strength of quadriceps muscles test in undergraduates of University of Malaya were analysed.

Statistical Analysis

The Statistical Packages for Social Sciences SPSS was used for statistical analysis. All the data collected from this research were analysed by using this statistical software. Descriptive statistics were calculated for the entire group.

The paired samples t-tests method were used to compare the differences between the pre-test and post-test which had been performed by both the experimental group (n = 15) and the control group (n = 15) to determine whether there were significant differences existed on strength of quadriceps muscles before and after the implementation of leg extension resistance training for the experimental group. In separate group of subjects (n = 15), the significant (2-tailed) score was determined. Statistical significance was set at $p < 0.5$. Finally, in order to compare the strength of quadriceps muscles between the experimental and control group, the independent samples t- tests were used.

to perform with a weight to identify their 1 repetition maximum (1RM). These tests were repeated for both experimental group (G1) and control group (G2). The results were recorded in subject's personal information sheet for data collection. The heaviest weight achieved was considered the pre-training 1RM. The 1RM was determined in fewer than five attempts with a rest interval of 3 minutes between 1RM attempts and 30 min were allowed before the start of the leg extension training for the experimental group. Following the 4 weeks of training, the 1RM was test was performed similarly to the pre-training test in order to compare the strength changes between the G1 and G2.

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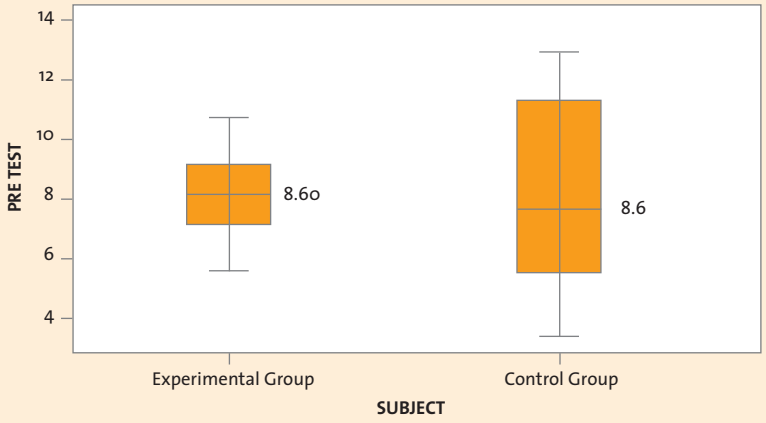
Frequency of the training program was two sessions per week with at least 48 hour rest between sessions. The experimental group were given 8 sessions of training during the 4 weeks of training period, each session

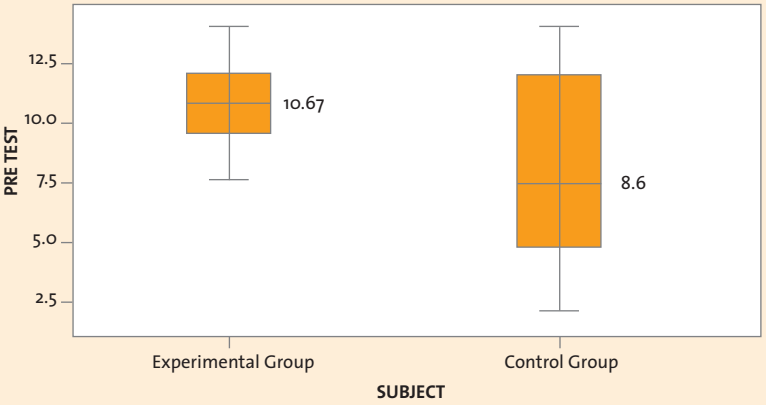
RESULTS

Graph 1 shows the comparison of the Experimental group and the Control Group on the strength of quadriceps muscles (pre-test). The mean value of the pre-test of the experimental group is (M = 8.60 ± 1.60) and the pre-test of control group is (M = 8.60 ± 3.16).



Graph 1:
Comparison of the Experimental group and the Control Group on the strength of quadriceps muscles (pre-test).

Graph 2 shows the comparison of the mean value between the Experimental group and the Control Group on the strength of quadriceps muscles (post-test). The mean value of the post-test of the experimental group is (M = 10.67 ± 2.23) and the post-test of control group is (M = 8.60 ± 3.38).



Graph 2:
Comparison of the mean value between the Experimental group and the Control Group on the strength of quadriceps muscles (post-test).

Table 2 shows the paired sample t- test within the experimental group on the strength of quadriceps muscles (pre-test and post-test), p< .05. There was a significant differences of the strength of quadriceps muscles between the pre and post-test for the experimental group (t = -7.75, df = 14, p <. 05).

Table 2:
Paired sample t- test within the Experimental Group (G1) on the strength of quadriceps muscles (pre-test and post-test), p< .05.

	PAIRED DIFFERENCES		
Experimental Group	t	df	Sig. (2-tailed)
Pre-test vs Post-test	-7.75	14	0.001

Table 3 shows the paired sample t- test within the control group on the strength of quadriceps muscles (pre-test and post-test), p< .05. There was no significant differences of the strength of quadriceps muscles between the pre and post-test for the control group (t = 0.21, df = 14, p >. 05).

	PAIRED DIFFERENCES		
Experimental Group	t	df	Sig. (2-tailed)
Pre-test vs Post-test	0.21	14	0.84

Table 3:
Paired sample t- test within the Control Group (G2) on the strength of quadriceps muscles (pre-test and post-test), p< .05.

Table 4 shows the independent samples t – test between the Experimental and Control group on the strength of quadriceps muscles (post-test), p< .05. There was a significant differences of the strength of quadriceps muscles between the experimental and control group during post-test (t = 1.97, df = 28, p <. 05).

GROUP	MEAN DIFF.	S.E. DIFF	T	DF	SIG. (2-TAILED)
Experimental Group & Control Group	2.07	1.05	1.97	28	0.03

Table 4:
Independent samples t – test between the Experimental and Control group on the strength of quadriceps muscles (post-test), p< .05.

DISCUSSION

The purpose of this study was to determine the effect of 4-week leg extension training on the quadriceps muscles strength. This is a study carried out in the University of Malaya aims to improve the strength of quadriceps muscles in short period of time of the experimental subjects. In this study, the randomly selected subjects were divided into two groups and the subjects were categorized as experimental group (involved in training intervention) and control group (does not involved in training intervention). Their 1 RM was compared before and after the intervention program. The 1 RM was used to calculate the parameters relatives to the muscle strength, training effects and the effectiveness of the leg extension machine. At pre-training assessment, the differences in the 1 RM between the two groups were not that significant; experimental group (M = 8.60 ± 1.60) and the control group is (M = 8.60 ± 3.16). By contrast the results of post- training were significantly higher in the experimental group.

As a result, the major finding of this study was that the intervention of the four weeks (8 sessions of resistance training) for the experimental group (n = 15; male = 7; female = 8) induced significant differences (t = -7.75, df = 14, p< .05) on their strength of quadriceps muscles. The mean of the post-test (M = 8.60 ± 1.60) significantly increased compared to the pre-test (M = 10.67 ± 2.26). The results mean that 8 sessions of leg extension training program able to improve the strength of quadriceps muscles. Based on the results, the hypothesis of this study: the effect of leg extension on the strength of quadriceps muscles is higher in the experimental group compare to the control group is accepted. The results of this research have proved that the leg extension training can improve the strength of quadriceps muscles. Studies have proven that the first 6 weeks of resistance training can increase muscle strength at rapid rate even though the rate of increase in muscle fiber cross-sectional area is not that obvious [4]. The results also supported that muscular strength can be increased by using few sets [2], a moderate number of repetitions [7], and a medium – low loads.

On the other hand, there was no significant differences of strength of quadriceps muscles for the control group (t = 0.211, df = 14, p >. 05).between pre and post-test. The mean of the post-test of the strength of quadriceps muscles for the control group (M = 8.60 ± 3.38) was more or less similar to the pre-test (M = 8.60 ± 3.16). The results indicated that the general walking movement which involves the usage of quadriceps muscles can be a reason for the maintenance of the strength of quadriceps muscles among the control group. Yet, without a proper resistance training, the maximum strength of quadriceps muscles is difficult to be achieved.

Besides that, approximately half of the subjects, 17 people had experiences in sports. There were 9 subjects (52.94 %) had more than 4 years of experiences in sports. While, 8 subjects (47.06 %) were found to be active in sports for past one year. This finding indicates that the leg extension training (resistance training) can give a good impact on trained individuals because their muscle activation and muscle adaptation to exercise is faster and more visible compared to untrained individuals. This findings support well the statement by some researchers that a frequency of 2 days per week per muscle group training was optimal to increase the muscle strength for trained individuals [6].

The result of this study expressed that there was a significant differences of the strength of quadriceps muscles between the experimental and control group during post-test (t = 1.97, df = 28, p <. 05). The findings also

have shown a significance mean difference between the experimental and control group. The post-test result of the experimental group (M = 10.67 ± 2.23) and the post-test of control group is (M = 8.60 ± 3.38) have a significance differences. Therefore, the results indicated that the strength of quadriceps muscles of the experimental group is higher than the strength of quadriceps muscles of the control group. So, the second hypothesis of this study; there is significance different of the strength of quadriceps muscles between experimental and control group was accepted.

The results supported that resistance training for a particular muscle can improve the muscle strength well within short period of time (less than 6 weeks) if uses the proper training program [6]. In addition, some research has shown that the quadriceps muscles have high potential to increase in strength with resistance training compare to hamstring muscle. Thus, the proper leg extension training can improves as well as help to gain maximal strength of quadriceps muscles. The objectives of this study have been achieved.

Limitations

From the present study, the researchers indeed discovered several limitations which may impair the findings. Firstly, the present study the time frame given to complete the research was relatively short. Hence, there was no extra time for the researcher to do test and re-test for more repetitions. In addition, the training venue was set at the outdoor due to limited choices. Moreover, most of the subjects were undergraduates; as such it was difficult to find a suitable training period for them to train together. In addition, the researchers cannot limit the physical activities of the control group as most of them used to usually perform mild physical activities such as brisk walking and jogging. Hence, the strength of quadriceps muscles of the control group may be maintained or improved.

PRACTICAL APPLICATION FOR COACHES

It is clearly proven with the present study that four week leg extension training is a suitable and effective training to increase the strength of quadriceps muscles. However, the training period have to prolong to a longer period so that better effects can be shown. The frequency of total sets per session, type of the training, the intensity and the duration of the training can be modified within the context of the resistance training program to make sure that the training is overload and progression throughout the training sessions based on the FITT principle. The leg extension machine can be suggested as one of the good equipment to improve quadriceps muscles strength in shorter period of time.

APLIKASI PRAKTIKAL UNTUK JURULATIH

Hasil kajian ini adalah dengan jelasnya membuktikan bahawa empat minggu latihan leg Extension adalah sesuai dan efektif untuk meningkatkan kekuatan otot quadriceps. Walaubagaimanapun, waktu latihan harus dipanjangkan sedikit supaya dapat memperolehi kesan yang lebih nyata. Kekerapan jumlah set satu sesi, jenis latihan dan intensiti dan juga jangka waktu latihan boleh diubahsuai mengikut konteks program latihan bebanan untuk memastikan lebihan beban dan ansur maju sepanjang sesi latihan mematuhi prinsip FITT. Mesin leg extension boleh dicadangkan sebagai satu alat yang sesuai untuk meningkatkan kekuatan otot quadriceps dalam masa yang singkat.

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COMPARISON OF THE ACUTE EFFECTS BETWEEN BACK SQUAT AND LEG PRESS ON THE SPEED OF THIRTY-METER SPRINT TRIALS

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TEO ENG WAH[4]

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INTRODUCTION

Speed is one of the components of skill related physical fitness that is important in relative to the sport that athletes participating in. Sprinters, cyclers and team sport athletes are the example of group of athletes that needs speed in their particular sport. Speed in sport refers to the capability of an athlete to move as fast as possible in a particular direction. Sport is the manipulation of the body or an external object; be it running, implement speed in throwing, or speed of implement to strike another object. Thus, speed of movement is critical to sports performance and in many cases is the basis for athlete selection. Given the dependence of running speed on muscle force or power and similar training adaptations, resistance exercise training appears to be a specific analogue for sprint performance and is critical for improving running speed [1].

