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Vertical jump height as an indicator of lower-extremity muscular fatigue in recreational Crossfit athletes

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Abstract

Crossfit is a sport that combines multiple facets of aerobic and anaerobic fitness, such as resistance training, cardiovascular training, and gymnastic movements into workouts designed to improve individuals' overall level of fitness. The vertical jump motion is a primary component used in the design of many Crossfit workouts and is a common measure of athletic performance and fatigue. The purpose of this study is to investigate the acute effects of performing an aerobic high intensity functional training workout entitled Cindy. The workout's effect on vertical jump and landing impact performance will be measured via a bounce jump test completed pre- and post- exercise. Sixteen university students (6 females, 10 males) completed a single trial of three consecutive countermovement maximum height bounce jumps recorded by the G-VERT system prior to (PRE) and immediately after (POST) the Crossfit workout 'Cindy'. Jump height and landing impacts were calculated by the G-VERT. The study population experienced a significant decrease in jump height from PRE to POST workout (PRE= 15.90 in. ± 2.64 in; POST= 14.98 in. ± 2.52 in., p=0.01) and a nonsignificant increase in landing impact from PRE to POST workout (PRE= 7.73 in. ± 3.04 in; POST= 8.52 in. ± 3.50 in., p=0.127). These results suggest that, over the course of a single aerobic high intensity functional training session, muscular fatigue may affect the ability of the lower extremities to produce forces necessary to achieve desired jump performance.

Key Words: Jump height, Jump, Countermovement jump, Landing impact, G-VERT, VERT, Crossfit, Cindy

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Introduction

Crossfit is one of the most popular commercial forms of high intensity functional training (HIFT), which is a training style that combines multiple fitness domains and is intended to improve cardiorespiratory fitness, endurance, and strength[1]. HIFT is a form of exercise recommended to train military personnel[1]. Though HIFT is largely an effective tool for improving physical fitness, both HIFT and Crossfit are largely scrutinized for their high risk for injury in the military as well as in amateur Crossfit populations [2,3].

HIFT and Crossfit movements are multi-joint exercises performed at high rates of speed with added resistance (thrusters, wall balls, and box jumps). Significant repetition of these types of movements may cause fatigue, which may, in turn, lead to injury[4]. Fatigue may result in decreased jump height, which in turn, may lead to common HIFT injuries (knee, shoulder, and lower back)[3].

Mate-Munoz et al. (2017) observed that jump height was heavily influenced during metabolic conditioning modality of HIFT. Most common workouts that apply the HIFT method, however, incorporate multiple modalities. In the Crossfit system, there are three modalities: metabolic conditioning (cardiorespiratory), gymnastics (bodyweight exercises), and weightlifting (Olympic lifting and powerlifting)[5]. All of these modalities are important because each provides a unique contribution to healthy human physiology.

Previous studies have used fatigue protocols to intentionally induce muscular fatigue in order to assess the protocols' effects on jump mechanics and fatigue[6,7,8.] It has been well documented that countermovement jump (CMJ) testing is a reliable measure of muscular fatigue[6,7,8,9]. Moreover, investigators have demonstrated that the CMJ pretest-posttest can be applied to experiments that use an aerobic fatiguing protocol[9,10]. While past studies have demonstrated the CMJ to be an effective measure of lower extremity muscular fatigue, the aerobic HIFT workout's impact on fatigue has not yet been analyzed using this test.

Therefore, the purpose of the current study is to investigate how jump height is influenced by an aerobic HIFT workout. This study offers insight into how this style of exercise affects muscular fatigue. Though there is a body of research surrounding Crossfit and HIFT regarding safety and efficacy in athletic training programs, additional research in the field of examining specific biomechanical aspects involved in this style of physical training is needed.

Another purpose of the present study is to investigate the acute effects of performing an aerobic high intensity functional training workout entitled Cindy on vertical jump and landing impact performance pre- and post- exercise as seen in a triple bounce jump test[11]. Due to the high volume of movement that Cindy requires of the athlete, it is hypothesized that maximum jump height will decrease due to muscular fatigue and that landing impact will increase due to landing strategy degradation.

