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RESEARCH ARTICLE OPEN ACCESS

HOW OLYMPIC WEIGHTLIFTING METHODOLOGIES CAN INCREASE ATHLETIC PERFORMANCE

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ABSTRACT

Objective: To review the current literature into Olympic Weightlifting as a modality for the purpose of increasing sport performance primarily through power production. **Materials and Methods:**This is a retrospective review of the literature with a quantitative approach. The sample population included data from various sports of different levels and subject demographics. Data collection was performed measuring power production through verified objective measures. The data analysis was performed by comparing methods of training, power production, and injury rates. **Results:** Sport performance was increased in subjects undergoing an Olympic Weightlifting program. **Conclusion:** Olympic Weightlifting seems to be an effective way to increase sport performance that does not result in higher injury rates when compared to other sports and strength and conditioning methods.

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INTRODUCTION

Strength and conditioning programs have become increasingly popular for the purpose of increasing sport performance in athletics of all levels. Strength and conditioning programsare becoming commonplace in professional sport, Olympic sport, and even youth sport (Faigenbaum, 2009). The purpose of these programs is to make athletes stronger, faster, and more powerful as is specific to their sport (Faigenbaum, 2009 and Hoffman, 2004). Strength and Conditioning facilities may include a combination of free weight, barbells, kettlebells, and resistance training machines (Haff, 2015). The biggest challenge for Strength and Conditioning coaches is finding the requisite time while working with different levels of athletes in different parts of their respective competitive seasons to build appropriate programs for the purpose of optimizing human and athletic performance (Haff, 2015 and Garhammer, 1980). The sport of Olympic weightlifting has been around for a long time while the modality of Olympic weightlifting is a newer concept but has become popular in athletes as a way to increase sport performance through power production (Garhammer, 1980). Olympic weightlifting consists of the Snatch and Clean and Jerk which are usually modified when applied to athletes. The purpose of this review article will be to explore Olympic Weightlifting as a modality and how it may be used to increase athletic performance while comparing it to other training modalities and injury risk factor. Even though each sport has their own individual and unique demands on the human body, power is the common factor that determines at what level an athlete will perform and how successful they will be (Fahey, 2001; Reynolds, 2012). Power is defined as the rate at which work is done, or how fast something can be done (Arabatzi, 2010; Fahey, 2001; Reynolds, 2012). The individuality of various sports calls for the development of speed, strength, stamina, accuracy, or agility. Yet, athletic performance can be measured in power or rate of force development (Fahey, 2001; Reynolds 2012; Adams 1992). Within the human body, it is the lumbo-pelvic-hip complex (LPHC) where force is developed, it is powerful hip extension that dictates power production (Hoffman, 2004; Garhammer, 1980; Falatic, 2015 and Tabata, 1997). Powerful hip extension can be transferred to most, if not all sports and athletic endeavors (Manocchia, 2013 and Palsson, 2009). The functionality of a powerful LPHC can be seen in countless athletic performances including but not limited to; a golf swing, the 100-meter sprint, or a finesse shot in soccer (Garhammer, 1980; Arabatzi 2010 and Klavora, 2000). Because this neuromuscular pattern is so crucial to elite performance, the importance of power development can't be understated in any strength and conditioning program. The

modality of Olympic weightlifting can help develop essential skills and attributes to various sports (Faigenbaum, 2009; Garhammer, 1980; Klavora, 2000; Moreno, 2014; Shafeeq, 2013).

METHODS

Search Strategy: This literature review was undertaken in accordance with PRISMA statement (Moher, 2009). Systematic searches were conducted by 2 researchers in 7 electronic data- bases: Cochrane, Lilacs, PubMed, Scielo, Scopus, SPORTDiscus, and Web of Science. The following combination of keywords was used: (Weightlifting) OR (Olympic Weightlifting) AND (Sport performance) AND (Power).

Inclusion Criteria: Each article reviewed was included into this review article if it met the following inclusion criteria: The article was written in English, included the full article's manuscript along with any supplemental material, and its purpose was to measure the effect of Olympic Weightlifting on sport performance in the healthy, athletic population. The article must have used healthy subjects with no neuromusculoskeletal injuries. Types of studies were not a limiting factor so articles ranging from case studies, experimental studies, and systematic reviews. The article must have been published within the last 15 years (2005-2020).

RESULTS

Study Characteristics: The electronic search yielded a total of 2,500 potentially relevant studies. Twenty-five full-text studies were identifiedas potentially relevant after the screening process. Fifteen studies were removed after screening the full text of the identified studies. This left the authors with a total of ten articles to be used for data extraction and discussion.

