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**EFFECT OF HIGH INTENSITY INTERVAL TRAINING ON PEAK
POWER AMONG AMATEUR POWER LIFTERS- AN
EXPERIMENTAL STUDY**

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ABSTRACT

Background: Powerlifting is a sport in which contestants compete against similar contestants based on the total combined weight lifted by each contestant. Exercises are developed using both 1RM and submaximal strength tests at various percentages (70%, 80%, and 90% of 1RM). High-Intensity Interval Training (HIIT) is now widely recognized for its effectiveness and efficiency across diverse populations. High-intensity interval training activities characterized by high intensity and short duration, such as sprints, jumps, turns, pushes, blocks, and throws Power is described as the skeletal muscle's ability to rapidly produce force, where power is the result of multiplying force by velocity.

Aim: To see the effect high intensity interval training on peak power among amateur power lifters.

Methods: An experimental study was done in Parul University .20 subjects was given High Intensity Interval Training. Subjects received their respective training program for 4 weeks on

alternate days. The primary outcome measures were Vertical squat jump test. Measurement was taken at baseline and after 4 weeks post training.

Results: The statistical software used was IBM SPSS Statistics Version 27 for the analysis of the data. The Pre- and Post-test MEAN \pm SD values for Vertical Squat Jump were 7.61 \pm 0.77 and 8.46 \pm 0.66, and post after the intervention, however results revealed a greater improvement in VERTICAL SQUAT JUMP and p value was shown to be 0.001 with p<0.05 significance level.

Conclusion: This study concluded that High Intensity Interval training are significantly effective in Peak Power among amateur Power Lifters.

Keywords: Powerlifters, high intensity interval training, strength, peak power, vertical squat jump

INTRODUCTION

Competitors in powerlifting vie against others in their weight category, with the ultimate victor determined by the total weight lifted across the three main exercises: squat, bench press, and deadlift [1]. Single-lift competitions, like bench press only, have distinct regulations for each powerlifting exercise. In the squat, the lifter begins the descent after the "squat" command, ensuring the squat reaches the required depth [2]. The lift concludes with the "rack" command after full knee extension [1]. During the bench press, commands such as "start" precede lowering the weight, stabilizing on chest contact, pressing up at the "press" command, and receiving the "rack" command at full elbow extension [2]. Powerlifting participants are classified by body weight, age, and gender, and they have three chances for each lift to execute a single repetition with maximal external load, adhering to defined judging criteria [1]. The Elite

grading is a component of the powerlifting grading system, aimed at assessing skill levels within different weight categories. This assessment helps create a profile of a successful lift, starting with the squat as the initial competition lift, followed by the bench press and deadlift. In the squat, the lifter lifts the bar from a shoulder-height rack, steps away, and initiates the lift by bending the knees. The lifter continues flexing the knees until the hip joint's surface is lower than the tops of the knees [3]. Subsequently, the lifter pushes upward until the knees are fully extended and then returns the bar to the rack. Originating in the 1950s in the USA as an offshoot of classic weightlifting, it gained official championship status. The three lifts, once supporting exercises for weightlifting enhancement, evolved into a separate sport with recognized competitions. Powerlifting

has been featured in the World Games since 1981 due to its increasing popularity [4]. Training in powerlifting focuses on maximizing force production, often achieved by enhancing speed and strength, requiring the musculoskeletal system to withstand high forces. Moreover, in both powerlifting and weightlifting competitions, the emphasis is on achieving a one-repetition maximum (1RM) performance [5]. To adhere to the specificity principle in training, it's crucial to frequently engage in competitive disciplines at a high percentage of 1RM. Furthermore, prediction equations for the squat (SQ), bench press (BP), and deadlift (DL) exercises are developed using both 1RM and submaximal strength tests at various percentages (70%, 80%, and 90% of 1RM) [6]. Consequently, testosterone concentration is also at its peak during this phase, as observed in various studies. Due to these factors, athletes are typically recruited for most sports between childhood and early adolescence to harness their maximum muscular development and physiological potential [7].

