Plyometrics

By Tyler Mertens and Graduate Student Mentor, Eric Leslie

Introduction

Humans have been performing movements using their own bodyweight for as long as our species has been around. The main difference between people now and early humans is the purpose of body movements which were once necessary for survival. But this is no longer the case because of technological advances. This increased use of technology is problematic because it generally leads to decreased daily physical activity which can eventually cause other health issues related to a sedentary lifestyle such as obesity and cardiovascular disease. One way to incorporate more movement into a person's life is through plyometrics. Plyometric training involves bodyweight movements performed explosively by using strong muscle contraction over short periods of time. This increases physical activity while improving muscular power and strength at the same time. Plyometrics also requires only one piece of equipment that everyone has: their own body. This type of training has traditionally been used by athletes to improve sport performance by increasing power and improving balance and coordination. Plyometrics is now becoming more popular for the general fitness community because it requires minimal equipment and time to complete. During the COVID-19 pandemic many gyms have been forced to close or remain open at a limited capacity, which leaves individuals to turn to other methods of training to maintain or improve their fitness. This is a good example of when plyometric training is beneficial and why this type of training has seen a spike in popularity. The purpose of this article is to explain the benefits of plyometric training, who these benefits help, and how plyometric training compares to other training modes for improving performance.

Adaptations of the body following plyometric training

Different types of stress cause the body to react and adapt in different ways, which is evident during plyometric training. One way the body has been shown to adapt to plyometric training is in the skeletal system. Osteokines (small proteins that make up part of bone structure) and other bone markers were analyzed during a study that focused on the effects of plyometric training in women which found that plyometric exercise involving 3 sets of 8 jumps organized into five circuit stations with three minute rest between stations effectively elicited bone-specific anabolic effects in younger women (1). This increased bone strength can reduce injury risk and provide a stronger foundation which is beneficial because of the adaptations seen in muscle following a plyometrics program. Eight weeks of medicine ball plyometrics performed using maximal effort for 3 sets of 10-20 reps per exercise and one minute rest between sets was shown to improve markers of upper body muscle

adaptations such as muscle activation, balance, and muscular power (2). When comparing to traditional resistance training, plyometrics elicited greater improvement in muscle power and jump performance (3). The effects of plyometric training suggest adaptations to many different structures in the body used to measure exercise performance such as muscular power and neurological pathways, both of which are involved in acceleration and change of direction movements. This is directly related to how plyometric training can be used by athletes to improve sport and athletic performance.

Effect of plyometric training on markers of sport and athletic performance

Athletes and other individuals concerned with sport performance have many tests that are used to determine training status and athletic ability such as jump height and reaction time. These tests help players and coaches determine what aspects of performance may need improvement before and during the sports season. One of the commonly measured aspects of sport performance is change of direction, which is used in competition to overcome opponents, and this can be used to judge overall performance because faster direction change ability can cause an athlete to have faster acceleration and deceleration advantages over other competitors (4). Change of direction can be improved through training techniques, including plyometrics. One study compared resistance training and plyometric training to determine any significant impacts on change of direction test outcomes. This was done using maximal effort sprint tests with varying change of direction degrees followed by squats and different jumps to evaluate EMG activity. The results of this study indicated that a plyometrics program caused improvements in markers correlated to change of direction (4). This information shows that multiple training modes may be useful for improving a key aspect of sport performance. Plyometric training is commonly used by athletes because the movements used during exercise translate over to the movements used during many sports. Other beneficial performance markers commonly tested in athletes include balance and gait, which are used in both individual and team sports. A 6-week plyometrics program involving movements such as squat jumps, box jumps, and scissor jumps was shown to produce significant improvements in dynamic balance, as well as knee proprioception in female badminton players (5). A very similar training program used by another researcher involving different jump movements arranged into a program that changed weekly for a total of six weeks and involved 2-8 sets of 5-10 reps improved gait variables (6). These improvements were seen in sprinters which require fast reaction time as well as explosive acceleration to cross the finish line ahead of opponents which provides more evidence of how plyometric training adaptations benefit athletic performance.

A relatively new method used by athletes to improve short-term force and power is post-activation performance enhancement (PAPE) which involves performing "a resistance conditioning activity followed by an explosive activity with a similar movement pattern" (7). An example of this would be performing bench press followed by plyometric push-ups. This training method increased power output as well as bar velocity during the bench press (7). Utilizing proven training methods involving plyometrics is beneficial due to the competitive nature of sports worldwide where having an athletic advantage can cause an individual or team to win.

