Abstract—This study compared the effects of internal, external and control focus of attention instructions on high intensity (85% 1RM) bench press and deadlift performance. Thirty male recreationally active patrons of a fitness centre volunteered for the study. Participants performed both exercises under three conditions (i.e. internal, external and control focus of attention) conducted in a randomized order. Participants performed all exercise to momentary muscular failure (MMF) and the repetitions were analysed to be compared between each conditions. Participants were instructed to focus on the movement during internal focus conditions while were instructed to focus on the barbell during external focus conditions. Control group were not receiving any focus attention instruction. Repeated measure multivariate analysis of variance (MANOVA) was used to analyse the repetitions performed following the instructions provided. Results showed that the types of instruction significantly affect the repetitions to failure of both the bench press and deadlift exercises. Participants perform significantly more repetitions during external focus instruction compared to control (p<0.001) and internal focus instruction (p<0.001) for both bench press and deadlift exercises. Participants were also shown to perform significantly more repetitions during control instruction compared to internal instruction (p<0.001) for both bench press and deadlift exercises. Results from this study suggest that externally focused instructions improve performance on maximum strength training while at the same time the internal focus instructions will decrease performance.

Keywords: focus of attention, instruction, repetition maximum, resistance training.

I. INTRODUCTION

A verbal instruction is one of the communication ways for a coach to the athlete.

Using verbal instructions, coaches can directly give information on what the athletes need to do during training or in the game. An effective verbal instruction is believed to benefit athletes’ progression during training that can possibly bring positive outcomes during games. Unfortunately, ineffective verbal instruction might possibly destruct athletes’ learning process that might cause undesirable outcomes during games.

One of the research focuses on verbal instruction is on its influence in manipulating an individual’s focus of attention throughout the task performed [1]. Previous researches have consistently demonstrated that the focus of attention implemented during task greatly influences on the task’s performance [2]. Moreover, Porter, Wu [3] on their study of track and field athletes has reported that athletes did direct their focus of attention based on their coach’s instructions and they did not learn or choose the most effective attention focus by themselves. This showed that the verbal instructions from coaches will absolutely played important roles in determining or changes the focus of attention among their athlete that is believed will affected the outcome of the task.

Focus of attention refers to what the individual choose to focus during task execution. Three types of focus of attention have been identified to be adopted by individuals during task execution (i.e., control, internal and external focus of attention) [1]. Internal focus attention involve the focusing on individual’s own body whereas external focus attention involve the focusing on effects of movements or specific features in the environment during the execution of the task [4]. A neutral focus of attention refer to the automatically executing a task without overt mental effort or attentional awareness directed to the performance of the task [1].

Over a past decade, it has been a popular opinion in sports coaching that a performer must know what they are doing to acquire and execute a particular complex motor skill. Coaches usually used instructions that direct the athletes’ attention to their body coordination while learning and mastery a skill [5].

However, evidence is accumulating to show that the used of internal focus is not the most productive method of acquiring a motor skill and produce better performance in a specific task. In recent years, numerous studies had been conducted on comparing the effectiveness of internal versus external focus attention for sports skills execution [5-10] and the findings were consistent showing the superiority of external focus of attention.

The benefits of adopting an external focus of attention have been explained with the constrained action hypothesis [7]. Based on this theory, it is suggested that internal focus interferes with the autonomic motor control process and is attentionally demanding while external focus causes the motor control systems self-organize more naturally and the process is more automatic. Performing a task with internal focus might cause disruptive effects to the motor system that might cause a reduction in task performance. In contrast, performing a task with external focus will allow quick and reflexive motor system processes that might enhance task performance [11].
In a within-participant design study conducted by Zachry, Wulf [12], they have found free throw accuracy was significantly higher when performers focused externally rather than internally. This was in line with the findings of previous between-groups study that were also conducted to find the effects of focus of attention on free throw score. This has showed that despite differences of study design, focussing externally did improved performance compared to internal focus of attention [13].