Literature Review

Jumping

The jump is a pattern of movement that follows the common stretching-unweighting cycle of muscles to cause motion[12]. The stretch-unweighting cycle begins with a countermovement phase divided into unweighting and stretching sub-phases. Next there is a concentric, propulsion-acceleration phase, where the muscle contracts in the direction of the intended movement[13]. Finally, there is a propulsion-deceleration phase wherein ground reaction force is reduced as the desired movement is executed. It is this stretch-unweighting cycle that forms the basis for human movement and is seen in applications such as jumping, running, and walking.

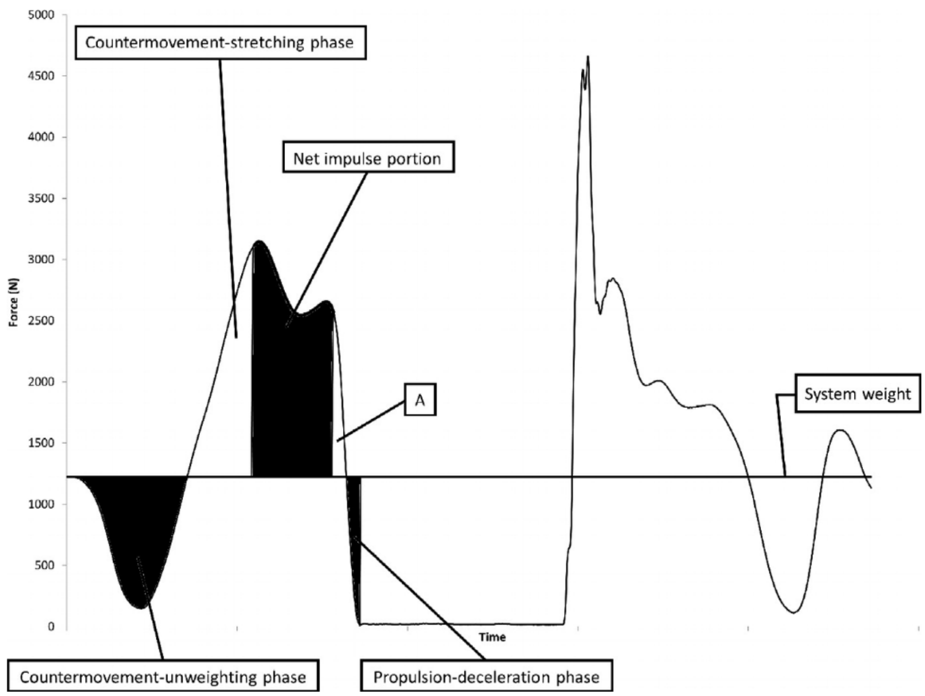

Figure 1. Diagram of the stretching-unweighting cycle of the countermovement jump on a force plate with vertical ground reaction forces shown in shaded regions where the y-axis indicates vertical ground reaction force (N) and the x-axis indicates time[12]

Countermovement Jump (CMJ)

Though there are multiple types of jumps, the countermovement jump (CMJ) is one of the most common types seen in Crossfit-style workouts. This style of jump is used frequently in Crossfit movements such as the box jump (which involves jumping from the ground onto a wood box [‘plyometric box’] of varied heights), rope climbs (which involves climbing from the bottom to the top of a rope), and reaching pull up bars and gymnastics rings. The CMJ is widely used in research as a method to measure athletic performance variables due to the jump's efficacy at demonstrating common athletic performance metrics and at measuring muscular fatigue[8,9,6,10,14,15, 16]. The CMJ is widely used in research due to its capacity to accurately elicit maximum jump height and maximum power as well as its capacity to be studied in its component phases[17, 18, 19]. The CMJ can be separated into three phases: the countermovement phase, the propulsion phase, and the take-off phase[20].