Resistance training which also known as strength training or weight training, is one of the training that helps performance of the athletes become more effective in terms of speed while on the field. The speed comes from the neuromuscular system's ability that creates a large impulse in the shortest amount of time. The stronger the muscles, the more speed it will be able to generate. Therefore, the resistance training should be more focus on strengthening the legs in order to improve speed and become a more efficient and effective in performance. The major leg muscles that involve in the leg strengthening exercise are quadriceps, hamstrings and calf muscles which are all necessary for good speed. Leg presses and back squats become the two exercises of leg strengthening exercises that have been proven as the good ways for improvement of the speed that targets the leg muscle region [4].

Leg presses, a compound exercise, train all of the major leg muscles at once in a natural squatting movement. As a compound or multi-joint exercise, leg presses require all the major muscles of the legs to work in coordination, which works the weakest muscles the most and increases joint stability. Passive leg press training enables lower limb muscle groups to apply a maximum downward force against a platform moved up and down at high frequency by an electric motor. Thus, these muscle groups accomplished both concentric and eccentric isokinetic contractions in a passive, rapid, and repetitive manner [8].

REFERENCES

Whereas, squatting is the most basic form of leg strengthening and muscle building exercises, but it works wonders. Running speed is influenced by being able to apply more force into the ground, and the fastest way to improve this is to increase lower body strength. Not only will heavy load front and back squats train the quads, gluteus, hamstrings, and calves to produce more ground reaction force, but they will increase strength in the entire core musculature [11]. This will allow athletes to integrate their increased speed into sports-specific movements on the field or court.

A lot of study has been done to investigate the effects of squats and leg press on the speed. The findings of these studies have proven that there is improvement of speed after doing the exercises. However, there is currently no study that have been done to determine and compare which one of these two types of exercise are the best method for the speed improvement on acute effects. According to the Yetter & Moir's [11] study, recent research has shown that performing muscular contractions under near-maximal load conditions improves subsequent performance during movements that requiring large muscular power outputs of the stimulated muscle groups. These increases in performance have been attributed to a Post activation Potentiation (PAP) effect within the stimulated muscle groups, whereby the force produced by the muscles is increased as a result of previous contractile activity. Different underlying mechanisms have been proposed to cause PAP. Therefore, the purpose of this study was to determine whether performing back squat versus leg press prior to sprinting would improve running speed during each 10-m interval of 30-m sprint trials.

OBJECTIVES

1. To measure the speeds of performances on pre- and post- intervention.
2. To compare the significant differences on the acute effects of performing back squat and leg press in the average speed during each 10-m interval of 30-m sprint trials.

METHODOLOGY

Method

Experimental method was applied in this study. This study used a randomized, cross-over design to investigate the acute effects of back squat and leg press on the average speed during each 10-m interval of 30-m sprint trials. Three 30-m sprint trials, with 3 minutes' rest between each, were performed before and after each of the exercise conditions. Split times (0–10 m, 10–20 m, and 20–30 m) were collected during each of the sprint trials. The times during each of these 10-m intervals were averaged among the three trials and converted to sprinting speeds. This design allowed for the determination of the effectiveness of the back squat and leg press exercise as PAP methods on the different phases of the sprint.

Subjects

Eighteen of second year students volunteered to participate in this study (N=18), which were the students from bachelor of sport science of the University of Malaya. The subjects (age = 21.17 ± 0.38 years, body mass = 57.28 ± 12.44 kg, height = 164.67 ± 9.02 cm) were all involved in

sports such as floor ball, hockey, football, track and field and they were considered active in sport which required the speed most. These subjects were divided into two groups where both were the experimental group (N=9) which respectively with a total of 9 subjects in each group and the order of the exercise sessions was randomized across the subjects.

TEST AND MEASUREMENT

Sprint Test

The subjects performed of three 30 m sprints on an outdoor cement floor and wearing standard training shoes. Sprints were interspersed with a 3-minute rest period. Time to 10, 20 and 30 m was assessed using infrared timing gates (Swift SpeedLight V2 Dual Beam Timing System). All the subjects began with their front foot positioned 50 cm behind the start line and were instructed to perform all the sprints with a maximal effort.

This test was conducted twice which were pre-test and post-test to compare the speed improvement of the experimental group. The test was carried out before did the back squat and leg press session and after implementation of the both exercise. The purpose of this test is to assess the subject's straight line quickness, speed and acceleration. The test were begin with place the timing gates at the start line, 10 m, 20 m, and 30 m lines ensuring that there is at least 15-20 m run out past the gates at both ends. A piece of tape was place on the floor 50 cm from the start gates. The subject must start with their toe immediately behind this line.

They must start the test from a stationary position with no rocking or swaying and begins their sprint once the tester indicates that the timing equipment has been zeroed and ready to record their score. The subject then sprints through all four gates and slowly walks back to the start during their recovery. Each subject gets three attempts with approximately three minutes rest in between sprints and the best time recorded is the time taken.

1 RM Back Squat Determination

One repetition maximum (1RM) for the back squat was determined for each subject using the protocol outlined by Baechle and Earle [1]. A successful parallel back squat required descending by flexing the knees and hips until the proximal head of the femur reached the same horizontal plane as the superior border of the patella. An attempt was considered successful when the movement was completed through a full range of motion without deviating from proper technique and form. Spotters were present during each squat attempt to provide verbal encouragement and safety for the subjects. A standard 25-lbs Olympic bar and weight plates (Body Solid, Smith Machine) were used during the exercise. Three days' rest was provided between the 1 RM procedures and the first data collection session.

1 RM Leg Press Determination

1 RM for the leg press was determined for each subject using Body Solid Pro Club Line Leg Press with 310 lb. Weight Stack SLP500G/3. The subject starts in a seated position with feet on a platform. The levers attached to the weight plates was released, allowing the weight to come down, then subject slowly extend the legs without locking knee at the top of the movement. Subjects performed the concentric phase, maintained full extension, and performed the eccentric phase of each repetition over 2, 1, and 2 seconds, respectively. The researchers progressively increased the resistance for each repetition until the subject could no longer move the lever arm one time through the full range of motion.

Procedures

Second year students in bachelor of sport science of the University of Malaya were chosen became the subjects for this study. The total of eighteen subjects were equally divided into two groups in which both were experimental group; back squat group and leg press group. All of the subjects were informed about this study that would be conducted on them entitled "Comparison of the Acute Effects between Back Squat and Leg Press on Speed during Thirty-Meter Sprint Trials". They were briefed about the whole procedures identified prior to the study carried out.

All of the subjects first performed the pre-sprint test and average speed of three attempts for each subject was taken. The subjects then went through 1 RM determination session with three days' rest were provided between the 1 RM procedure and the first data collection session. Once the 1 RM of the subjects were determined for each of back squat (30 ± 15 kg) and leg press exercise (117.78 ± 45.22), the 65 %, 75 % and 85 % of the subject's 1 RM were selected for the loads to be used in testing. After three days' rest from 1 RM determination session, the subjects were instructed to complete 3 sets of exercise according to their respective test groups, with different repetitions using the loads that have been selected and they were also tested for post-sprint test after completed the 3 full sets of exercise.

In order to control the possible effects of the exercise test on the performance, all of the subjects warmed up on a cycle ergometer (Monark Ergomedic 828E, Varberg, Sweden) for 5 minutes at an intensity of 300 kpm. After this, the subjects walked for 4 minutes to a free-weights room where they performed a series of back squats. The subjects first performed five repetitions at 65 % of their 1 RM, then four repetitions at 75 % 1 RM, and finally three repetitions at 85 % 1 RM. Two minutes' rest was provided between each of the loading sets. The subjects then walked for 4 minutes to an outdoor cement floor where they performed the sprint trials (Figure 1). This protocol is similar to that used in a previous PAP investigation involving sprint running [9].

Subsequently for the leg press group, the subjects followed the same procedure as for the back squats session. The subjects also had to complete a 5-minute warm-up on a cycle ergometer (Monark Ergomedic

828E, Varberg, Sweden) at an intensity of 300 kpm. Following this, the subjects walked slowly for 4 minutes to maintain body temperature then performed the leg press exercise for five repetitions at 65 % of their estimated 1RM, four repetitions at 75 % estimated 1 RM, and finally three repetitions at 85 % estimated 1RM. Each set was separated by a two-minute rest period. Subjects were given a 4 minutes walking recovery before going on to 30 m post-sprint test (Figure 1).

After the back squat and leg press session, the subjects performed three 30-m sprint trials on an outdoor cement floor. The subjects began each trial when they were ready from a stationary position with their front foot positioned 50 cm behind the start line, and they were instructed to run at maximal effort throughout each trial. Three minutes' rest was provided between each trial. Swift Speed Light V2 Dual Beam Timing System was used to record the following split times: 0–10 m, 10–20 m, and 20–30 m. The average split times were calculated among the three trials for each subject. The average split times were then converted to speeds for each 10-m interval (distance/time) for the subsequent analyses. The results of the pre- and post-sprint test was recorded by the researchers, therefore the acute effects between back squat and leg press on speed during thirty-meter sprint trials could be analyzed and the procedures of the study was considered end.

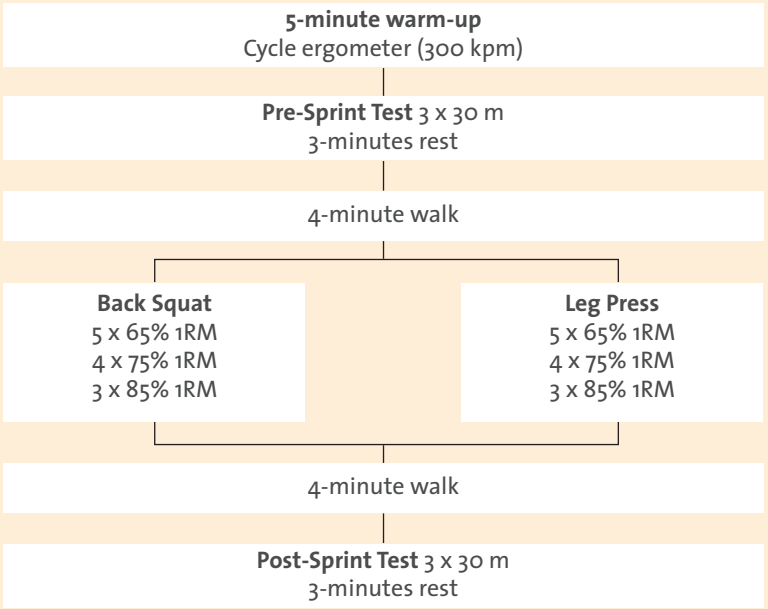

Figure 1: Schematic representation of the study design.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS for Windows, version 22.0; SPSS Inc., Chicago, IL). Measures of central tendency and spread of the data are presented as means and standard deviations. Descriptive statistics were calculated for the entire group and separately for subjects' age, height, body mass and one repetition maximum (1 RM) of back squat and leg press.

Other than that, paired sample t-tests were performed to assess the differences in performance of pre- and post-sprint test which had been performed by both the experimental group (N = 18). This method was used to determine whether there were significant differences existed on sprint performance before and after the implementation of the exercise test for the both experimental group. The α value was set at $p < 0.05$. Subsequently, the independent t-tests were used for mean comparisons to identify the magnitude of the differences in post-average speed during each 10-m interval of 30-m sprint trials caused by the back squat group and leg press group. The significance level was set at $p < 0.05$.

RESULTS

Table 2:
1 RM determination of back squat and leg press.

1RM DETERMINATION	MEAN	STANDARD DEVIATION
Leg press (kg)	117.78	45.22
Back squat (kg)	30.00	15.00

Table 2 shown the mean and the standard deviation of the subjects based on their 1RM of leg press and back squat. The mean and the standard deviation of the 1RM leg press was 117.78 ± 45.22 kg, and the 1RM of the back squat was 30.00 ± 15.00 kg.

INTERFERENCE STATISTICS
Paired Sample t-test

Figure 2 represented the sprint performance changes on pre- and post of 30 m sprint trials after did back squat exercise.