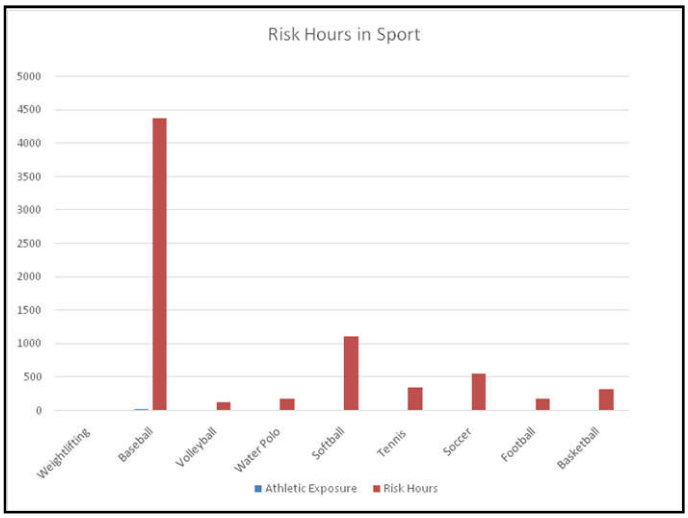
Results of Studies: The studies gave a broad spectrum of sports and activities such as Football, Soccer, and Basketball which allows us to draw from different sports and their demands (Arabatzi, 2010; Shafeeq, 2013). In the development of speed, power, and strength, Olympic lifting seems to be an effective modality used (Faigenbaum, 2009; Hoffman, 2004; Haff, 2015; Beltz, 2013 and Manocchia, 2013). Olympic lifting is the only method of resistance training shown to increase anaerobic work capacity (Millet, 2014; Wadley, 1998; Tabata, 1996). In a study by Hoffman et al, an Olympic lifting program was compared to a traditional lifting program in development of 1-rep max (Squat, Bench press), 40-yard sprint (Speed), Vertical Jump (Power), and the T-test (agility) (2). At the end of 15 weeks, the intervention group who used Olympic lifting had greater gains in the 40-yard sprint (Speed) and Vertical Jump test (Power) with no differences found in the other measures (2). Arabatzi et al. studied the effects of plyometric training and Olympic lifting on vertical jump (power) in three groups where athletes only performed one style of training or did both programs simultaneously (Arabatzi, 2010 and Fahey, 2001). Although there were no differences in power improvement within the groups, each group increased their vertical jump by different methods (Garhammer, 1980). The Olympic training group increased their height by adaptations in power and technique while the plyometric group through better use of the stretch-shortening cycle (Garhammer, 1980; Noyes, 1996; Beltz, 2013). Monnochia et al. studied if there was any transference from the Power Clean (PC) into strength, power, or endurance (Beltz, 2013). Results showed the PC increased a 40-yard sprint time and vertical distance in the counter movement jump (CMJ) (Beltz, 2013; Manocchia, 2013; Comyns, 2006). Similarly, Lake and Lauder explored the PC in improving maximal and explosive strength by measuring 1-rep max back squat and vertical jump when compared to a jump squat group (Moreno, 2014). The PC group showed greater increases in maximal strength and no difference was found in explosive strength compared to jump squats (Moreno, 2014).

DISCUSSION

By using a wide variety of modalities, exercises, and periodization (micro-, meso-, macro-), athletes can benefit in long-term athletic development (LTAD) while focusing on power (Tabata, 1997; Faigenbaum, 2009 and Hoffman, 2004). While the modalities through which strength and conditioning program can be achieved are vast, this article focuseson Olympic lifting and its various components. Olympic lifting receives much attention in the athletic strength and conditioning community. In the development of speed, power, and strength, Olympic lifting seems to be an effective modality (Faigenbaum, 2009; Hoffman, 2004; Haff, 2015; Lake, 2012; Falatic, 2015; Millet, 2014). Olympic lifting is the only method of resistance training shown to increase anaerobic work capacity (Beltz, 2013; Falatic, 2015; Comyns, 2006). The Clean and Jerk and Snatch are the two lifts but are usually broken down into the power clean, power snatch, push press, and push jerk in strength and conditioning programs. The term "power" is used to describe any variation in which lifts that are received above parallel (<90 degrees of knee flexion) (3). The term "hang" is used to describe a variation of the lifts where the implement (barbell, kettlebell, etc.) begins above the ground and common positions include knee height, thigh height, and hip height (3). Thus, it is important that programs using Olympic Weightlifting not be limited to believing only strict implementation of the "full" Clean and Jerk or "full" Snatch are ways to increase power production.Free weights have been proven to be more effective than resistance machines at increasing strength by means of hypertrophy within skeletal muscle (Hoffman, 2004; Garhammer, 1980; McBride, 1999). But more interesting is the comparison between free-weights and an Olympic lifting program when measured against markers of athletic performance (Hoffman, 2004; Garhammer, 1980; Arabatzi, 2010). It is hypothesized that gains in power (vertical jump test) come from the similar biomechanics and motor unit firing patterns of both movements to Olympic lifting (Faigenbaum, 2004; Hoffman, 2004; Garhammer, 1980). The high force, high velocity movements of Olympic lifting training are better suited in developing strength, power, and speed as opposed to traditional resistance training using high force and low velocity movements which increase only muscular strength (McBride, 1999; Fahey, 2001 and Theodorou, 2013).