Phases of the CMJ

In Figure 1, the first shaded black region shows the duration of the countermovement-unweighting phase. The white region immediately following the countermovement-unweighting phases shows the duration of the countermovement-stretching phase. The propulsion-acceleration phase includes the regions marked "Net impulse portion" and "A." The propulsion-deceleration phase is marked by the third shaded black region in the figure.

The countermovement-unweighting phase is the portion of a jump wherein the jumper relaxes agonist muscles (those muscles that directly cause bodily movement)[21]. The relaxation of the agonist muscles results in hip and knee flexion[18]. The countermovement-unweighting phase begins and the onset of movement and ends when the downward momentum reaches zero[12]. The rate and magnitude of force produced in the countermovement-unweighting phase is critical because it will carry over to subsequent phases and ultimately contribute to the success of a CMJ[18].

The countermovement-stretching phase begins when the center of mass of the jumper has a positive velocity (caused by upward propulsion due to the extension of the hips, knees, and ankles)[18,21]. The beginning force of the countermovement-stretching phase is dictated by the force generated by the end force of the countermovement-unweighting phase[18].The phase continues until the onset of take-off[18].

The propulsion-acceleration phase begins at the end of the countermovement-stretching phase and ends at the instant where the force on the plate is equal to that of the subject's mass. During the propulsion-acceleration phase, force is applied in order for a movement to be performed. The propulsion-deceleration phase begins at the instant where the force on the plate is equal to that of the subject's mass and ends at the onset of takeoff. The intention of this phase of jumping is to achieve a maximal center of mass displacement (or maximum vertical jump height). A maximal center of mass displacement is achieved in the instant where the center of mass velocity is equal to zero[18].

Measuring CMJ

Various tests are available to measure the countermovement jump. Standing jump board and Vertec field tests as well as contact mats and force plates are common study tools for the assessment of the vertical jump[22]. The G-VERT, a commercially available, wearable device has also been used as a tool to measure the CMJ[23]. Though there is disagreement on the level of reliability of each of these tests, one of the most important factors to consider when it comes to selecting a method by which to measure the CMJ is the availability of equipment[22]. The G-VERT system was the instrument readily available for the present study and was therefore selected for data collection.

Physical Principles

Vertical ground reaction force (vGRF) is one of the foundational principles that contribute to the analysis of jumping metrics. vGRF is based on Newton's third law which states that, for every action, there is an equal and opposite reaction. Any time a mass makes contact with the ground, the mass gives a certain amount of force to the ground (typically measured in Newtons of force [N]). The vGRF is the amount of force that the ground gives back to that same mass (also measured by N). The amount of force that the mass exerts on the ground is the exact same amount of force that the ground exerts on the mass. The amount of force given to the ground by an athlete will determine the GRF imposed back on that person in order to complete a successful vertical jump.

High acceleration is critical to achieving a large initial jump velocity which is a critical component in the success of a vertical jump[20,24]. To achieve takeoff in a jump, the acceleration of the vertical jump must be positive. In order for acceleration to be positive, the ground reaction forces must be large enough to overcome body weight (m) and the force acting on a person's center of mass[21]. Force is demonstrated as (F_{grf})-(mg) where F_{grf} is the ground reaction force on the jumper, m is the mass of the jumper, and g is the acceleration due to gravity[21]. In this way, ground reaction force is related to acceleration in the context of a vertical jump[25].

<u>Functional Fatigue Protocol</u>

Acceleration and velocity of a countermovement jump may be impacted by fatigue due to exercise. In the most common Crossfit workouts, the athlete is fueled by energy generated in the aerobic (or oxidative) metabolic pathway. The oxidative pathway is the primary energy system used to fuel activities lasting 3 minutes or longer during low exercise intensity[26]. The length of time of the assessed workouts class them into the aerobic category[26, 27,28]. To examine the effects of a typical Crossfit workout on jump height, a fatigue protocol mimicking the effects of an aerobic Crossfit workout must be utilized.