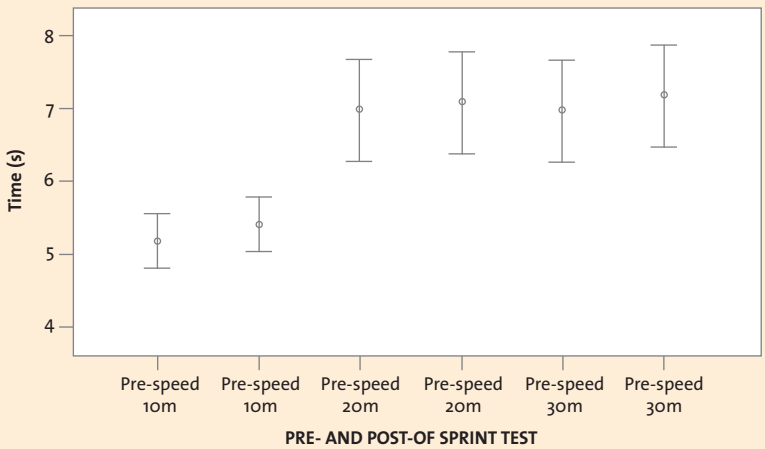

Figure 2:
Changes in sprint performance for back squat group during 30 m sprint trials.

Table 3:
Paired samples t-test within the back squat group on speed during 30 meter of sprint pre-test and post-test ($p < 0.05$).

PRE- AND POST OF SPRINT TEST	PAIRED DIFFERENCES				
	Mean Diff.	S.D	t	df	Sig (2-tailed)
1st 10 m	-.12222	.09176	-3.996	8	.004
2nd 10 m	-.14333	.15588	-2.758	8	.025
3rd 10 m	-.24111	.22569	-3.205	8	.013

Table 3 shown the paired samples t-test within the back squat group on speed during 30 meter sprint pre-test and post-test, $p < 0.05$. There were a significant difference on average speed of 30-m sprint trials caused by back squat group during first 10 m ($t = -3.996$, $df = 8$, $p = 0.004$), second 10 m ($t = -2.758$, $df = 8$, $p = 0.025$) and third 10 m interval ($t = -3.205$, $df = 8$, $p = 0.013$).

The sprint performance changes on pre- and post of 30 m sprint trials after leg press exercise were represented in the Figure 3 below.

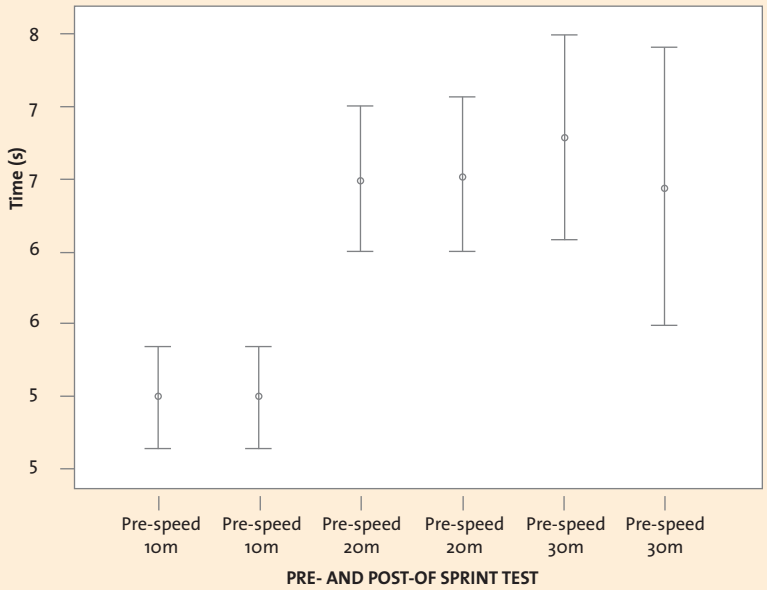

Figure 3:
Changes in sprint performance for back squat group during 30 m sprint trials.

Table 4:
Paired samples t-test within the leg press group on speed during 30 meter of sprint pre-test and post-test, $p < 0.05$.

PRE- AND POST OF SPRINT TEST	PAIRED DIFFERENCES				
	Mean Diff.	S.D	t	df	Sig (2-tailed)
1st 10 m	.00111	.16729	.020	8	.985
2nd 10 m	-.01778	.34343	-.155	8	.880
3rd 10 m	.32111	.76457	1.260	8	.243

Table 4 shown the paired samples t-test within the leg press group on speed during 30 meter sprint pre-test and post-test, $p < 0.05$. There were no significant difference on average speed of 30-m sprint trials caused by leg press group during first 10 m ($t = 0.020$, $df = 8$, $p = 0.985$), second 10 m ($t = -0.155$, $df = 8$, $p = 0.880$) and third 10 m interval ($t = 1.260$, $df = 8$, $p = 0.243$).

Independent Sample t-test

Table 5:
Independent samples t-test between the back squat group and leg press group on speed during 30 meter sprint post-test, $p < 0.05$.

EXPERIMENTAL GROUP	T-TEST FOR EQUALITY OF MEANS				
	Post Sprint Interval (m)	Mean	df	t	Sig (2-tailed)
Back Squat Vs Leg Press	1st 10 m	.19556	16	1.015	.325
	2nd 10 m	.43778	16	1.171	.259
	3rd 10 m	.52222	16	1.023	.322

Table 5 shown the independent samples t-test between the back squat group and leg press group on speed during 30 meter sprint post-test, $p < 0.05$. There were no significant differences on average speed of 30-m sprint trials between the back squat group and leg press group during first 10 m ($t = 1.015$, $df = 16$, $p = 0.325$), second 10 m ($t = 1.171$, $df = 16$, $p = 0.259$) and third 10 m interval ($t = 1.023$, $df = 16$, $p = 0.322$).

DISCUSSION

The purpose of the study was to investigate the acute effects of different resistance exercises (back squat and leg press) on the average speed during each 10-m interval of 30-m sprint trials. This is the first study that were carried out to compare the acute effects of back squat and leg press on 30-m sprint performance, directly using a Postactivation Potentiation (PAP) protocol to enhance sprint performance because running speed is critical in many athletic events.

The research hypothesis of this study in which back squat will improve the speed performance better as an acute effect compared to leg press during each 10-m interval of 30-m sprint trials was accepted. The results of this study proved and supported that back squat was a suitable and effective training method which could increase the speed level. In addition, studies by Gourgoulis et al. [5]; Jensen & Ebben [7], and Young et al. [12] found that by using back squats involving various types of loading to initiate the PAP were appeared successful in eliciting the PAP, which then improve the sprint performance.

Based on the results, there were a significant difference on average speed of 30-m sprint trials caused by back squat group during first 10 m ($t = -3.996$, $df = 8$, $p = 0.004$), second 10 m ($t = -2.758$, $df = 8$, $p = 0.025$) and third 10 m interval ($t = -3.205$, $df = 8$, $p = 0.013$) compared to leg press group that had no significant difference on the average speed of 30-m sprint trials. The results indicated that back squat group could enhance the sprint performance better compared to the leg press group.

Furthermore, the results of this study expressed that there were no significant differences on average speed of 30-m sprint trials between the back squat group and leg press group during first 10 m ($t = 1.015$, $df = 16$, $p = 0.325$), second 10 m ($t = 1.171$, $df = 16$, $p = 0.259$) and third 10 m interval ($t = 1.023$, $df = 16$, $p = 0.322$). The results of the study maybe due to some of the subjects in the group that actually not well-trained where study by Gullich & Schmidtbleicher [6] noted that PAP effects were only reported for well-trained subjects. Every subject was varying depending on their strength ability to perform the speed. Besides that, the loads that used in the study also affect the result outcomes. Based on previous study, it was speculated that initiating a PAP may be related to the training mood, intensity, volume, and recovery period between the end of the conditioning activity and the beginning of the performance [2,10] which then might give the significant changes on speed performance

PRACTICAL APPLICATION FOR COACHES

From the results of this study, it is verified that back squat exercise is a suitable and effective method that would improve the speed performance better as an acute effect during each 10-m interval of 30-m sprint trials compared to leg press. In addition, it is also shows that by performing some kind of muscular contractions under near-maximal load conditions like back squat and leg press, it would attributed to a Post Activation Potentiation (PAP) effect within the stimulated muscle groups.

APLIKASI PRAKTIKAL UNTUK JURULATIH

Hasil kajian ini telah menegaskan bahawa eksesais back squat adalah method sesuai dan efektif untuk meningkatkan prestasi kelajuan lebih baik dalam kesan akut dalam larian pecut berselang dari 10m hingga 30m jika dibandingkan dengan eksesais leg press. Tambahan pula, ia juga menunjukkan bahawa dengan melakukan aktiviti pengecutan otot dengan beban yang tinggi seperti squat dan leg press, ia akan merangsang kesan Post Activation Potentiation (PAP) terhadap otot yang berkenaan.

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EFFECT OF DIFFERENT TYPES OF GLYCEMIC INDEX PRE-EXERCISE MEALS ON CYCLING PERFORMANCE

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ABSTRACT

The influence of pre exercise low glycemic index (LGI) meal on endurance performance remains controversial with some findings reporting of an enhance performance while others reported of no difference. This study was therefore design to examine the effect of LGI pre exercise meal on subsequent endurance exercise performance. After consuming either a LGI or a HGI pre-exercise meal, seven well-trained male cyclists (age: 19.4 ± 1.3 years old; weight: 59 ± 3.6 kg; height: 1.69 ± 4.6 m; body fat percentage: 11.0 ± 2.2 ; Lean body mass: 52.7 ± 2.9 ; VO2max 56.2 ± 8.4 ml.kg-1.min-1) completed a randomised, cross-over design of two cycling exercise bouts at an intensity of 65% VO2max until volitional fatigue. Individual data demonstrated a trend which suggested LGI pre-exercise meal enhanced endurance performance as subjects were able to exercise 19 minutes longer (LGI time: 1:46:08) as compared with the HGI pre-exercise (1:27:08). The finding of this study was consistent with the proposition that a LGI pre-exercise meal enhances endurance performance as muscle glycogen utilization is spared while fat oxidation increased which provides a much needed source of fuel for exercise.

INTRODUCTION

Athletic performance and recovery from exercise are enhanced by optimal nutrition before, during and after an exercise bout [1]. The effect of pre-exercise meal on the subsequent prolonged exercise performance has been an area of great research interest. One of the diet manipulation involved in the pre-exercise meals concerns with the concept of glycemic index (GI) was introduced by Jenkins and workers in the early 80's [10]. The glycemic index ranks the different kinds of carbohydrate foods according to their effects towards postprandial glucose level.

In sports, low glycemic index (LGI) pre-exercise meal has been shown to improve endurance performance as compared with high glycemic index (HGI) pre-exercise. Thomas et al. [15] was the first study done on effects of GI towards cycling to exhaustion performance among cyclists. Since then, a large number of experiments have been conducted to examine the effect of different GI content on endurance exercise performance. The findings remains controversial, with some studies comparing the effects of LGI and HGI pre-exercise meal showed significant difference in performance [6,11] while others reported no significant differences in sports performance between the LGI and the HGI [6,7,16,17]. The inconsistency in the results is probably due to differences of timing of the meal ingestion, quantity of carbohydrate ingested and type of exercise employed.

Majority of the experiments on the effect of pre-exercise LGI and HGL meal on sport performance involved subjects consuming their meal between two to three hours prior to exercise [17,18]. Limited information is available on the effect of LGI meal when it is consumed 1 hour prior to exercise. Thus, this study was conducted to further examine the influence of pre-exercise LGI in meal consumed 1 hour prior to a 60 minutes cycling exercise. This study provides valuable practical information to athletes and coaches who wish to cosume light meal prior to exercise (within 1 hour) .

MATERIALS AND METHODS

Study design

This was a cross-over design study where subjects who were recruited through convenience sampling method were divided into two groups. Two groups of subject underwent 2 different trials where 2 different pre-exercise meals with different GI were provided to compare the time achieved during trial by 2 groups of subjects. The study protocol was approved by the UKM Medical Centre Research Ethics Committee.

Subjects

Seven trained amateur cyclists (aged 19.4 ± 1.3 years old; VO2max 3.32 ± 0.4 L.min-1) from local cycling clubs were recruited in this study. Participation was voluntary without any incentives after being informed that no risk was associated during procedures. They were given short briefing to understand about procedures and informed consent were signed.