Powerlifters, as per previous research, are less strong compared to Olympic lifters. This conclusion was drawn from assessments involving strength-to-body weight ratios and the time it takes to achieve peak isometric force production. Over a year, Olympic lifters have shown enhancements in both the rate of force

development and maximal force production. These findings suggest that the training approaches utilized by Olympic lifters may effectively boost muscle strength and power concurrently [8].

High-Intensity Interval Training (HIIT) is now widely recognized for its effectiveness and efficiency across diverse populations. In essence, HIIT involves short bursts of intense exercise interspersed with brief periods of low-intensity exercise or rest, as explained by researchers including Billat (2001), Buchheit and Laursen (2013a, 2013b), and Laursen and Jenkins (2002) ⁽⁹⁾. High Intensity Interval Training (HIIT) stands out as an efficient method for improving cardiovascular performance and elevating the body's metabolic rate. Beyond its immediate impact on fat conversion to energy during workouts, HIIT induces a sustained increase in metabolism during periods of rest. This means that even when the body is at rest, there is a heightened ability to produce energy, contributing to overall metabolic health [9].

High-intensity interval training activities characterized by high intensity and short duration, such as sprints, jumps, turns, pushes, blocks, and throws [10]. This successful method, known as high-intensity intermittent training (HIIT), has proven to enhance specific variables. Studies indicate that HIIT improves aerobic capacity and the ability to perform high-intensity actions,

relying significantly on the anaerobic system. The personalized and adjustable nature of intensity in this approach further contributes to its efficacy [11].

A High-Intensity Interval Training (HIIT) routine involves alternating between sprint exercises and jogging. This could entail 60 seconds of jogging followed by 30 seconds of sprinting, and so forth. Research, such as studies conducted by Racil *et al.*, supports the effectiveness of HIIT workouts [12]. Sperlich *et al.*'s research indicated that incorporating plyometric exercises into a HIIT program can be advantageous for promoting weight loss in obese female adolescents [13]. The application of High-Intensity Interval Training (HIIT) in children, especially in the context of soccer, has attracted research attention. Children's activities, characterized by spontaneous bursts of short-term high intensity, align well with HIIT principles. Research indicates that prepubertal children can sustain performance during repeated sprints with short recovery periods, experiencing less fatigue compared to adults. Baquet *et al.* conducted a 7-week HIIT program, implemented twice a week for 30 minutes during physical education lessons. The results showed a significant improvement (8.2%) in children's maximal oxygen uptake and maximal aerobic speed. This suggests that HIIT positively impacts cardiovascular fitness in children [13].

In addition to cardiovascular benefits, HIIT in children has been linked to enhancements in anaerobic performance, including improvements in short-term muscle power, strength, and speed. These findings suggest that incorporating HIIT into training programs for children, especially in sports like soccer, could positively affect both aerobic and anaerobic aspects of physical fitness. However, it's crucial to consider individual variations in exercise response and tailor programs to the specific needs and abilities of each child [13]. Pushparajan's research showed that engaging in High-Intensity Interval Training (HIIT) significantly boosts VO2 Max and enhances the performance of football players during games [14].

In the realm of human performance, power is described as the skeletal muscle's ability to rapidly produce force [15]. Peak power (PP) capabilities are associated with performance across various athletic, occupational, and functional tasks [16]. Due to cost considerations, some practitioners substitute a vertical jump test as an indirect measure of PP capabilities ⁽¹⁶⁾. However, relying solely on vertical jump height (VJH) for estimating PP is imprecise. It doesn't account for the fact that heavier individuals need to generate greater absolute power to lift their body mass (BM) to a given height. Additionally, changes in VJH may not accurately reflect changes in PP capabilities

if the subject's BM fluctuates during a training intervention. Therefore, accurately assessing actual PP (PPact) is crucial for practitioners [17].

NEED OF THE STUDY:

Multiple articles suggested that High Intensity Interval Training had effect on peak power among volleyball, basketball, power lifter, handball, shot put player. Few studies demonstrated effect of High intensity interval training on peak power among power lifters. Despite of the available literature and evidence on effect of High intensity interval training there is scarcity of literature comparing the effect of high intensity training on peak power. Hence, the purpose of the present study is to analyze the effect of high intensity interval training on upper and lower body peak power among amateur power lifters.

AIMS:

To see the effect high intensity interval training on peak power among amateur power lifters.