The exercise protocol that was used in this study is meant to induce fatigue in such a way as to reflect functional movements common in HIFT. The results of the study can be applied to many other functional movement settings[29]. In order to find the most common time domain and workout style used in Crossfit, an assessment of all workouts from the Crossfit Open (a series of five workouts that occur every year open to all persons) in years 2014 to 2018 was executed[27]. The results from the assessment showed the ‘As Many Repetitions as Possible’ (AMRAP) style workout was most common and 12 minutes was the average time per workout[27].

In past studies, the Crossfit workout Cindy was used as the fatigue protocol to test fatigue in a HIFT setting[4,30]. Previous researchers have reported a significant change in maximum jump height following this workout[4]. While the participants in Mate-Munoz et al. were college aged males with at least six months of resistance training experience and no exposure to Crossfit, the changes in the current study were observed in healthy university students and Crossfit athletes of varying HIFT experience. The data in the current study were measured using the G-VERT system[31]. The workout fits the AMRAP qualities of the most common workouts mentioned previously and its 20-minute time frame classes it into the same aerobic category as the most common Crossfit workouts seen in the Crossfit Open. Therefore Cindy was selected as the workout to induce fatigue caused by a typical aerobic Crossfit workout.

Cindy has been used in research before due to its length and aerobic characteristics[26]. The heart rate range of participants classes it as a workout of vigorous intensity according to the ACSM HR max guidelines[30]. A three repetitive ballistic bounce jump test with hands kept on the hips was used to assess jump height pre and post HIFT workout[11]. Hands were kept on hips to ensure that the test would measure explosive leg strength only; arm swing may have confounded the results[32].

Methodology

Participants

Participants for this study were recruited via personal verbal invitation from the investigators. Participants included well trained and amateur, healthy university students and Crossfit athletes. Before participation in the study, subjects were screened with a health history questionnaire and no risk factors for cardiovascular, metabolic, or pulmonary disease were evident. Participants were asked to abstain from exercise for 24 hours pre-trial. The participants that were included in the final data analysis included 16 individuals of college age (18-27 years of age). Six females and ten males with varied Crossfit and fitness experience were included. All participants had prior exposure to all of the movements included in the Crossfit workout Cindy. This study was approved by the University of Nevada, Reno Institutional Review Board (protocol # 1316713-1).

Study Tools

In order to perform the workout and to accurately measure jump height and landing impact, the investigators utilized specific exercise and measuring tools. The university's student fitness facility functional training zone was utilized to conduct the trials. The Precor Assault AirBike Elite[33] was used for the active warm-up. A Beaver-Fit custom gymnastics rig[34] was used to perform the pull-ups. Elastic assistance bands and

ROGUE plyometric training boxes were used by those who modified their pull-up technique. The G-VERT[31] wearable movement and impact tracker was used to measure the accelerometery, magnetometery, and gyroscope of each participant in order to calculate jump height and landing impact over the duration of the trials[35,36]. The device is housed in a fabric belt worn around the waist of each participant with the G-VERT device itself resting on the lower lumbar area of the spine. Though there are several limiting factors, this system has been demonstrated to be a 96% accurate measure of vertical jump height[23].

Trial Procedures

The pilot run of the study and a repeated measures ANOVA was conducted using the G*Power computer program to assess sample size needed to achieve power[37]. Primary data was then collected during three separate trials over the course of two weeks. For each trial, the participants were given a G-VERT and instructed to strap the belt to their waist and place the device underneath the waistband of their shorts, leggings, or Spandex. The participants were instructed to ensure the device rested snugly on their lower lumbar spine before beginning any activity. The participants were then instructed to do a light warm up on the stationary Assault Bike for roughly five minutes. After the warm up, the participants were briefed on the format of the Crossfit workout, on the style of jump to be performed pre- and post- workout, and on each movement of the workout.