Preliminary measurement and familiarization

Subjects made an initial visit to the laboratory for familiarization with the equipments. Subjects undertook a preliminary test to determine their VO2max by using electrical bike test to exhaustion. Subjects were required to exercise on electrical bike and maintain at constant speed (Ergoline, Germany) of 70 rpm. Workload was increased 50 watt every 4 minutes during the 16 minutes of the test. Subjects then rest for 5 minutes before resumed to maximal exercise test. During maximal test, subjects exercised at 25 workload increment every 2 minutes until they were exhausted. Workload for subsequent exercise to exhaustion trial for each individual were then determined through 65% of their VO2max.

Test meal

Subjects were provided 2 types of pre-exercise test meals. Both meals contained 70g carbohydrate (≈1.1g/kg body weight). Both test meals were prepared by referring data from previous studies on GI food [12,13]. They were prepared in similar nutritional content so that effects towards exercise performance can be determined. Sardine sandwich [13] and peanut butter sandwich [14] were used as HGI and LGI food, respectively. Sardine sandwich with GI of 75 (HGI) consists of plain bread (Gardenia), mackerel (Ayam Brand), butter, onion and cucumber. While, peanut butter sandwich with GI 42 (LGI) was prepared by using plain bread and peanut butter (Lady's Choice). Both of them contained similar amount of protein and fat. Table 1 shows the composition for both test meals.

Table 1.
Composition of test meals

	HGI	LGI
Energy (kcal)	475	462
Weight per serving size (g)	205	147
Carbohydrate (g)	70	70
Fat (g)	13	14
Protein (g)	15	14

Energy balance

Energy balance was assessed using total energy intake and total energy expenditure. Total energy intake was estimated through 3 days diet record which included 2 training days and 1 rest day. Time and motion study was used to estimate total energy expenditure and was carried out simultaneously with diet record.

Experimental protocol

Subjects needed to complete 2 exercise trials in a randomized crossover design. They need to record diet intake and physical activity so that it could be repeated 2 days before each trial to minimize their influence on test result. Besides that, they were advised to maintain regular eating pattern and exercise and avoid vigorous activity. During this period, caffeine drink, alcohol and cigarettes were strictly prohibited. On the day of each exercise trial, subjects reached the laboratory at 7 o'clock in the morning after 12 hours overnight fast. Their body weight was measured with minimal clothing using Tanita Digital Scale HD 309 (Tanita, Japan) before meal, after meal and after exercise. Test meal was given and to be consumed in 15 minutes. No extra foods and drinks were permitted during period of ingestion except small amount of water. About 60 minutes after test meal ingested, they start to cycle on exercise bike at workload of 65% VO2max until exhaustion. Only minimal clothing was allowed during exercise trial to minimize the weight of sweat bear by subjects. Water was available ad-libitum during each trial. A heart rate detector (Polar Electron OT, Finland) was attached to subject's chest and heart rate can be read from the heart rate monitor. Expired gas samples were collected through a mouth piece which was attached to subject, and analyzed by using Metamax gas analyzer (Cortex Biophysik, Germany) to determine VO2, VCO2, VE and RER value throughout trial. Total CHO and fat oxidation rates, were estimated from VO2 and VCO2 by using stoichiometric equations [8]. Gas calibrator (Calibration gas safer, Cortex Biophysik) was used to calibrate the gas analyzer before it runs during exercise trial. Heart rate was recorded every 5 minutes and water level was taken each time subject drinking. Time achieved by subjects was then recorded to nearest second. Both trials were performed at the same time of the day under similar condition and procedures with different GI food given.

Statistical analysis

Data obtained were analyzed using statistics software package SPSS for windows version 15 and Cohen's (1988). Paired T test was used to compare mean difference of heart rate, fat and carbohydrate oxidation rate, fluid intake level and weight loss. 3 days energy balance was analyzed by using ANOVA repeated measure. Significance was set at 0.05 level of confidence. Besides that, mean of time to exhaustion achieved by LGI and HGI trial was compare using Cohen's [4] equation.

RESULTS

Table 2 showed physical characteristics of 7 cyclists. Their age ranging from 18 to 21 years old and mean BMI indicated that they are categorized as normal. Mean body fat was estimated about 11% with lean body mass of 52.7 ± 2.9 kg. While, maximum oxygen uptake (VO2max) was between 2.83 to 3.79 L.min-1.

Table 2.
Physical characteristics of the cyclists (mean ± sd)

VARIABLE	MEAN	RANGE
Age, year	19.4 ± 1.3	18 - 21
Height, meter	1.69 ± 4.6	1.62 - 1.74
Body weight, kg	59 ± 3.6	55.5 - 65.5
Body mass index, kg.m-2	20.8 ± 2.0	18.8 - 21.9
Percentage of body fat	11.0 ± 2.2	7.8 - 14.4
VO2max, L.min-1	3.32 ± 0.4	2.83 - 3.79
Lean body mass, kg	52.7 ± 2.9	48.5 - 56.6
Total body water, liter	64.6 ± 3	59.8 - 68.3

Energy balance of subjects was shown in figure 1. Subjects facing negative energy balance on 2 training days where energy expenditure (4695 kcal) exceeds energy intake (3610 kcal) as high as 1085 kcal. However, positive energy balance of 509 kcal during rest day indicates that energy intake (2678 kcal) is higher than energy expenditure (2169 kcal). As an overall, subjects were suffering from negative energy balance at -554 kcal.

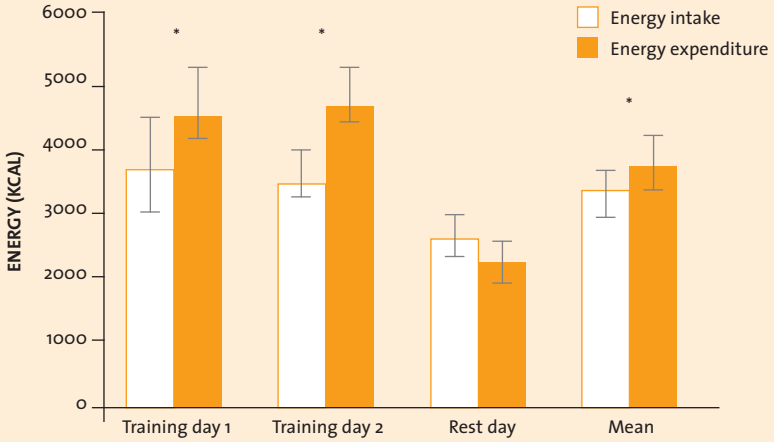


Figure 1.
Energy balance

Figure 2, reported nutrients composition in subjects' habitual intake diet. Results showed that percentage of carbohydrate ingested was higher in both training days than in rest day since they need instant energy provided by carbohydrate. Protein content in subjects' diet was high with an average of 28.6% and fat content was 23.3%.

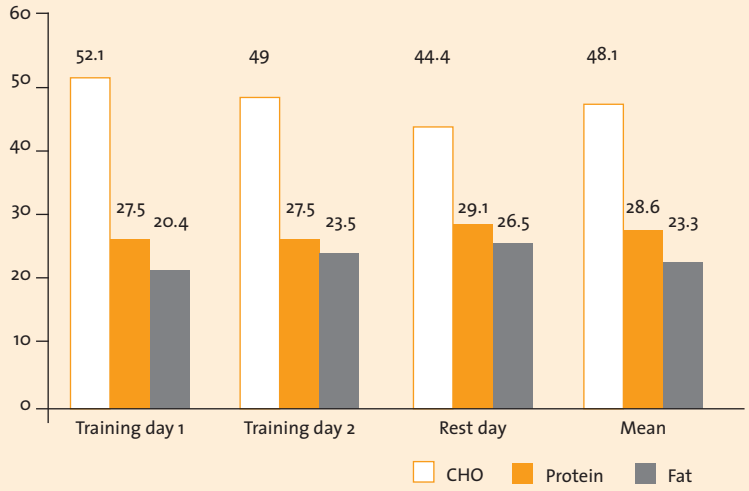


Figure 2.
Nutrients composition in subjects' habitual dietary intake

All 7 subjects completed 1 preliminary test and 2 exercise to exhaustion trial. Performance for both exercise trial were shown in figure 3 which represented by time achieved by subjects. Subjects achieved an average exercise time of 106 ± 40 minutes in LGI trial and 87 ± 35 minutes in HGI trial as shown in figure 2. The mean differences in time achieved for both trial is not significantly different ($p>0.5$) when analyzed with SPSS version 15. However, Cohen's d value of 0.5 shows a moderate effect size on influence of GI on exercise time. This result supported the influence of LGI meal provided better performance where it exhibits an increment of 22% on exercise time.

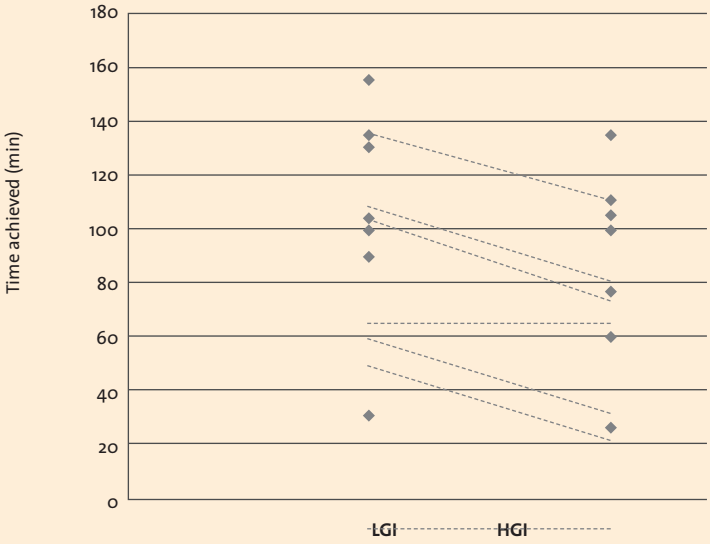


Figure 4 showed the overall trend of performance achieved by both trials. Exercise time to exhaustion for LGI trial is higher than HGI trial in 6 subjects whereas 1 subject achieved almost similar exercise time in both trials. Mean exercise time reported in LGI trial was 19 minutes higher than HGI trial.

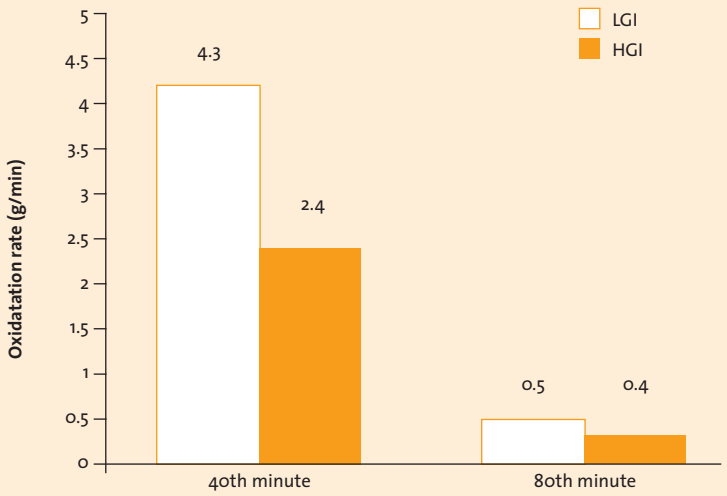


Figure 4.
Subjects performance in both trials

Figure 5 illustrated that amount of fat oxidized at 40th minute and 80th minute during LGI trial was higher compared to HGI trial but not significantly different (P>0.05). During early stage of trial, oxidation rate for LGI was 4.3 and 1.9 g/min higher than HGI trial. Meanwhile oxidation rate for both trials were almost similar in the later stage of trial. Conversely, in figure 6 showed that HGI trial demonstrated a greater carbohydrate oxidation rate (4.4 g/min) in the early stage compared to LGI trial (2.5 g/min). Both trials showed almost equal rate of oxidation during 80th minute. Oxidation in both trials did not shown differences (p>0.05).