Plyometrics is another form of training used to increase power and is described as taking advantage of the stretch-shortening cycle through a high-intensity eccentric contraction immediately before a rapid and powerful concentric contraction (Garhammer, 1980; Klavora, 2000; Theodorou, 2013). It seems that Olympic training may workthrough adaptations in power and technique while plyometric training

through its better use of the stretch-shortening cycle (Moreno, 2014; Shafeeq, 2013). Coaches could implement both styles of programs during the competitive season for increasing strength while simultaneously increasing power and a more efficient use of the stretch-shortening cycle (Shafeeq, 2013 and Lake, 2012). An argument brought into light when discussing Olympic Weightlifting is injury and injury rates. Common injuries seen in this sport and when used as a modality are knee, hip, lumbar spine, and shoulder pathologies (Aasa, 2017). Proponents against Olympic Weightlifting will state risk-reward ratios. Even thoughOlympic weightlifting as a modality has been shown to increase power production in athletic performance as measured by vertical jump or countermovement jump there is a proposed higher risk of injury. This higher risk of injury is compared to traditional resistance programs, strength and conditioning programs, and other sports in general (Hoffman, 2004; Tabata, 1997; Weisenthal, 2014). The authors performed a review to briefly investigate the incidence of injury in other sports over the course of a season and found injury rates in Olympic Weightlifting to be lower than other sports as compared per 1000 risk hours (Hootman, 2007 and Kerr, 2015). This evidence shows how Olympic Weightlifting may be a safe option to improve athletic performance.



Limitations

This review is not without limitations such as skill acquisition. Olympic weightlifting and its variations are complex motor patterns that take time to learn. Each of the studies included in this review do not speak about proficiency during the lifts and could be a limiting factor to its product. Similarly, Olympic Weightlifting makes up a small portion of Strength and Conditioning curriculums and coaches who wish to use these lifts in their programs are encouraged to take course such as the USA Weightlifting (USAW) Sport performance certification.For example, if a subject is proficient in a lifting technique, they are likely to obtain the correct stimulus and maximize neuro-physiological gains while an inexperienced lifter may need time to learn the correct technique (Haff, 2015). The current review only included comparisons between Olympic weightlifting to traditional resistance training programs and plyometric training (Noyes, 1996; Moreno, 2014; Lake, 20121). There are other varieties of strength and conditioning including complex training and flywheel training that may have a positive effect on production of power. The authorswere confined to studies which included a full manuscript, in the English language that were published. There may be ongoing studies or abstract papers with different findings on the subject matter. The studies included did not mention injury rates in comparing methods which are beyond the scope of this paper.

Conclusion

By using Olympic Weightlifting as a modality, athletes can experience significant increases in power and increase skills specific to their sport such as speed, maximal strength, and coordination (McBride, Fahey, 2001; Reynolds, 2012).To date, there are few articles studying the prevalence of injury in Olympic Weightlifting that have limited validity due to the lack of control and intervention groups along with being grouped together with subjects who are performing CrossFit simultaneously (Hak , 2013; Weisenthal , 2014 and Montalvo, ?). It should be noted that Olympic Weightlifting and CrossFit are two different sports and modalities of strength and conditioning even though Olympic Weightlifting may be programmed into a CrossFit workout. Injury prevalence is commonly measured per 1000 hours of exposure in a respective sport. Olympic Weightlifting was found to have 3.1 injuries per 1000 hours of exposure (27). This number does not differ from other sports such as gymnastics, rugby, soccer, and football (Hak, 2013; Hootman, 2007 and Kerr, 2015). There are many methods that can increase athletic performance. It seems that complex movements (multi-joint) involving moderate resistance and performed at high velocities are most suited to increasing power (Hoffman, 2004; Garhammer, 1980; Klavora, 2000 and Beltz, 2013). This purpose of this review article is not to recommend or mandate that Olympic Weightlifting be programmed to increase athletic performance. This review article simply strives to shed light on Olympic Weightlifting as being broken down into multiple exercises with varying complexities that are adequately safe and may be programmed to increase athletic performance increasing power production.

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