Each trial consisted of participants completing a set of three consecutive, maximum-height, countermovement bounce jumps before the workout[11]. The change in the participants' center of mass during the jumps were measured by the G-VERT system. The participants then completed the Crossfit workout Cindy. This workout consisted of as many rounds as possible of five pull-ups, ten push-ups, and fifteen air-squats in a twenty-minute period. After the workout, the participants immediately completed a second CMJ bounce jump test while wearing the G-VERT.

For the pull-ups, an overhand grip was taken on the bar with arms spread slightly wider than shoulder width. One repetition was counted as movement from an elbows-locked position to a chin above bar position. For the push-up, hands were positioned on the ground slightly wider than shoulder width apart. The feet-on-ground style was used by most participants, but some used a modified knee-on-ground style. One repetition was counted as chest to the ground or 90 degrees of arm bend at the bottom of the movement to an elbows locked position at the top of the movement. For the air squat, feet were positioned at a comfortable position about shoulder width apart with the hands never being placed on the legs through the range of the movement. One repetition was counted as hip-seem (about the area of the greater trochanter) below the knee-seem (about the area of the patella) at the bottom to a knees locked and pelvis extended position at the top.

For the pre- and post- jump tests, participants were instructed to jump as high as possible three times in the vertical direction while keeping their hands on their hips. The participants were instructed to minimize contact with the ground between each jump, but told to jump at a self-selected, controlled rate. The participants were instructed to take-off and land with the same body position. To check for understanding, participants were asked to perform each movement for the investigators after demonstration.

After the briefing, participants prepared their workout areas and were instructed to push themselves to their limits during the duration of the workout and to count the rounds of Cindy they completed. Data collection in the G-VERT application on a mobile tablet was then started and the first bounce jump test was conducted. Participants then went to their workout stations and waited for the investigator to begin the timer for the workout. Cindy was then completed and the second bounce jump test was conducted immediately after conclusion of the workout. Following the conclusion of the bounce test, data collection in the G-VERT application was ended, participants returned the equipment, and the number of rounds completed were recorded.

Data Analysis

Data from all three trials were uploaded to the VERT secure servers immediately post workout. Trial data were then downloaded and compiled into a Google Sheet. Individual and overall averages and standard deviations were taken for pretest and posttest data sets for jump height and landing impact.

Statistical Analysis

The data from the pilot test was analyzed and put into the G*Power computer software to conduct a repeated-measure analysis, within factors ANOVA *a priori*[37]. The sample required to reach statistical power (power=.95) came out to n=113.

Upon examination of the overall study results, the data were determined to be normally distributed. Each jump trial was then averaged by session (PRE and POST) and exported to SPSS Version 24.0[38] and assessed for power, significance, and normality where two 1x2 (group x conditions) Repeated Measures ANOVAs were conducted to assess differences between average G forces and jump height. If any significance was determined, *post-hoc* Bonferroni correction was applied based on the alpha level set *a priori* at 0.05.Values greater than two times the standard deviation of average jump height and landing impact were considered outliers and omitted before analysis was conducted. Two participants were omitted from analysis due to this screening.

Results

Table 1 presents the means and standard deviations of average jump heights and landing impacts pre and post 'Cindy' workout in the study population (n=16)

Table 1.

Means and Standard Deviations for the G-VERT Variables

Variables	Test Type	Mean	Std. Deviation
G Force (g)	Pretest	7.73	3.04
	Posttest	8.52	3.50
Jump Height (Inches)	Pretest	15.90	2.64
	Posttest	14.98	2.52

A significant main effect of time was observed for jump height (F (1.0, 5.86)= 8.584, p=0.01, $\eta^2 = 0.364$) where jump height differed between PRE to POST. Follow-up post-hoc analysis further revealed that participants had significantly lower jump height (PRE = 16.33 in; POST = 15.47 in, mean difference = -.86 in, p=0.01) at the conclusion of the work out. No significant main effect of time was observed on G forces (F (1.0, 4.972) = 2.617 , p=0.127, $\eta^2 = 0.149$).