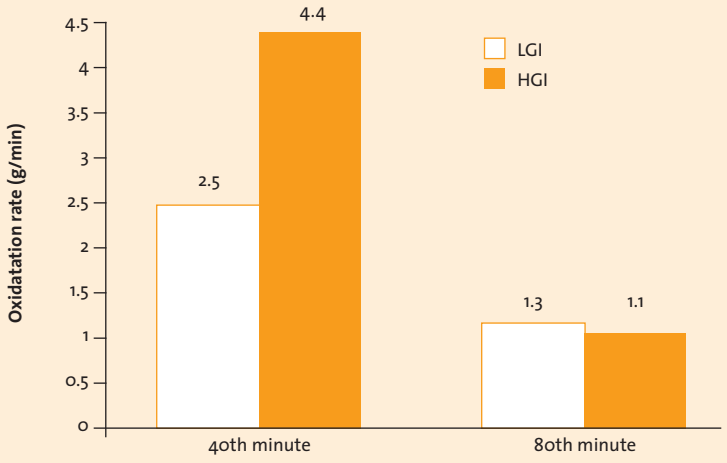


Figure 5.
Fat oxidation rate

Figure 6.
CHO oxidation rate

Figure 7 showed overall trend of heart rate during both trials. Apparently heart rate was hiking from early until final stage with an average of 153 beat.min-1 in HGI trial. LGI trial showed consistent heart rate with mean of 154 beat.min-1.

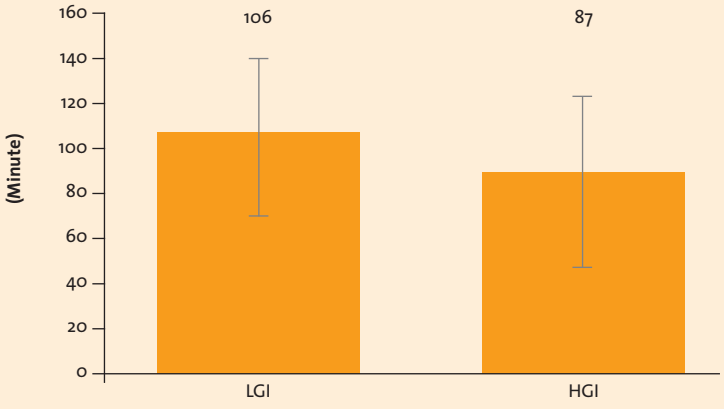
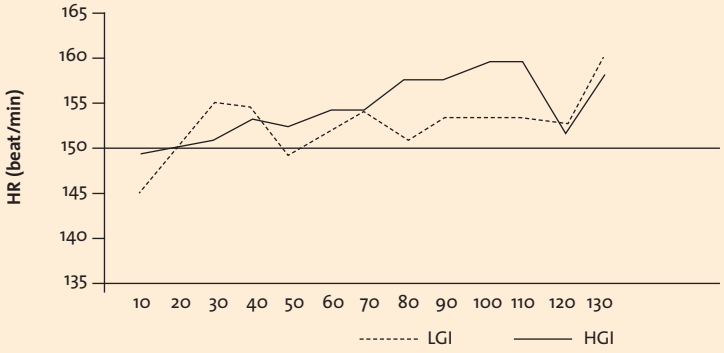


Figure 7.
Heart rate during exercise trials



DISCUSSION

The main finding of this study was that LGI pre-exercise meal ingested 60 minutes before trial gives moderate effect size in enhancing exercise time to exhaustion for up to 22% compare to HGI meal. Six out of 7 cyclists achieved longer time to exhaustion in LGI trial compare to HGI trial. LGI meal provides low and consistent glucose supply during exercise thus delayed the onset of fatigue. HGI meal exhibit high glucose concentration in blood and caused peak glucose level during early stage of exercise. This induced hyperinsulinemia and rebound hypoglycemia among cyclists and caused shorter time of exercise time to exhaustion. Carbohydrate oxidation rate become greater resulted from hyperinsulinemia, causes glycogenolysis and muscle glycogen stores decreased. On the other hand, although LGI contributed low level of glucose concentration during postprandial period, a sparing muscle and liver glycogen effect during subsequent exercise was observed in LGI trial, provided steady glucose supply during exercise. Result from this study was supported by previous evidence where LGI pre-exercise food 45 minutes before exercise improves endurance capacity in exercise to exhaustion trial.

Data showed that subjects were facing negative energy balance where energy expenditure (3853 kcal) exceeds energy intake (3299 kcal) as much as 554 kcal. Subjects undergo 5 hours strenuous training everyday which was energy-cost activity. High intensity and duration of training utilize big amount of energy among subjects. Moreover, carbohydrate content in their diet is low (48.1%) from total energy intake and protein intake is higher than normal (28.6%). Therefore they should increase their energy intake by taking carbohydrate dense foods in order to achieve energy balance. Several local studies also reported negative energy balance among national cyclists [12,3]. There are factors which might caused low energy intake among athletes for example lack of time, less appetite and mood changes. Athletes should cope with this problem to prevent detrimental effects on health as well as sports performance.

HGI provides higher glucose concentration during early stage of exercise but it drops tremendously after peak glucose level because of hyperinsulinemia. This lowered subjects' heart rate during exercise where they were supplied with sufficient glucose level in the beginning and as glucose level decreased, heart rate elevated gradually as they need exercise harder during trial. LGI meal provided gradual glucose concentration and caused consistent heart rate trend throughout the trial.

Fat oxidation rate was higher in LGI trial where less glucose ready to be utilized. Sparing glucose effect due to low glucose level promoted greater fat oxidation rate during LGI trial [15]. HGI meal supply higher blood glucose level and caused hyperinsulinemia, which in turns, induced higher carbohydrate oxidation rate compared to LGI trial. According to Coyle et al. [5], it stated that HGI meal could induce metabolic changes during postprandial period, thus increased carbohydrate oxidation rate.

CONCLUSION

This study confirm several earlier findings of a positive contribution of a LGI pre exercise meal on subsequent prolonged exercise performance. Based on this finding, coaches should emphasize the need to consume LGI in their athletes meal prior to training and competition.

ACKNOWLEDGEMENT

The authors wish to thank coaches and cyclists from Letua Cycling Club and Selangor Cycling team for participating in this study. This study was supported by Sports Center, University of Malaya where the study was conducted.

PRACTICAL APPLICATION FOR COACHES

The finding of this study highlights the importance of maintaining energy supply throughout the exercise period via consuming LGI meal prior to exercise. Futhermore, LGI meal should be promoted to endurance athletes by their coaches in order to preserve energy supply during prolonged exercise. The finding of this study can also be adopted by athlete training and competing during the month of Ramadhan. In a situation where Muslims fast from sunrise to sunset, LGI meal during sahur can potentially help maintain energy source during the period of Ramadan fasting as glucose is slowly release into the blood. Further study to confirm this proposition is needed.

APLIKASI PRAKTIKAL UNTUK JURULATIH

Hasil kajian ini menekankan kepentingan mengekalkan bekalan tenaga di sepanjang tempoh senaman melalui pengambilan hidangan indeks glisemik rendah (LGI) sebelum latihan. Tambahan pula, jurulatih sepatutnya menggalakan atet mengambil makanan LGI perlu untuk mengekalkan bekalan tenaga semasa latihan yang berpanjangan. Hasil kajian ini juga boleh diguna pakai oleh atlet yang menjalani latihan dan bertanding di bulan Ramadhan. Dalam keadaan di mana umat Islam berpuasa dari matahari terbit hingga matahari terbenam, makan LGI semasa sahur berpotensi membantu mengekalkan sumber tenaga dalam tempoh berpuasa, di mana glukosa dilepaskan secara perlahan-lahan ke dalam darah. Walau bagaimanapun, kajian lanjut perlu untuk mengesahkan cadangan tersebut.

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SEA Games 2013 -The winning diving team. Coach Yang Zhuliang (standing far right)

2013 SEA GAMES GOLD MEDALIST in mens Discuss throw Muhammad Irfan Shamshuddin with Coach Frantisek Petrovic

2013 SEA GAMES Weight Lifting – Coach Mohd Faizal Baharom (left) Bronze medallist Men's 94kg Mohd Faiz Musa, Coach Stefan Htistov Stefanov, Women's 69kg Bronze medallist Nor Khasida Abdul Halim

2013 SEA GAMES - Gold Medal Women's Hockey Team – Coach Nasihin Nubli Ibrahim.

NUTRITIONAL STATUS, PHYSICAL FITNESS AND ACTIVITY LEVEL OF THE BATEK CHILDREN IN KUALA TAHAN, TAMAN NEGARA (NATIONAL PARK), MALAYSIA

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ABSTRACT

A cross-sectional study of the body mass index (BMI) status and nutritional status of Batek and Malay children was carried out in Taman Negara, Pahang, Malaysia. A total of 129 children were examined, of which 92 were Batek children. The age was determined and anthropometric measurements such as height, weight, and middle upper arm circumference were taken. The nutritional status was assessed by looking at the distribution of the z-score of weight for age (WAZ), height for age (HAZ) and weight for height (WHZ). Malay children were found to have a higher prevalence of obesity where 19% of them were overweight and 11% were obese. In comparison, there is no prevalence of overweight and obesity among the Batek children. It was found that the nutritional status of the Batek children for both sexes were poor as compared to the Malay children. This may be due to the higher physical activity among the Batek children but poor nutritional intake. A comprehensive primary health care program is essential for the Batek children in Taman Negara.

Results showed that the overall prevalence of mild and significant underweight was 32.1% and 56.5% respectively. The prevalence of mild stunting was 25.6% while another 61.3% had significant stunting. The overall prevalence of mild and significant wasting was 39.0% and 19.5% respectively. A very active physical activity level were measured with steps/day values were attained at 19,301 (3391) and 17,334 (3281) for boys and girls respectively. This study highlights the presence of a high prevalence of underweight and stunting among Orang Asli children in Kuala Tahan Wildlife Reserve. This may be explained by insufficient nutrition and very active lifestyle as evident by this study.

KEYWORDS — Anthropometry, Activity level, Aborigines, Children.

INTRODUCTION

Rapid socioeconomic development worldwide has brought marked changes in lifestyle of the Orang Asli including diets and activity level [1, 2]. For the past two decades, Malaysia has recorded a marked increase in the prevalence of lifestyle non-communicable diseases which includes diabetes mellitus type II, coronary heart disease and hypertension [3]; The Third National Health and Morbidity Survey [4]. Similarly, this phenomenon is also affecting the population of indigenous Orang Asli in Malaysia [5]. Although some of the indigenous Orang Asli still maintains their isolation from the urban population, many of them are going through the westernization of diet and lifestyles [6]. This may partially explain the increase in prevalence of chronic diseases among the population. In addition, the original active lifestyle of fishing, hunting and herding among the indigenous people are gradually shifting to a

sedentary lifestyle [7]. However, unlike the area of diet and nutrition, less study have been conducted to discuss on the fitness and activity level of Orang Asli population.

Although malnutrition remains a major health issues among Orang Asli population, there is accumulating evidence to show that the level of adiposity and obesity is also on the rise in this 'at risk' population particularly among their children [6]. One of related factor may due to resettlement activity by the government to special land scheme. This change transformed their dietary and lifestyle practice, from nomadic culture of hunting and gathering to permanent cash crop agriculture. Usually, this resettlement was located in close proximity to Malay villages. However, the current nutritional status and lifestyle of aboriginal Batek tribe in Taman Negara Kuala Tahan is still unknown. Studies also reported high prevalence of obesity among children has been directly related to low fitness and activity level [1,8]. Given the link between physical fitness and activity level and obesity, it is of interest for this study to assess and provide nutritional and fitness profile among the Batek children and compare it with the Malay children living in the area of Taman Negara Kuala Tahan, Pahang.

METHODS

Study Population

This study was carried out in Kuala Tahan, Taman Negara, Pahang which covers more than 4,343 square km of land area with approximately 2,909 total residents that include the Malays and Batek among others. This study consists of two sample groups which are Batek children residing in Kuala Tahan, Taman Negara (National Park), Pahang and Malay children living in nearby village. The Batek children aged 9 to 12 years were selected using purposive sampling method from the tribe's villages located in Taman Negara. Information sheet and consent forms were given to the subjects. Data reported here were collected during the months of September and October 2012.