Study by Marchant, Clough [8] conducted on the novice dart throwers aim to determine the effects of focus attention on dart throwing have found that external focus groups were more accurate compared to the internal focus groups. However, interesting findings have been found in this study where the control group’s performance were similar to the external group and was more accurate compared to the internal focus group. These findings demonstrated the effectiveness of external focus on improving performance might be task-dependent in which some skills could be well performed without any focus instruction.

Study of attentional focus had also been conducted on American football field goal kicking [14]. The study involved participants that had never experienced kicking a football. After given a technique demonstration, participants performed the kicks with three focus conditions (i.e. internal focus, external focus and control) conducted on counterbalanced order. Results showed the external focus condition promote significantly higher kicking accuracy followed by internal focus and control conditions.

As many studies on the focus of attention had been conducted on sports skills, the study of attentional focus on resistance training was not so intensive. Vance, Wulf [15] in their study instructed the participants to performed biceps curl task with either internal or external focus of attention. The results showed that EMG activity was significantly higher for the internal focus condition compared to the external focus condition. As the results indicated no significant difference in performance, this showed external focus attention produce greater movement efficiency. More interestingly, EMG activity was not only decreased in the agonist muscles (i.e. biceps), but also in the antagonists muscle (i.e. triceps). The authors suggested that the increment of movement efficiency was not only due to the more effective recruitment of muscle fibers within a muscle, but also through enhanced coordination between muscles. Additionally, the effectiveness of external focus attention has also been shown to reduced EMG activity even when compared to the ‘natural’ control condition [16].

A recent study [17] investigated the effects of attentional focus instructions on maximal repetition of three types of resistance training (i.e., assisted bench press, bench press and free squat at 75% of 1-Repetition Maximum (RM)). Twenty three participants performed assisted bench press test on a Smith’s machine. Focussing externally resulted in significantly better performance compared to the internal focus attention, but not the control condition. Seventeen participants performed bench press and squat exercises at 75% 1RM. External focus of attention again resulted in significantly better performance compared to the control and internal focus conditions in both tasks [17].

Although external focus has been demonstrated to support better performance across a variety of skill levels, there exist some inconsistencies regarding performance and internal focus. Specifically, some studies have found increased novice task performance while adopting an internal focus [18, 19]. Additionally, majority of the research conducted on comparing the effectiveness of focus of attention has been directed to the sports skills execution [5-10] whereas not many study been conducted on the resistance training task especially on high intensity resistance training. It is important to have an investigation into this area as the ability to execute better performance during high intensity resistance training will further improve maximum strength that is going to be advantageous for athletic performance. Thus, the objective of this study was to compare the effects of internal, external and control focus attentions instruction on repetitions of high intensity resistance training exercises. Bench press and deadlift were chosen as the tests in this study due to the popularity of the exercises to be included in majority of trained populations. 80% 1RM were chosen as the intensity to be used as it has been shown that this intensity should be used by trained populations to maximize strength gains [20].

II. METHOD

A. Participants

Thirty male recreationally active patrons of a fitness centre volunteered for the study (M age= 21.60, SD= 1.45 years). At the time of testing, all participants had been engaging in resistance training at least three times a week and had incorporated bench press and deadlift exercises into their training for at least six months. Before participation, and as part of familiarization, all participants were assessed and subsequently advised on demonstrating proper bench press and deadlift technique.

B. Procedure

The experiment was conducted at a well-equipped physical conditioning center. All participants were not told about the purpose of the study as to make sure the outcome was from the desired objectives (instruction and focus of attention). All participants were not alcohol consumer and were instructed to refrain from any exercise at least 48 hours and avoid caffeine intake for at least 24 hours before testing. Participants were also asked to arrive for testing appropriately hydrated and at a minimum of three hours postprandial to avoid gastronomic discomfort. The Physical Activity Readiness Questionnaire [21] was used to check the readiness of participants to participate in the study. The informed consent was obtained before participation, and participants were fully debriefed upon completion.

The participants reported to the testing setting on four separate occasions. Participants were tested on four days interspersed with 72 hours rest to allow for full recovery and to avoid from contamination of test results due to inadequate recovery from earlier tests. The first test session was the multiple-RM test in which 6-8 RM had been chosen as the required repetitions needed to be lifted by the participants. The other test sessions were the experimental sessions in which the participants were tested for bench press and deadlift
performance during control, internal and external focus instruction. All the experimental tests were conducted in randomized order to minimize order effects.