Discussion

The purpose of the study was to investigate the acute effects of performing an aerobic high intensity functional training workout Cindy on vertical jump and landing impact performance pre- and post- exercise as seen in a bounce jump test. Previous researchers have reported a significant change in maximum jump height following this workout[13]. However, other researchers failed to demonstrate jump height reduction with the same workout at the alpha level used in the current study (0.05)[39]. In both studies, landing impact was not assessed. The main finding of this study was that jump height was significantly lower following a single bout of Cindy in moderately active individuals. This may indicate that, in the presence of fatigue, individuals will not jump as high. Furthermore, average impact G forces increased post exercise, although it was not a significant change. The key findings demonstrated that maximum jump height in a healthy college population significantly decreases as a result of a purely aerobic HIFT workout. The significant difference in jump height was unexpected due to the fact that there is little specificity between jump height and aerobic exercise due to the muscle fiber type utilized. Type I muscle fibers are generally high endurance fibers with a high aerobic capacity, but low potential for rapid force generation; however, Type II muscle fibers generally demonstrate ability to generate rapid force and anaerobic work output, but show limited aerobic work capacity[26]. 'Cindy' is a workout purely aerobic in nature, so it works primarily with Type I fibers. Countermovement jumps on the other hand, are a highly explosive, anaerobic movement primarily fueled by Type II fibers. Hence, Cindy does not provide much opportunity for fatigue of the Type II muscle fibers that would influence maximal vertical jump performance. Further, no significant difference was anticipated because Cindy only requires low energy output from the legs relative to many other HIFT and Crossfit workouts[27,28]. The study's hypothesis that CMJ height would be affected by an aerobic fatigue protocol was supported by the trial data, but is not supported by the aforementioned physiological principles. The mechanism by which the study's results were obtained must be investigated by further research that examines different aspects of athletes' physiology and changes it undergoes due to aerobic HIFT.

The key finding for landing impact indicated there was an increase in impact post workout, but not to a significant degree. This finding was unexpected due to previous researchers indicating a strong significant increase in ground reaction forces after a functional fatigue protocol which was metabolically similar to Cindy[40,41]. The difference in outcome may have been due to the fact that Brazen et al. (2010) studied landing impact using single-leg landings while the present study examined impacts in double-leg landings. The body may be better equipped at eliciting biomechanical landing strategies to reduce impact forces on the lower extremities when using two legs instead of just one[40]. Another reason the difference may have occurred is in the precision of the measuring tools. vGRF is explicitly measured by a force plate (the measuring tool used by Brazen et al.), but has to be indirectly calculated when using the G-VERT system. The current study showed a trend toward significantly higher landing impacts in a significant main effect of time, but more precise measurement of vGRF, such as the use of a force plate, may yield more significant results and should be explored further.

The findings of the present study indicate that aerobic exercise may pose increased risk of injury in HIFT movements that require vertical jumping like box jumps, hurdles, gymnastics ring movements, and climbing over large barriers (as seen in obstacle courses). The difference between vGRF and jump height demonstrates that a higher jump height is contingent upon a higher vGRF value[21]. Further, there is a relationship between peak force and jump height; it has been shown that jump height will increase as a direct result of increased peak force[11]. It then follows that, as peak forces decrease due to fatigue, athletes are at risk of not achieving the forces required to achieve the jump heights necessary to safely perform the movements required of them. For example, at the end of a long aerobic workout, an athlete may not generate the necessary force required to land on top of a plyometric box. The athlete may then fall and injure themselves. Though these kinds of instances may be rare and heavily circumstantial, there is still a likelihood for them to occur, so further investigation into possible solutions to reduce risk due to jumping fatigue is warranted.

Implications and recommendations

The present study recorded a significant decrease in jump height due to an aerobic HIFT workout. The information regarding decreased jump height may prove helpful to athletes who engage in HIFT workouts. This finding is not fully supported by current literature regarding the metabolic pathways implicated in aerobic fatigue relative to the pathways implicated in acute bouts of maximal vertical jumping. For this reason, the mechanism by which an aerobic HIFT workout affects acute vertical jump performance should be investigated. Further, the study results exhibited a trend toward significantly higher landing impacts in a main effect of time. Trainers and athletes should be cautioned by this result and be wary of the strain they may be placing on their joints by participating in long aerobic HIFT workouts. More precise measurement of this variable via use of different instruments for data collection may yield more significant results and should be explored in future studies.