Anthropometric Measurements

Participant's height and weight were measured by trained assistants. Children's weights were measured using portable mechanical scale (SECA 762; Hamburg Germany) to the nearest 0.5kg with subjects wearing light indoor attire and without shoes. A correction of 0.5 kg was made for the weight of the clothes. Height of children were measured by using a wall mounted stadiometer (SECA 206; Hamburg, Germany) with subject standing height without shoes against a Frankfurt plane horizontal and were read to the nearest 0.1 cm. Weight-for-age Z-score was used to denote underweight as an overall indicator for malnutrition while height-for-age Z-score was used as an indicator for stunting. Weight-for-height Z-score was used as an indicator for wasting (acute malnutrition). The Z-scores were calculated based on the median values of the National Center for Health Statistics United States (NCHS) reference population.

Physical Activity Level

The Omron HJ-113 piezoelectric pedometer (Healthcare Ltd., UK) were worn by the children for three days. It has a 7-day memory, which avoids the need for participants to record their own daily step counts. Pedometers

were attached to the children's belt at a position directly in line with the patella. All pedometers were sealed with a cable tie and clear plastic wrap to prevent accidental resetting and to discourage behavior modification due to access of the pedometer's step count. The subjects were asked to not tamper with the seal. Researchers collect the pedometer each morning, record the pedometer score, then reset, reseal and reattached the pedometer to the subjects. From the pedometer data, the first day were excluded because of partial data collection and an average steps/ day variable was computed.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (version 19.0 for Windows, SPSS Inc., Chicago, IL, US). T-tests were used to assess any differences and comparisons of proportion were tested with the z-test. Nonparametric test (Mann - Whitney U test) was done if the distribution was not normal. The significance level was set at $p < 0.05$.

Ethical Approval

Approval to conduct the study was granted by the Department of Orang Asli Development(JAKOA), Kuala Lumpur, Malaysia. Ethical approval was obtained from the The Research Ethics Committee (REC) of Universiti Teknologi MARA (UiTM), Malaysia.

RESULTS

Nutritional Status

Table 1 shows the percentage of children classified as normal or stunting (low height-for-age), wasting (low weight-for height) and underweight (low weight-for-age). There an overall prevalence of underweight among Batek and Malay children was 57.3% and 7.8% respectively. As in underweight, a similar pattern of prevalence was also seen in stunting. The overall prevalence of stunting among Batek and Malay children was 69.6% and 11.3%, respectively. The prevalence of malnutrition based on these measurements revealed that more Batek children were significantly stunted and underweight than the Malay children. However, there was no significant difference found in wasting measurement for both population.

Table 1:
Distribution Of Batek And Malay Children According To Weight-For-Age, Height-For-Age And Weight-For-Height

Attributes	Categories	Batek (n=89) N (%)	Malay (n=37) N (%)
Weight-for-age (WAZ)	Normal Underweight	38 (42.7) 51 (57.3)	34 (92.2) 3 (7.8)*
Height-for-age (HAZ)	Normal Stunting	27 (30.4) 62 (69.6)	33 (88.7) 4 (11.3)*
Weight-for-height (WHZ)	Normal Wasting	79 (88.4) 10 (11.6)	35 (99.6) 1 (0.4)
*z-test, p<0.05			

Physical Activity level

Results revealed that all of Batek and all of rural Malay children met or exceeded the BMI referenced cut-offs for health of 15,000 steps/day for boys and 12,000 steps/day for girls respectively. In respect to weight status 6.1% of underweight, 83.6% of normal weight, 7.9% of overweight and 2.4% of obese children met these cut-off points. Mean pedometer step counts did not differ significantly among body mass groups.

The mean (SD) values for the children's step counts and anthropometric characteristics are shown in Table 1. Mean step counts according to weight status and by school year are presented in Tables 2 and 3 respectively. Results revealed that 28.7% of boys and 46.7% of girls met or exceeded the BMI referenced cut-offs for health of 15,000 steps/day and 12,000 steps/day respectively. In respect to weight status 41.2% of normal weight, 36.4% of overweight and 12.5% of obese children met these cut-off points.

Table 2:
The mean (SD) Values for Anthropometric Characteristics

Race	Gender	Height (m)	Mass(kg)	BMI (kg/m2)
Batek	Boys (n=53) Girls (n=36)	1.27 (.08) 1.26 (.07)	24.3 (8.8) 23.8 (9.5)	15.1 (2.6) 15.1 (2.2)
Malay	Boys (n=19) Girls (n=18)	1.31 (.08) 1.33 (.09)	30.2 (7.1) 32.8 (8.1)	17.5 (2.9) 18.6 (3.5)

Physical Fitness level

Results showed significant different in physical fitness that Batek child exceed good score in cardiovascular endurance for children as suggested by Tomkison, 2003. While rural Malay children stated poor and average score on level in cardiovascular endurance which were 4.3 and 3.9. On muscular endurance, Batek children performed better than rural Malay children for both gender. While in flexibility test, rural Malay children in very good score compare to Batek children that score were poor.

Table 3:
The mean (SD) Values for Cardiovascular Endurance, Flexibility, Muscular Endurance and Steps Count

Race	Gender	Cardiovascular Endurance (Level)	Muscular Endurance (Repetition)	Sit and Reach (cm)	Average Steps (Steps/day)
Batek	Boys Girls	6.3 (2.5)* 5.5 (1.6)*	41.7 (7.2)* 44.5 (10.1)*	10.9(4.9)* 14.4 (4.4)*	19,881 (3823) 17,404 (3049)
Malay	Boys Girls	4.3 (1.2)* 3.9 (0.8)*	33.1 (4.8)* 28.8 (6.5)*	36.78 (8.4)* 41.1 (5.2)*	15,377 (4035) 13,987 (3663)
*p<0.05					

DISCUSSION

In general, the nutritional status of the children attending primary schools in Kuala Lumpur was good with respect to height-for-age and adequacy in several micronutrients examined. These results may be due to the socio-demographic background of the families - most parents having formal education, earning middle level income on average, and with access to affordable health care and exposure to nutrition information in the capital city of Kuala Lumpur.

The prevalence of underweight was lower than previously reported [15]. Nearly all the children (96.6% of boys and 97.3% of girls) had normal height-for-age. A child with normal bodyweight for age is more likely to become overweight or obese if he or she is stunted; however, this was not the case in this study as the prevalence of stunting was low, at less than 5%. This finding is encouraging compared to previous studies. Zalilah et al.[9] reported that as high as 50% of primary school children in Kuala Lumpur were stunted, in a survey of 4212 boys and 3793 girls aged 6-10 years, albeit from low income households [16].

This study however found a high prevalence of obesity in the young children. More than one-third of the children aged 7-12 years were overweight or obese based on BMI-for-age. This finding is higher than that reported by previous studies on children in Kuala Lumpur city. In 2002, Tee et al.[10] reported that 8.4% of primary school children (n = 5,995) in Kuala Lumpur were overweight, based on the WHO 1995 definition [18], while Moy et al.[11] reported 10.1% were overweight, based on BMI-for-age >95th percentile, among 1,320 schoolchildren in the capital city. Differences in definition and criteria used by the various studies may explain some of the different results on excess adiposity in the urban children studied. Notwithstanding that, the high overweight and obesity prevalence in the present study is a matter of public health concern.

Under the assumption that the Batek children lifestyle reflects various aspects in their nomadic lifestyle, it was predicted that Batek children would demonstrate greater physical fitness level possibly because of their lifestyle which may provide more opportunities for activity level and subsequently the development of fitness level than the lifestyle of rural Malay children in Taman Negara, which is believed to be more sedentary.

Body composition measurement (body weight, body mass index) yielded non-significant results. Batek children are less number of overweight because of their lifestyle. Most of the Batek children in the study were normal weight and rural Malay children (18.9%) have over weight and obese when body mass index was compared to age and sex-specific cut off developed by the International Obesity Task Force of World Health Organization [12]. These prevalence estimates are similar to those reported by Tremblay et al. [13] in nationally representative samples of seven to 13 years old Canadian children. The lack of statistical significance in body composition variables between groups may be partially explained by the inherent problems common to skinfold measurements and body mass index in small samples. For example, the triceps skinfold is one of the most commonly used sites for assessment of subcutaneous fat distribution in growth studies [14]. Unfortunately, intra individual and inter individual reliability of skinfold measurements are difficult to establish with reliability decreasing as body fat increases for a given individual [15].

Body mass index is one of the frequently used indices of body composition [16]. However, body mass index is limited because of its derivation from body dimension. Ideally, the definition of body composition should be based on fat [12,17]. Additionally, body mass index has been found to have variables sensitivity, which limited utility in detecting those who are at increased risk for overweight [18]. Nevertheless, in field-based settings and epidemiological studies, skinfolds and body mass index are preferable because of their simplicity of computation and low cost.

To explain the lack of difference in body composition between groups, it should be observed that the difference in physical activity between groups may not have been biologically meaningful and therefore inefficacious in eliciting a more lean body mass among Batek children. The benefits of lifestyle related to activity level on body composition in Batek children were masked by a high fat diet. However, the likely explanation for the non-significance of the body composition variables in this study was no real difference.

From this study, there was a significant difference in body weight status of Batek children determined according to BMI. Underweight was reported to be lower when body mass index was used as the criterion (2.3%) than when body fat classification was used (no under nutrition). In addition, body fat percentage shows a higher prevalence of normal subjects than body mass index. BMI is unable to differentiate between body fat and fat-free mass.

Thus, the reason for the difference in the percentage of overweight/obese subjects determined using different criteria may be that the study population has a high lean body mass relative to their height. This might be due to a high level of physical activity. Thus, these findings were also consistent with the idea that females accumulate fat subcutaneously whereas males do not, whereas age factor specifically determined the linear correlation with BMI. An insufficient food supply can contribute to poor dietary intake.

Previous studies indicated the poor health status of Orang Asli community and infections are still a common burden [19, 20]. In this study, there were low prevalence of underweight and stunting among Batek children compared to rural Malay children that living in same area. When sexes were compare male Malay children state higher prevalence of underweight, stunting and wasting for both race. This is contradict to other studies [21]. Based on three main nutritional problems, stunting or the slowing of skeletal muscle growth of children is stated more prevalent. This result reflects the poor of overall economic conditions and inadequate energy consumptions. The decreasing sources of food from hunting and gathering due to logging activities in the Batek settlement area will also contribute to this finding. Stunting also may result from impaired growth in utero when the fetus is deprived of essential substances during pregnancy.

Wasting also state a low of prevalence among Batek children compared to rural Malay children. Wasting is led to weight loss. But the number of children wasting is less than stunting children. Wasted children need to take immediate intervention from improvised problem because wasting is related to high level of morbidity and mortality.

All the findings may apply to other Batek settlement village. However, this community in unique culture and belief, they chose to refuse from been resettle and still performing nomadic lifestyle. Although the aim of resettling these unique communities is to diverse the culture of nomadic to permanent residence, the process is slow and adequate support must be provided to maintain this unique communities satisfaction.

CONCLUSION

Batek children states better scores in cardiovascular fitness and muscular endurance while rural Malay children performed better in flexibility. The better muscular endurance was attributes in part to the agrarian lifestyle of Batek children. Both group of children attained more than 11000 steps of daily, moderate to vigorous activity levels. However, Batek children states 2,0242 steps more each day. These result may indicates secular deterioration in the activity level of Batek children population that still performed nomadic lifestyle. Any clear benefit in health outcomes as a result of greater activity level was not observed between these two groups in this study.

PRACTICAL APPLICATION FOR COACHES

Various challenges remain for research in physical fitness among children in Malaysia. New and more precise data are required. Additionally, how children accumulate their activity needs to be quantified and whether one pathway is more protective against chronic disease such as coronary heart disease than the others remains to be determined. All of these studies need may be addressed most adequately by resource to a longitudinal approach of research in which participants are followed prospectively.

APLIKASI PRKATIKAL UNTUK JURULATIH

Berbagai cabaran akan dihadapi dalam kajian berkaitan dengan kecergasan fizikal di kalangan kanak-kanak di Malaysia. Data baru dan yang lebih mendalam adalah diperlukan. Tambahan pula, bagaimana kanak-kanak mengumpulkan kehendak aktiviti mereka haruslah di kuantitikan dan samada satu hala tuju adalah lebih berkesan dalam mengawal penyakit kronik seperti sakit jantung. Semua kajian ini harus diketengahkan untuk memberi maklumat kepada kajian yang berpanjangan dimana peserta yang mengikuti selama ini.