Prior been tested, participants had a 5 minutes light cardiovascular exercise and 50% 1RM of the exercises that were going to be tested on that day. During 1RM and experimental testing sessions, cadence was not controlled, but all participants were instructed to perform movements in a controlled manner. Failure was defined as an inability to complete a full movement repetition (bar movement ceases, or full extension not possible), or the failure to conduct such a movement in a safe manner with proper form (supervised by an appointed experienced trainer). All the mass of all weights and bars used were determined using a precision scale.

C. Multiple-RM test

As a precautionary measure to avoid potential injury, multiple-RM tests were used to predict the 1-RM of the participants’ bench press and deadlift exercises. The participants were instructed to perform the multiple-RM test until momentary muscular failure occurred between six and eight repetitions. The participants based their attempts on the amount of weight they had been lifting during their regular training sessions with the agreement from the main researcher. If the participants were able to lift more than 8RM, the load was increased i) 5% to 10% for bench press exercise or ii) 10% to 20% for deadlift exercise. The number of repetitions performed and the amount of weight lifted were recorded and then converted to a 1-RM using the Wathan prediction equation [22]. The Wathan equation was chosen because of its accuracy and reliability in predicting a 1RM [22]. The multiple-RM was determined in fewer than three trials with five minutes rest interval between each trial. During testing, all participants received a standardized instructions on the testing procedure with standardized verbal encouragement were provided during the test.

D. Bench press

A Cybex bench station, a calibrated UESAKA bar, calibrated UESAKA and Olympic weight plates and calibrated locks were used for bench press exercise. The testing procedures involved the protocols as mentioned by Baechle and Earle [23]. After adjusting the desired amount of weight on the bar, participants assumed a supine position on the bench and two spotters place the bar in their hands and across the chest. With the hands approximately shoulder-width apart, the participant extends the arm, pressing the bar to a “locked out” (elbow straight) position. Starting positions were standardized, with participants positioning themselves with the bar at nipple height when in the lower position at the chest. The two spotters remove the bar on completion of the trial.

Participants were needed to perform 80% 1RM of bench press exercises as many repetitions as they can in each conditions (control, internal and external focus). Instructions for each condition were developed in line with the previous review of Makaruk and Porter [1] on the focus of attention for strength and conditioning training. To minimize possibility of inconsistencies in instructions that were thought might affect the attention of the participants; all tasks were instructed by the same instructor. During control conditions, participants were not given any instructions regarding focus attention but just instructed to “perform as many repetitions as possible”. The control instructions were also used for both internal and external focus conditions. During internal focus conditions, participants were instructed to “focus on exerting force with the arm” whereas in external focus conditions, participants were instructed to “focus on exerting force through and against the barbell”. Instructions were provided verbally before the execution of the task, and the participants were stressed to follow the instructions throughout the task.

As the participants were observed to approach failure, the instructor provided additional instructions based on the testing conditions. During control condition, participants were provided with “go for more repetitions” instruction while during internal focus condition, participants were instructed to “concentrate on pushing your arms”. In contrast, during external focus condition, participants were instructed to “push the bar up”.

Approaching failure refer to the condition where participants were seen to have deterioration in lifting technique and at the same time participants were seen to only able to lift about two more repetitions. An experienced instructor was appointed for this task of evaluating the approaching failure among the participants. It is important to be aware of this “approaching failure” as it is believed that during this condition, participants were likely to shift their focus from what had been instructed [17], (e.g. during internal focus condition, participants shift their focus from focusing on the arm to focus on the barbell while during external focus condition, participants shift their focus from focusing on the barbell to focus on the arm).

E. Deadlift

A calibrated UESAKA bar, calibrated UESAKA and Olympic weight plates and calibrated locks were used for deadlift exercise. The testing procedures involved the protocols as mentioned by Baechle and Earle [23]. After adjusting the desired amount of weight on the bar, participants take into position with the legs approximately narrower than shoulder-width, to allow for comfortable arm placement. The starting position was set to be the position where the plates were touching the floor. Participants extended their knees and hips while pulling the bar with a “locked out” (elbow straight) position. During downward movement, participants were instructed to keep the bar near their legs and just let the plate slightly touch the floor before continue another repetitions until momentary muscular failure (MMF).