Limitations

There are limitations that must be addressed in this study. Only 16 subjects (six females and ten males) were used in the study, which may have been too small of a sample size required for this experiment (as indicated by the power analysis conducted *a priori*). The data set was, however, assessed for power, significance, and normality so the impact of a small sample size was minimized. The subjects for the study were taken from a convenience sample and did not boast a uniform amount of fitness experience. The participants, however, all had prior experience to the movements required in 'Cindy' and were all deemed healthy due to the health history screening. The absence of homogeneity of the sample or a control group may have skewed the results of the study in unpredictable ways. The variability of participant type contributes to a higher external validity, but causes the internal validity to be slightly diminished. Further, some researchers examined power, the product of force times velocity, as a variable of interest[42,43]. Power may have revealed relationships with jump height and landing impact, but power was not examined in this study. In the absence of analysis of power, important conclusions were still generated from this study. Further, anthropometric values, such as weight, were not input into individual G-VERT profiles prior to the testing which may have altered the accuracy of jump height and landing impact values. The data were still able to be used, however, because jump height and landing impact values were appraised via relative pretest-posttest differences.

Further Research

Future researchers should investigate the same pretest-posttest bounce jump test using a HIFT workout as the fatigue protocol, but using a force plate as the measuring tool in place of the G-VERT. The force plate will yield more precise measurements regarding jump height and landing impact and will enable researchers to add vGRF and power data in their analysis of the results.

Further, Cindy only encompasses one modality of HIFT (metabolic conditioning). In later studies, a different fatigue protocol that better represents the typical HIFT workout should be selected in order to observe the acute effects of a workout with all three modalities (gymnastics, metabolic conditioning, and weightlifting). Attention should also be given to examining the biomechanical strategies of the subjects in each phase of the CMJ pre- and post- Cindy. Analysis of the ways in which subjects jump pre- and post- fatigue protocol may give further indication of the reason behind the decreased jump height evident in this study.

Finally, researchers should use strategies to normalize participants and to mitigate potential confounders during testing and analysis. Time taken to rest over the duration of the workout should be measured for each participant. Further, results should be normalized to BMI, height, and weight. Finally, the visual analog scale should be used to assess fatigue of participants[39].

Conclusion

The results of this study showed a significant decrease in jump height and a non-significant increase in landing impact after exposure to a fatigue protocol. The results and conclusions of this literature may prove valuable in the field of Crossfit and HIFT exercise programming. The results from this study can be applied to fields of research regarding Crossfit and HIFT in the context of biomechanical stability and endurance of the CMJ motion.

The outcomes and plans for further research can be shared in athletic training journals, conferences, and to sports medicine and athletic training professionals (including Crossfit headquarters and military training facilities).