OBJECTIVES:

- To determine the effect of high intensity interval training on peak power among amateur power lifters.

HYPOTHESIS

NULL HYPOTHESIS:

- There is no significant effect of high intensity interval training on peak power among amateur power lifters.

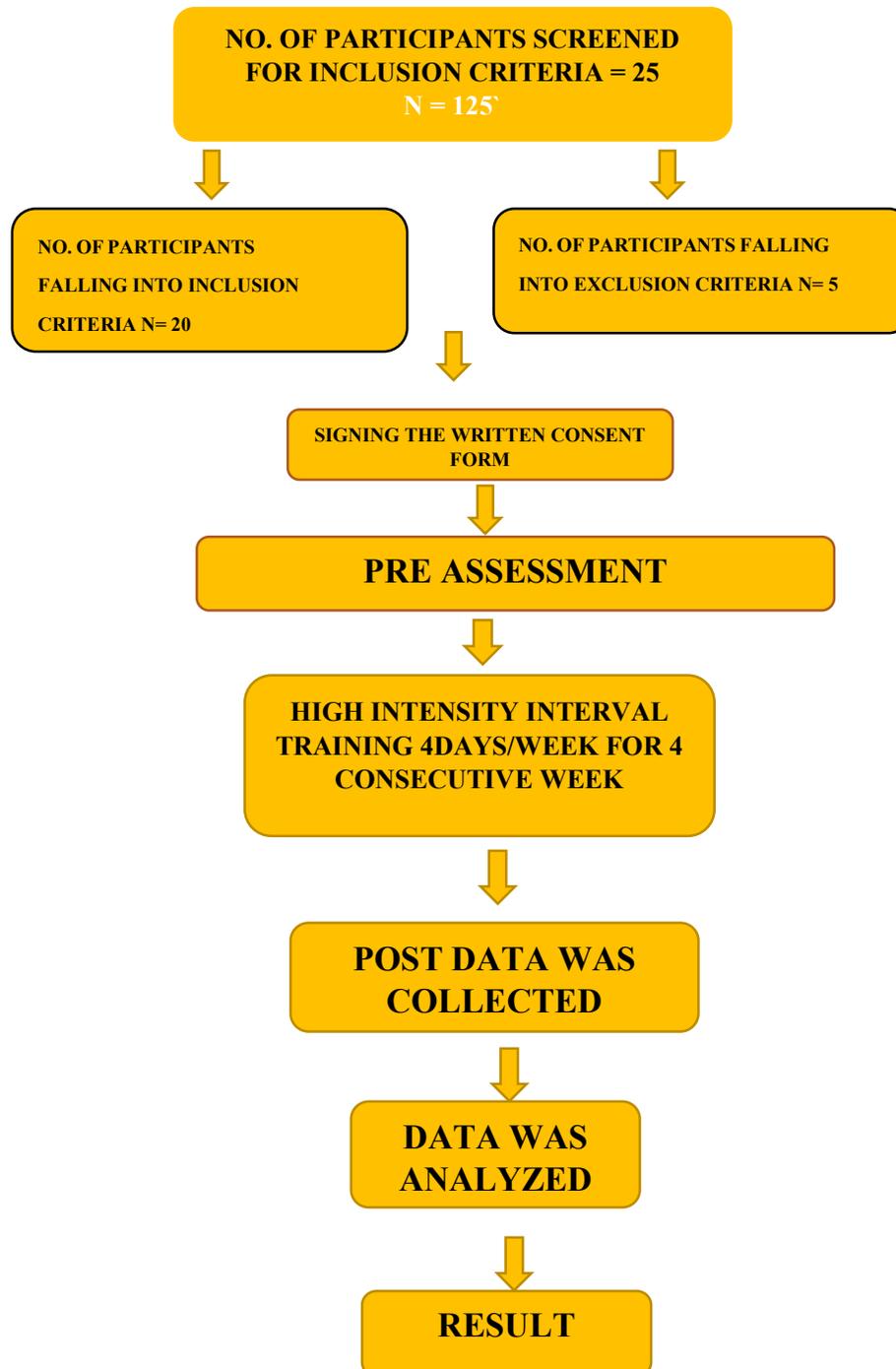
ALTERNATIVE HYPOTHESIS:

- There is significant effect of high intensity interval training on peak power among amateur power lifters.