ACKNOWLEDGMENT

We would like to express our gratitude to the community of Batek, all the children who participated in this study and Department of Orang Asli Development (JAKOA) for their permission to carry out this study. The authors gratefully acknowledge Prof. Madya Dr. Anuar Suun, En. Alias of JAKOA and Miss Nazratul Husna of UiTM for their help in this study.

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THE EFFECTS OF ATTENTIONAL FOCUS INSTRUCTIONS ON LEARNING STROKES IN SQUASH

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ABSTRACT

The effects of internal versus external focus of attention instructions and feedback on performing service and drop shot in squash were evaluated among 30 male right-handed college students(M age = 20.03 ± 0.96). The participants were randomly assigned to two group, Internal Focus (IF, n=15) and External Focus (EF, n=15) based on the pre-test scores of 10 shots for each of the skills. The EF group received instructions and feedback regarding the trajectory of the ball and target on the front wall whereas the IF group on body movements with the swing of racket. Separate 2 Group (IF, EF) x 2 Test (Pre, Post) ANOVAs with repeated measures on the second factor (i.e., pre and posttests) were used to determine the effects of the different attentional focus instructions on performing the lob serve and drop shot. Although both EF and IF groups improved in both skills after the acquisition periods, the EF group improved significantly in the post-test, 71% and 84% for the lob serve and drop shot respectively, compared to 47% and 41% with the IF group. External focus of attention instructions and feedback are more effective for teaching both self-controlled and interceptive skills.

KEYWORDS : focus of attention, self controlled skill, interceptive skill, squash.

INTRODUCTION

Instructions can be an effective means of conveying goal related information, and educators commonly use them to teach and refine motor performance at all levels of skill [6, 19]. Traditionally, it has been a popular opinion in sports coaching to acquire and execute particularly complex motor skills, a performer must know what he or she is doing. Termed as declarative knowledge, an integral part required during the initial stages of learning. The early stage, where the learner is trying to figure out what to do and how to produce the correct movement, is typically attention demanding and characterized by conscious and effortful information processing. Only when the learner becomes proficient can performance take place automatically without reference to this explicit reservoir of information [14]. Prinz [15] suggests that for actions to be effective, movements need to be planned in terms of their intended outcome. The "action effect hypothesis" suggests that the attention focused on the intended outcome of the performance of a skill will be more effective than attention focused on one's own movements. This theoretical approach has been to consider the attentional focus of the learner. Evidence regarding the best practice for providing feedback, specifically as it relates to the focus of attention when executing motor skills, has emerged [31].

To facilitate the learning process, instructions and feedback are typically given that direct the learners' attention to various aspects of their

movement coordination. The effectiveness of instructions in motor skill learning has been found to depend largely on the focus of attention they induce [25, 26, 29, 30, 32]. In these studies, the effectiveness of directing the learners' attention to their body movements (internal focus attention) was compared to that of the learners directed to focus their attention on the effects of their movements on the apparatus or implement, termed as the environment (external focus of attention).

Wulf et al. [25] first reported the efficacy of external focus instructions in skill acquisition study where novices, who had no prior experience of the tasks, learned how to perform multi-articular movements. In the study, the goal of the task was for participants to stand on a platform of a ski-simulator and to rhythmically move it in the transverse plane as far as possible by making slalom-type movements. An internal focus group was instructed to focus on exerting force on their feet when performing the task (i.e. internal focus instructions). An external-focus group was required to focus on exerting force on the wheels of the ski simulator (i.e. external focus instructions). A control group did not receive any instructions. Results showed that the external focus group performed the action better across two days of practice than the internal focus group. Intriguingly, results showed that the internal focus instructions group was not only less proficient than the external focus instructions group but also less proficient than the control group which had not received instructions.

In the study conducted by Zarghami, Saemi & Fathi [36], the researchers examined the effects of an external focus and internal focus attention on discus throwing. 20 male undergraduate students had limited experience with the task completed five maximum effort trials under each attention focus condition (external and internal). The results revealed that participants had a significantly more effective performance in external focus of attention condition compared with the internal focus, where the throwing distance for external score average 20.49m and 19.37m for the internal focus of attention. These findings are in line with the previous studies showing enhanced motor performance as a result of giving external versus internal focus of attention.

Evidence for the learning advantages of inducing an external focus of attention have also been found for sport skills involving the acquisition of a soccer throw-in [24], tennis ball toss [16], golf putting [5], gymnastics routine [8], Frisbee throwing [13], and dart throwing [9]. However, there are numerous variables that must be considered which may influence the overall effectiveness of the external focus of attention type of instructions and feedback.

External focus attention proved benefits to task which requiring maximum power production. Wulf, Zachry, Granados & Dufek [35] examined the effects of external versus internal focus of the attention on vertical jump-and-reach task. The participants performed under three conditions which were external focus (i.e., focus on the rungs of the measuring tool that were to be touched), internal focus (i.e., focus on the finger, with which the rungs were to be touched), and control conditions (i.e., focus on jumping as high as possible). The result showed that participants' jump-and reach height was greatest with external focus scored 6.08cm compared to an internal focus 5.23cm, and control condition 5.21cm. This suggests that participants jumped higher by producing greater forces when they adopted an external focus.

In term of physiological performance, Schücker, Hagemann, Strauss, & Völker [17] examined the attentional focus influence on running economy. For the three consecutive 10 minutes periods, runners had to focus on running movement (internal), on breathing (internal), and on their surroundings (external) while running on a treadmill. Results showed an increased running economy in the external focus condition where the consumption of oxygen in this condition were 39ml/kg/min, which is lower compared to internal focus: running movement condition, 40.81ml/kg/min and internal focus: breathing condition at 42.80ml/kg/min. The results founded are in line with the research on motor control.

Freedman, Maas, Caligiuri, Wulf, & Robin [4] investigated whether the effects of attentional focus on limb performance would also occur in the oral-facial system. 23 participants were administered both hand and tongue impulse force control tasks after randomly assigned either an internal or external focus of attention. Participants were required to exert rapid pressure bursts to achieve a target force level of 20% of their maximal strength. The findings showed a significant advantage of an external focus for both hand and tongue control tasks, as opposed to an internal focus of attention.

Wulf & Su [33] reported the same effect in novice and expert golfers performing a chipping task. They showed that instructions inducing an external focus (in their study, on the motion of the club) resulted in significantly higher accuracy scores, irrespective of the skill level of the participant, when compared to either an internal focus (on the motion of the participant's arm), or in a condition providing no instructions for attentional focus (control condition).

Also, the comparative learning benefits of an external over an internal focus of attention appear to hold for a variety of tasks. The advantages of an external focus instructions have been attributed to performers' use of more automatic control processes when attending to the movement effect than when attending to the actual movements [29, 32].These findings have been replicated and extended in further studies involving the acquisition of a basketball free throw [1], a suprapostural task [12], a standing balance task [18], a biceps curls task [21], golf-chipping [26], volleyball serving [28], and tennis forehand [27]. However, to our knowledge, no research has been conducted on the influence of attentional (internal vs. external) focus instructions in squash.

Much has been learned about the benefits of attention focus when executing a skill, but there is still much to be learned about where to direct one's attention when performing motor skills for optimal performance [2]. The majority of literature on the subject of movement effects versus actual movements indicates that external focus is more effective when performing a motor skill or a specialized sport skill. However, there are numerous variables that must be considered which may play a factor in overall effectiveness of using an external focus. One variable of interest needing further investigation relates to self-controlled versus interceptive motor skills. While interceptive motor skills involve an unpredictable environment where the environment, person and/or object are in motion, self-controlled skills involve less variability where the environment, person and/or object are stationery. Because of a great deal of variability, interceptive skills are more difficult to perform than self-controlled sport

skills so where to focus attention may be different. Hence, more studies need to be conducted using various interceptive skills in numerous sport settings along with exploring attention preferences to determine if an external focus of attention is more effective than an internal focus for skill acquisition.

Thus, the primary aim of this study was to investigate the effects of attentional focus instructions on squash players when acquiring the lob serve and drop shot. The secondary aim of this study was to examine the relative effectiveness of attentional focus instructions on a self-controlled skill (i.e., lob serve) and an interceptive skill (i.e., drop shot).

We hypothesised that the external focus group would perform significantly better than the internal focus group in performing the lob serve and drop shot. Furthermore, the external focus instructions would be more effective for self-controlled skill compared to interceptive skill.

METHODOLOGY

Participants and preliminary testing

Thirty male (M = 20.03 years of age ± SD = .96) right-handed college students volunteered to participate in the study. All participants provided informed consent prior to data collection. All participants were considered to be novices as they had never played squash on a regular basis. They were not aware of the specific purpose of the study. All participants undertook a skill test (i.e., service and drop shot) prior to commencement of the experiment. The pre-test scores of 10 shots for each of the skill were used to assign the participants randomly to two groups, Internal Focus (IF, n=15) and External Focus (EF, n=15). The pre-test results obtained shown that there was no significance difference between EF Group and IF Group in both skills, where $t(28) = .852$. $p>0.05$ for lob serve and $t(28) = .585$, $p>0.05$ for drop shot.

The participants completed two weeks of squash serve and drop shot training on a thrice a week basis, 10 shots with three blocks per skill per session, with a rest interval of one minute between blocks. The practice sessions were conducted by two experienced squash coaches. The coaches were briefed separately to apply coaching instructions for the internal and external focus groups. Performance tests were conducted in a college's squash courts. Pre-test was conducted before the commencement of the training phase. Post-test was conducted two days after the training period. Two days later, participants performed a retention test consisting of 10 trials for each skill. They received no instructions during the test.

Experimental design

The participants were required to perform two skill tests, which were the squash lob serve and drop shot. The first task involved participants performing the self-controlled sport skill which is the lob service from the right service box. The ball must strike the front wall above the service line and below the outline and land in the opposite quarter of court. In the second task, the participants performed drop shot where the ball is hit softly just above the tin, landing close to the front wall and tight to the side wall. This task was chosen because it is an interceptive sport skill which requires the participants to react to the ball fed by the instructor

from the back of the court. In the first session, each participant performed 10 services and 10 drop shots with five to ten seconds of break between trials for holding of pre-test. These 20 trials were recorded as pre-test scores.

Scoring: Lob Serve

Points are awarded according to where the balls strike in the scoring grid shown in Figure 1. The innermost rectangle is worth three points, the outer rectangle worth two, and anything outside the rectangle but within the opposite quarter worth one point. The score is the total for 10 shots. Ball striking below the service line, above outline or striking the side wall before reaching the front wall earns no points.

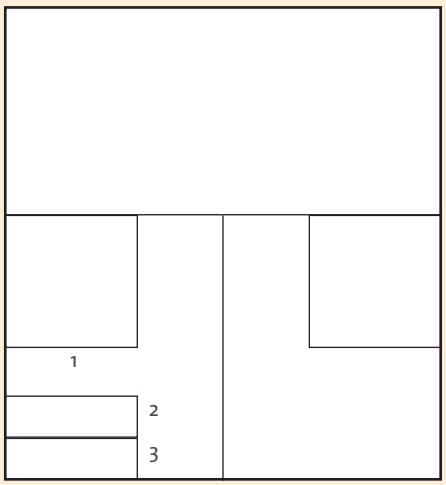


Figure 1.
Lob Serve Scoring Grid

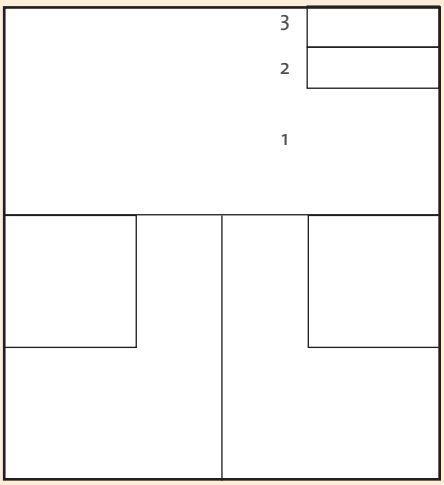


Figure 2.
Drop Shot Scoring Grid

Skills	Internal Focus Instruction Cues	Meaning
Lob Service	Toss low	Ball toss to be lower than the shoulders
	Underarm swing	Use a low underhand swing
	Racket face open	Open racket face when contacting the ball
Drop Shot	Short backswing	Short backswing
	Racket face slightly open	Keep the racket face a little more open
	Touch the ball	Push the racket through the ball

Table 1.
Internal focus instruction cues.