The protocols for deadlift test were conducted in much similar to the bench press test with just adjustments to the focus instructions provided during the internal and external focus conditions. During internal focus conditions, participants were instructed to “focus your attention on extending your knees and hips” whereas in external focus conditions, participants were instructed to “focus your attention on pulling the bar up”. Instructions were provided verbally before the execution of the task, and the participants were stressed to follow the instructions throughout the task.

As the participants were observed to approach failure, the instructor provided additional instructions based on the testing
conditions. During control condition, participants were provided the same instruction as during bench press test while during internal focus condition, participants were instructed to “extend your knees and hips”. In contrast, during external focus condition, participants were instructed to “pull the bar up”.

F. Statistical analysis

Descriptive statistics were used to measure the physical characteristics and mean score. Repeated measures multivariate analysis of variances (MANOVA) was used to examine differences in bench press performance. Statistical significance was accepted at an α-level of \( p \leq 0.05 \). All statistical analyses were conducted using SPSS version 23 (IBM, New York, USA).

III. RESULTS

Thirty participants has involved in this study. Table 1 presented the mean (M) and standard deviation (SD) of participants’ age, height, weight and 1RM score.

<table>
<thead>
<tr>
<th>TABLE I: PHYSICAL CHARACTERISTICS OF PARTICIPANTS</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>30</td>
<td>21.67</td>
<td>1.06</td>
</tr>
<tr>
<td>Height (m)</td>
<td>30</td>
<td>168.56</td>
<td>3.64</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>30</td>
<td>66.32</td>
<td>3.40</td>
</tr>
<tr>
<td>Bench press 1RM</td>
<td>30</td>
<td>75.46</td>
<td>4.46</td>
</tr>
<tr>
<td>Deadlift 1RM</td>
<td>30</td>
<td>143.24</td>
<td>1.40</td>
</tr>
</tbody>
</table>

N = number of participants, M = mean, SD = standard deviation

Table 2 showed the mean and standard deviation of the participants’ score in control, internal and external conditions. Repeated measure multivariate analysis of variance (MANOVA) was conducted to assess the different scores among conditions. A significant main effect was obtained for bench press exercise, Wilk’s Lambda = 0.180, \( F(2,28) = 63.778, p< 0.001 \), partial eta squared = 0.820 (large effect size). A significant main effect was also found for deadlift exercise, Wilk’s Lambda = 0.087, \( F(2,28) = 146.858, p< 0.001 \), partial eta squared = 0.913 (large effect size). To analyse specifically the different between each conditions, Post hoc analysis was conducted through Bonferroni correction. Based on the results, it has been shown that participants perform significantly more repetitions during external focus condition compared to control (\( p< 0.001 \)) and internal focus instruction (\( p< 0.001 \)) for both bench press and deadlift exercises. Participants were also shown to perform significantly more repetitions during control instruction compared to internal instruction (\( p< 0.001 \)) for both bench press and deadlift exercises.

<table>
<thead>
<tr>
<th>TABLE II: MEAN AND SD OF REPETITIONS ACHIEVED</th>
<th>Mean BP-reps</th>
<th>SD</th>
<th>Mean DL-reps</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.77</td>
<td>0.67</td>
<td>7.77</td>
<td>0.16</td>
</tr>
<tr>
<td>Internal focus</td>
<td>6.73</td>
<td>0.74</td>
<td>6.90</td>
<td>0.12</td>
</tr>
<tr>
<td>External focus</td>
<td>8.50</td>
<td>0.93</td>
<td>8.70</td>
<td>0.16</td>
</tr>
</tbody>
</table>
| \( a = \) significantly different with control focus instruction \| \( b = \) significantly different with internal focus instruction

IV. DISCUSSIONS

The main aim of the study was to compare the effects of different focus of attention (i.e. internal focus, external focus and control) instructions on 80% 1RM bench press and deadlift performance among recreationally active resistance trained populations. Participants were generally asked to perform as many repetitions as they can. Participants were instructed to focus on the movement during internal focus condition and were instructed to focus on pushing/pulling the bar during external focus condition. No focus instructions were given during control conditions.