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Tables and Figures

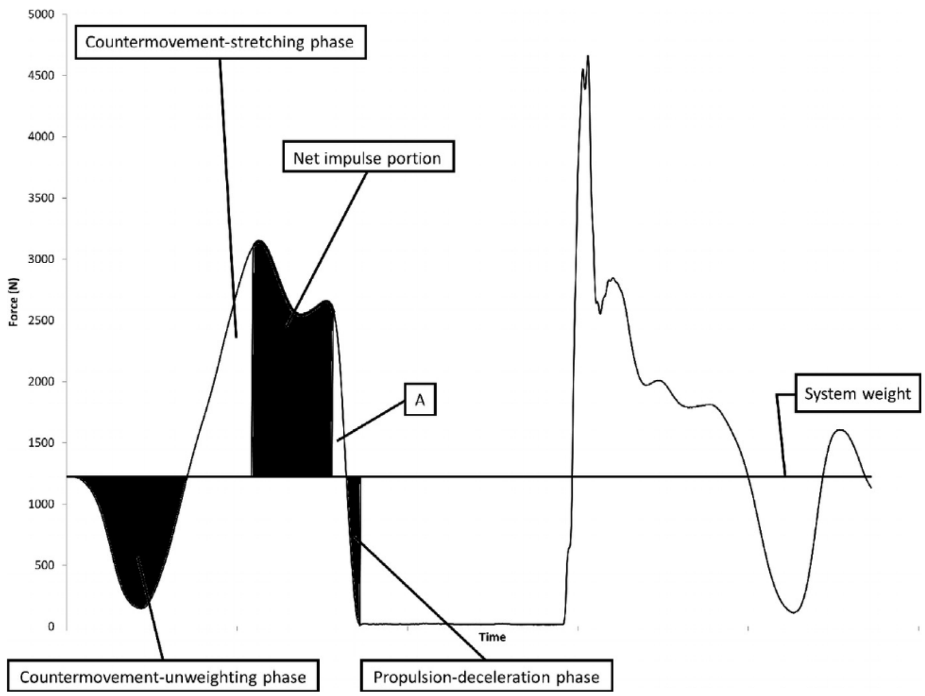

Figure 1. Diagram of the stretching-unweighting cycle of the countermovement jump on a force plate with vertical ground reaction forces shown in shaded regions where the y-axis indicates vertical ground reaction force (N) and the x-axis indicates time[12]

Table 1. Means and Standard Deviations for the G-VERT Variables

Variables	Test Type	Mean	Std. Deviation
G Force	Pretest	7.73	3.04
	Posttest	8.52	3.50
Jump Height	Pretest	15.90	2.64
	Posttest	14.98	2.52

Appendix A

University of Nevada, Reno

Research Integrity
218 Ross Hall / 331,
Reno, Nevada 89557
775.327.2368 / 775.327.2369 fax
www.unr.edu/research-integrity

DATE:	October 18, 2018
TO:	Nicholas Murray, Ph.D.
FROM:	University of Nevada, Reno Institutional Review Board (IRB)
PROJECT TITLE:	[1316713-1] Vertical jump height as an indicator of lower-extremity neuromuscular fatigue in recreational Crossfit athletes measured using the G-VERT system
REFERENCE #:	Social Behavioral
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
REVIEW TYPE:	Ex*empt*
DECISION DATE:	October 18, 2018
REVIEW CATEGORY:	Exemption Category #2

An IRB member has reviewed this project and has determined it is EXEMPT FROM IRB REVIEW according to federal regulations. Please note, the federal government has identified certain categories of research involving human subjects that qualify for exemption from federal regulations.

Only the IRB has been designated by the University to make a determination that a study is exempt from federal regulations. The above-referenced protocol was reviewed and the research deemed eligible to proceed in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46.101).

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Reviewed Documents

- Application Form - 1_Part II Application SOC-ED 060618 (4) (5) (2) (1).docx (UPDATED: 10/18/2018)
- Consent Form - Consent FormTemplate SOC 021716_NMedits 9_25_18 (2) (1).doc (UPDATED: 10/18/2018)
- Questionnaire/Survey - Medical History Questionnaire.pdf (UPDATED: 10/9/2018)
- Training/Certification - BrennanJordanIRB.pdf (UPDATED: 10/9/2018)
- Training/Certification - Brian Szekely_IRB.pdf (UPDATED: 10/5/2018)
- Training/Certification - Dr. Nicholas Murray HSR.pdf (UPDATED: 10/4/2018)
- University of Nevada, Reno - Part I, Cover Sheet - University of Nevada, Reno - Part I, Cover Sheet (UPDATED: 10/5/2018)

If you have any questions, please contact Nancy Moody at 775.327.2367 or at nmoody@unr.edu.

NOTE for VA Researchers: You are not approved to begin this research until you receive an approval letter from the VASNHCS Associate Chief of Staff for Research stating that your research has been approved by the Research and Development Committee.

Sincerely,