Skills	Internal Focus Instruction Cues	Meaning
Lob Service	Aim one racket below outline and center	Focus on target point about 0.5m below the outline and center on the front wall
	Cling high to the side wall	Make sure the ball cling high to the sidewall
Drop Shot	Just above the tin	Aim about 1 feet above the tin near the right corner of the front wall
	Low and tight	Make sure the ball drop low and tight to the side wall at the front wall

Table 2.
External focus instruction cues

Participants performed 10 shots with three blocks per skill, with a rest interval of one minute between blocks. They were also reminded of their attention focus goal in every each of practice sessions. All participants followed the same warm up prior to each practice session and the serving practice was done immediately following the five minute warm up period, followed by the drop shot practice. Following the last practice session and after two days of rest, the participants performed the post-test which was conducted in the same manner as the pre-test.

The quality of lob serve and drop shot test were assessed by two independent squash coaches, qualified with a Squash Coaching Level One license, awarded a score as referred to the scoring grid, with the highest score indicating perfect performance. The data of all 30 participants together were used to calculate the correlation (Pearson Correlation) between the scores of the two coaches for each test period. The correlation between the movement form raters was 0.725 for the pilot test, 0.824 for the pre-test, and 0.735 for the post test. In order to verify the reliability of these correlations Cronbach's Alpha was calculated. Cronbach's Alpha was 0.756 for the pilot test, 0.849 for the pre-test, 0.819 for the retention test. For each test period Cronbach's Alpha was over 0.7 which was considered excellent. Thus, the mean point scores of each participant for each test period and for each group were calculated and then the score of each coach was averaged.

Data analysis

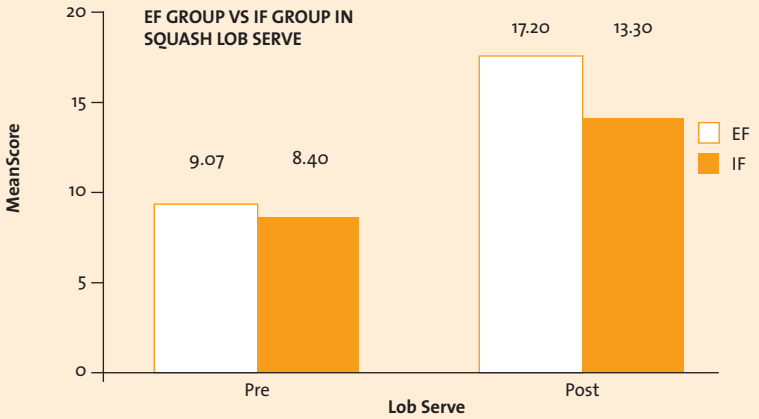
The results for pre and post-test were collected and the interval period between pre and post-test for internal and external focus group is three weeks. The data was analyzed using statistical software Predictive Analysis Software, Version 17.0 (PASW, Inc, Chicago, IL). Pre-test data was compared to the post-test, and comparison of data between pre-test and post test were through descriptive analysis to determine the mean and standard deviation. Separate 2-way mixed between-within subjects ANOVAs with repeated measures on the second factor (i.e., pre and post tests) were used to determine the significance between the internal and external focus group on service variable and drop shot variable. Statistical significance was set at $p<.05$.

RESULTS

The data collected is determined mean scores for EF Group and IF Group in the squash lob serve (Graph 1) and drop shot (Graph 2) pre- and post-test.

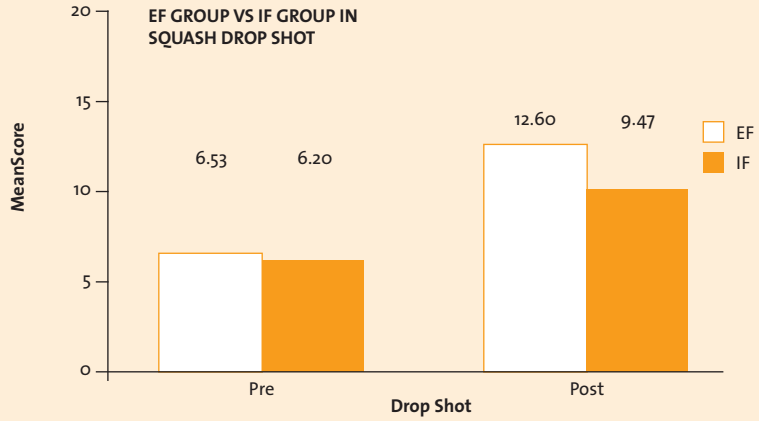
Descriptive Statistics

Graph 1.
Descriptive statistics of lob serve mean scores pre- and post-test for both EF group and IF group.



Graph 1 showed that the mean scores of lob serve for both EF group and IF group in pre- and post-test. From Graph 1, the mean score for EF group was slightly higher compared to IF group in the pre testing. However, after two weeks of lob serve training, the EF group shown a greater increment in lob serve mean score compared to IF group. Where the improvement for the EF group was eight points when compared between the pre-test ($M= 9.07\pm 2.28$) and post-test ($M= 17.20 \pm 2.20$), and five points increment seen in IF group when comparing between pre-test ($M= 8.40 \pm 2.00$) and post-test ($M= 13.30 \pm 2.00$). There were significant main effects for groups ($F_{1,28} = 10.09$, $p<0.05$) and tests ($F_{1,28} = 467.67$, $p<0.05$). However, both main effects were due to a significant interaction ($F_{1,28} = 28.05$, $p<0.05$). Both groups improved in their lob serve, but the EF group's post test scores was significantly better than the IF group's performance.

Graph 2.
Descriptive statistics of drop shot mean scores pre- and post-test for both EF group and IF group.



Graph 2 showed that the mean scores of drop shot for both EF group and IF group in pre- and post-test. From Graph 2, the mean score for EF group was slightly higher compared to IF group in the pre testing. However, after two weeks of drop shot training, the EF group shown a greater increment in drop shot mean score compared to IF group. Where the improvement for the EF group was seven points when compared between the pre-test (M= 6.53 ± 1.55) and post-test (M= 12.60 ± 2.30), and only three points increment seen in IF group when comparing between pre-test (M= 6.20 ± 1.57) and post-test (M= 9.47 ± 1.55). There were significant main effects for groups ($F_{1,28}$ = 9.89, $p<0.05$) and tests ($F_{1,28}$ = 190.82, $p<0.05$). However, both main effects were due to a significant interaction ($F_{1,28}$ = 17.17, $p<0.05$). Both groups improved in their drop shot, but the EF group showed significant improvement after the intervention.

DISCUSSION & SUGGESTION

Discussion

The main purpose of this study was to determine if an external focus instruction would be better than an internal focus instruction when performing squash skills. In previous research [10, 18, 26], it has been shown that external focus of attention is more beneficial than internal focus of attention for other sports skill acquisition. This study investigated whether this also was true for squash.

The results from analysis showed that there is a significant interaction for both groups and tests ($F_{1,28}$ = 28.05, $p<0.05$). This contrary to some previous research [33] where it was expected that an internal focus of attention in instruction would be more beneficial than external focus instructions at the coordination stage of learning because learners are seeking to assemble a basic pattern of coordination between relevant body parts [20]. In this study, a significant improvement was found in both groups, where for the EF group was 8 points when compared between the pre-test (M= 9.07± 2.28) and post-test (M= 17.20 ± 2.20), and 5 points increment seen in IF group when comparing between pre-test (M= 8.40 ± 2.00) and post-test (M= 13.30 ± 2.00) in lob serve test. On the other hand, the EF group obtained the increment of seven points in drop shot test, whereas IF group obtained mean score of three points when comparing between pre-test and post-test in drop shot. This finding indicated that the participants of both EF group and IF group improved their performance in both skills after the acquisition periods.

However, the advantage of the EF group was clearly evident during the post-test, where their performances were increase by 71% for lob serve, and 84% in drop shot, whereas improvements of 47% in lob serve and 41% in drop shot were found in IF group. Our results reinforced previous findings regarding the advantage of external focus of attention (focus on the action effects) over internal focus of attention (paying attention to the body movements) in squash. This replicated the results of a number of recent experiments using laboratory [18,25], and sports-type tasks [10, 26, 27]. The external focus instructions were found to be more beneficial than internal focus instructions because it helps performers to understand the effects of varying (or controlling) the basic patterns of movement on performance. Based on this research finding, the benefit of an external focus on learning appears to be a stable finding.

In several of previous sport skill studies, the majority of the motor skills investigated were self-controlled rather than interceptive motor skills.

Such as basketball free throw [1], golf pitch shot [26], putting [14] and the standing soccer shot [28]. Thus, our second purpose for this study was to compare whether attentional focus instruction would enhance more in self-controlled skill (i.e., lob serve) or in interceptive skill (i.e., drop shot). Through the result of comparing attentional focus instructions in self-controlled skill (i.e., lob serve) and interceptive skill (i.e., drop shot), EF group shown a greater improvement in drop shot compared to lob serve with a different of 13% higher than in lob serve. On the other hand, IF group showed to have a greater improvement in lob serve, which it was 6% higher than the result they achieved in drop shot. When comparing within the groups, EF instructions were found to improve more in interceptive skills, and IF instructions were found more beneficial in self-controlled skill. However, it should note that both skills did improve with practice. In present study, practical significance was found for practicing the serve and drop shot using either an external focus of attention or an internal focus. Thus, it could conclude that both self-controlled and interceptive skill did improve with attentional focus instructions.

Suggestion

Although our study's sample was sufficient to provide information on the attentional focus effects for the squash lob serve and drop shot, future studies using participants of greater ranges of experience and skill levels would provide more information about the impact of these factors on the dependent variables.

Besides, we found that most studies examined attentional focus effects on motor performance and learning comparing internal and external focus conditions, only a few included control conditions without attentional focus instructions. In those studies, internal focus and control conditions resulted in similar performances, whereas an external focus produced superior performance or learning. This suggests an external focus enhances motor performance, whereas an internal focus neither enhances nor degrades performance compared to no attentional focus instructions (control condition). Thus, we suggest future studies may include the control group with the same task in order to verify that an external focus of attention is actually more advantageous for learning than internal focus and control conditions, vice versa. This is because the controls give a baseline against which to compare experimental results. Also, it is to prevent the investigators to form clear conclusions regarding the positive or negative effects of the attentional manipulations.

PRACTICAL APPLICATION FOR COACHES

Overall, the present study adds to the current state of knowledge by reporting that both attentional focus instructions (internal and external) seem to benefit early learners performing squash serve and drop shot. But the external focus instructions affect a better improvement in squash novices in learning the skills. Moreover, the finding in this study showed that the attentional focus instructions were not only enhanced the learning for self-controlled skill but also in interceptive skill.

APLIKASI PRAKTIKAL UNTUK JURULATIH

Secara keseluruhan, kajian ini telah menyumbang kepada pengetahuan bidang ini dengan melaporkan bahawa fokus pemerhatian (dalaman dan luaran) akan mendatangkan faedah kepada pemain baru dalam mempersembahkan servis dan drop shot. Walaubagaimanpun, fokus pemerhatian arahan memberi kesan yang lebih nyata dalam peningkatan dalam pembelajaran kemahiran. Tambahan pula,hasil kajian ini

juga mendapati focus pemerhatian arah juga dapat meningkatkan pembelajaran dalam kemahiran kawalan dan juga kemahiran interceptive.

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MY AUTOGRAPH

Take a break and pen your thoughts

LATAR BELAKANG

CORAK SAUJANA SDN BHD DITUBUHKAN PADA 1999. KAMI ADA LEBIH DARI 10 TAHUN PENGALAMAN DALAM BIDANG PERCETAKAN DARI SEGI KUALITI, KECEKAPAN DAN HARGA YANG BERPATUTAN. SYARIKAT KAMI MERANGKUMI PENGENDALI-PENGENDALI MESIN DAN PENGURUSAN BUMIPUTERA.

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  Sila menghubungi pihak kami menerusi emel beserta dengan spesifikasi percetakan

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