Two main findings were found in this study. First, wording instructions in a way directing learners’ attention to the movement effect (external focus) can enhance skills performance. In contrast, directing individuals’ attention to coordinating their movements (internal focus), can decrease skills performance.

Results demonstrated that participants performed significantly higher repetitions during external focus condition compared to control (\( p< 0.001 \)) and internal focus instruction (\( p< 0.001 \)). This finding was in line with several previous researches that showed the superiority of external focus condition compared to internal focus and control conditions [5-10, 16, 17, 24].

The current findings suggest the association between the increments of maximal force production with the external focus of instructions. Marchant, Greig [24] found the beneficial effects of an external focus on increasing muscular recruitment and movement efficiency. The improvement of movement efficiency might be related to the more effective recruitment of muscle fibers within a muscle and through enhanced coordination between muscles [15]. External focus resulted in efficient movements, with less muscular energy needed to generate resultant forces [17]. The greater number of repetitions being executed during external focus conditions in this study suggests that focussing on the effects of movement result in more energy efficiency.

Besides the superiority of external focus conditions in this study, results also demonstrated that participants perform significantly higher repetitions during control instruction compared to internal instruction (\( p< 0.001 \)). This finding was in line with previous study on the dart throwing where the study demonstrated better performance of control groups compared to internal focus group. However, this finding contradicts the findings by Marchant, Greig [17] where they had found internal focus instruction increased the number of repetitions compared to the control condition although there is no significant different between both conditions. Such different in findings could be related to the differences of intensity used in which the current study involves 80% 1RM while previous study by Marchant, Greig [17] involved the use of 75% 1RM. The differences could also be attributed by the different of exercise used in which the current study used bench press exercises whereas Marchant, Greig [17] used...
bench press and squat exercises. Overall, this raised the probability of the internal focus effects to be task-dependent.

The reduction in performance during internal focus of attention could be related to the inefficient muscular activity produced [12, 24] and movement patterns [25]. The decrease in the movement efficiency has been associated with the ineffective cocontractions or 'noise' in the motor system induced through an internal focus [12, 15] that later resulted in fewer repetitions of bench press executed. Focusing on the movement mechanisms result in unnecessary muscular energy expenditure, which limits the repetitive production of force.

The present findings supported the ‘constrained action hypothesis theory’ which explain the benefit of inducing an external focus [7]. According to this theory, an internal focus of attention promotes conscious control of movements and interfering with automatic motor control processes which would normally control the movement, whereas external focus is thought to allow movements to be executed more automatically, without the interference from conscious control and so promote more efficient motor system processes.

Future research needs to address the specific kinematics of lifts to failure under each attentional condition. Such data is required to highlight the mechanisms associated with each attentional condition’s effects. Additionally, improvements in maximum strength are suggested not to just depend on the muscular adaptations, but also the improvements are due to neuromotor adaptations to specific movements. Therefore, it is important to train with proper exercise techniques [26]. Research assessing lifting kinematics associated with different attentional focuses will allow for the development of instructions that will promote correct movement form.

To allow for more accurate comparisons between the effectiveness of attentional focus instruction, future researchers should be aware and control the specific instructions provided to the participants during testing sessions. This is due to the possibility of different outcomes that might cause by inconsistencies of instructions provided. Future studies are suggested on investigating more complex weight-lifting movements such as the power clean, the clean and jerk, and the snatch, which are unrestricted and an effort of attention promotes conscious control of movements and interfering with automatic motor control processes which would normally control the movement, whereas external focus is thought to allow movements to be executed more automatically, without the interference from conscious control and so promote more efficient motor system processes.

As the conclusion, verbal instruction on encouraging external focus attention should be more emphasized compared to internal focus attention to improve a performance in high intensity resistance training. It is a hope that coaches, personal trainers and strength and conditioning specialists to take consideration on the best way to improve the performance of their athletes, trainees or clients on gaining maximum benefits in their training.

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