METHODOLOGY:

This study analyzed the effects of peak power of powerlifters. Participants for the research studies were recruited from Parul University. Subjects were recruited for the study and once they fall into inclusion criteria, they have been asked to sign the written informed consent form. The subject has complete freedom to refuse to participate in the study. Inclusion criteria were 18-25year of age, included both male and female. Exclusion criteria were any musculoskeletal disorders, neurogenic disorders, cardiovascular respiratory or endocrine disorder, previously undergone any surgery (last 6 Months). 20 subjects were given High Intensity Interval Training for 4 weeks on alternate days. The primary outcome measures was Vertical squat jump test and subjects were assessed before and after intervention and then the final result was analysed.

PROCEDURE

**EXERCISE PROTOCOL:**

- Exercises began with a brief introduction to each activity for each subject.
- Each subject has a warm-up session (5–10 minutes) before the start of the training program.

- After that, each subjects participated in a 45-minute training session, (3 reps 1min rest between sets) which will followed by a cool-down session (5–10 minutes).
- ❖ WARM UP PROGRAM (FOR BOTH GROUPS 5 – 10 MINUTES)
 - 800 meters jogging
 - Rotation exercises of Arms, Neck & Trunk (5 reps)
 - Swing arm in a circle & cross the body (5 reps)
- Legs in big swinging movement across the body, to front & back (5reps)
 - ❖ COOL DOWN PROGRAM (FOR BOTH GROUPS 5 – 10 MINUTES)
 - Slow jogging for 400 meters
 - Relaxation breathing technique
 - Static Stretching – flexibility of upper & lower body muscles

The subjects will be given 4weeks of High-Intensity Interval Training protocol as follows:

EXERCISES	REPETITIONS								SETS
	WEEK 1 ST	WEEK 2 ND	WEEK 3 RD	WEEK 4 TH	WEEK 5 TH	WEEK 6 TH	WEEK 7 TH	WEEK 8 TH	1min rest between sets
BURPEES	10	15	20	25					3
PUSHUP	10	15	20	25					3
PLANK	10	15	20	25					3
CRUNCHES	10	15	20	25					3
SQUAT JUMPS					10	15	20	25	3
ALTERNATE LUNGES WITH JUMPS					10	15	20	25	3
CLIMBERS					10	15	20	25	3
CLEAN AND PRESS					10	15	20	25	3

Statistical Analysis –

After gathering the data, it was arranged in Microsoft Excel. The statistical software used was IMB SPSS Statistics Version 27 for the analysis of the data and Microsoft Word and excel have been used to generate graphs and tables.

Results: The Pre- and Post-test MEAN±SD

values for Vertical Squat Jump were 7.61 ± 0.77 and 8.46 ± 0.66 . P value was 0.001 discovered, indicating that there was statistically significant difference in vertical squat jump in pre and post after the intervention, however results revealed a greater improvement in VERTICAL SQUAT JUMP.

Table 1: Age Distribution

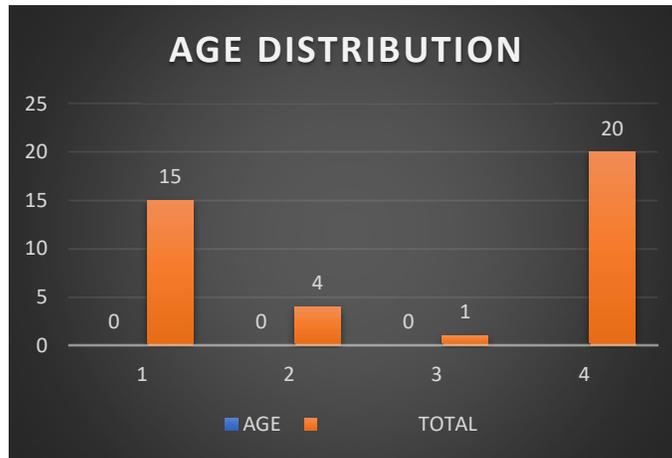
AGE	TOTAL	PERCENTAGE
18-20	15	75%
21-23	4	15%
24-25	1	5%
	20	

Table 2: Gender Distribution

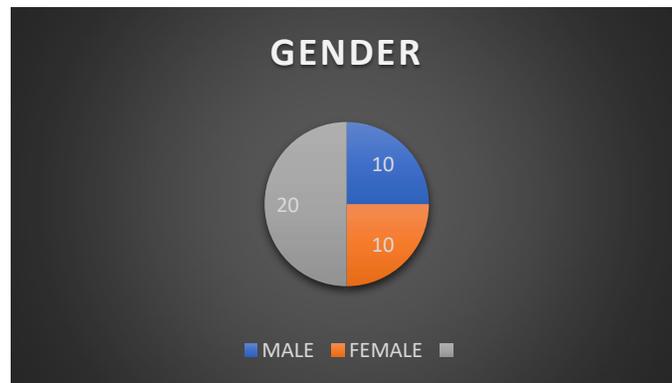
GENDER	TOTAL	PERCENTAGE
MALE	10	50%
FEMALE	10	50%
	20	

Table 3– PRE AND POST COMPARISON OF VERTICAL SQUAT JUMP

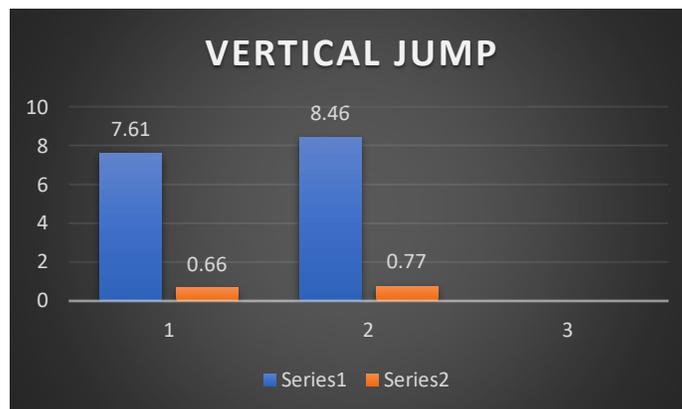
GROUP A	MEAN	SD	Z-VALUE	P-VALUE
PRE	7.61	0.66	-3.44	0.001
POST	8.46	0.77		



Graph 1: Demographic Data- Age



Graph 2: Demographic Data- Gender



Graph 3: Pre and Post of Vertical Squat Jump



Figure 1: Burpees



Figure 2: Pushup



Figure 3: Squat Jump

DISCUSSION

In the previous study, Reference to Dr. Hab's research, a comparable outcome measure for powerlifters involved a power clean and jerk test, assessing upper limb strength. Their conclusion suggests that the outlined weightlifting moves phasing scheme in their study provides a more precise approximation of the fundamental aspects of standard weightlifting motor.

High intensity interval training is measured using a Vertical squat jump, and is presented graphically in graph 3 where the mean value (pre was 7.61) after intervention it was

decreased (post – 8.46). Previous study (18) shows that a low-volume HIIT-based running plan combined with the high training volumes is effective for improving athletic performance during a simulated sprint distance triathlon competition. This improvement is suggested to be due to improved neuromuscular characteristics that were transferred into improved muscle power. In our study it is shown that there is an improvement in vertical squat jump.

In this study, our findings was high-intensity interval training was greater improvement that we conducted for 4

weeks. A previous study Pinto *ET AL* (19) Six-Week High-Intensity Interval Training (HIIT) Study showed During a six-week duration, a blend of High-Intensity Interval Training included 10 repetitions of 60 seconds of exercise at the arm's peak heart rate, followed by 60 seconds of passive recovery, resulting in an average training intensity. Post-training, HIIT demonstrated a more significant improvement in VO₂peak compared to the control group. Both groups showed enhanced peak power output, with no notable difference between them. HIIT appeared to enhance cardiopulmonary capacity and exercise duration more effectively than conventional training, potentially offering a time-efficient alternative for those incorporating upper extremity aerobic activities into their training regimen.

CONCLUSION

This study concluded that High Intensity Interval training was significantly effective in Peak Power among amateur Power Lifters.

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