Effect of plyometric training on different age groups and training status

There are many variables to consider when choosing a training type for an individual including age, training status, and fitness goals. While plyometric movements have recently become more commonly seen in many training routines, younger age groups have been shown to benefit the most from programs. One of the biggest concerns for older populations regarding plyometrics is the safety of the movements. With many of the exercises requiring explosive movements and jumping on to or off of objects, there are concerns of potential injury especially in older individuals. A study that prescribed 12 weeks of plyometric training in older men involving resistance training and plyometric step-up and jump movements for 2-4 sets of 8-20 reps three times per week produced increased fitness performance markers such as dynamic strength, functional capacity, and jump performance but also had increased injury risk associated with programs for older clients (3). During this study, three participants in the plyometric group dropped out due to pain or strain in at least one part of the body. Another study involving women ages 18-68 years old noted that plyometric training was effective for bone health markers in younger women, but this was not the case for postmenopausal women due to lower levels of hormones checked 5 minutes, 1 hour, and 24 hours post exercise (1). Additionally, healthy adults that participated in plyometric training programs involving jumps 2-3 days per week for 4-10 weeks improved vertical jump performance (8). While plyometrics may not be the best training type for older adults, younger age groups and adult athletes responded well and are at a lower risk of injury. This information adds to the evidence that plyometric training benefits different age groups, but younger individuals tend to have a lower risk of injury during training. The effects of plyometrics were noted in a study on cricket players of different age groups that found adolescent subjects were more adaptive than adult subjects and showed significantly greater neuromuscular adaptations to medicine ball plyometric training than the control group (2). This information is useful because it shows that younger age groups benefit the most from plyometric training, but it can also help improve fitness levels in older adults. Many exercises found in a plyometric program involve movements that translate

into functional training for activities of daily living such as pushing doors open or standing up from a seated position on a chair. This is one reason why plyometric training is becoming more popular among groups other than athletes, but older age groups need to be aware of the injury risk associated with explosive movements which may require special care and close monitoring during exercise.

Conclusion

When looking at the wide variety of training modes available today it is important to consider which training types provide noticeable benefits and what is practical for the majority of people. Plyometric training fulfills all of these criteria by being able to be performed by most individuals and involving the use of little or no equipment which is cost-effective and a great option to maintain or improve fitness levels. Since plyometrics only involves bodyweight movements it can be performed by anyone at any location, making it convenient and easy to fit into most schedules. With health and performance benefits seen in various groups ranging from athletes to older adults, plyometrics should be considered when developing a training program that focuses on improving both athletic performance and overall fitness.

Additional Elements

Apply It

Plyometrics training causes the most noticeable benefits in younger age groups such as acceleration, jump performance, and muscular strength

Performing a set of plyometrics exercises following a set of resistance training exercises can cause further performance improvements

Plyometric training requires little to no equipment and can be done anywhere

Bridging the Gap

Plyometric training is a useful type of exercise because it can be performed almost anywhere. While traditionally performed by athletes to improve sport performance, plyometric training is now more common for other individuals looking to maintain or improve their health through exercise. Benefits from plyometrics related to athletic performance like change of direction and jump height can be seen in various different age groups but provides the most noticeable benefits in younger individuals.

Summary Statement

Plyometric training is an accessible form of exercise that focuses on using bodyweight movements to improve markers of health and performance. While traditionally used by athletes in sport settings,

plyometrics is gaining popularity among the general public due to its versatility and benefits that have been shown in many adults, especially those of younger age groups.

Pulled Text

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Bio

Tyler J. Mertens is currently finishing his bachelor's degree in Exercise Science at the University of New Mexico. His interests include resistance training for hypertrophy and strength and he aspires to use his knowledge for personal training.

References

Nelson K, Kouvelioti R, Theocharidis A, Falk B, Tiidus P, Klentrou P. Osteokines and bone markers at rest and following plyometric exercise in pre- and postmenopausal women. BioMed research international [internet]. 2020 [cited 2020 Feb 10]; 2020. Available from: https://doi.org/10.1155/2020/7917309.

Singla D, Hussain ME. Adaptations of the upper body to plyometric training in cricket players of different age groups. JSR. 2020; 29(6): 697-706.

Van Roie E, Walker S, Van Driessche S, Delabastita T, Vanwanseele B, Delecluse C. An age-adapted plyometric exercise program improves dynamic strength, jump performance and functional capacity in older men either similarly or more than traditional resistance training. PLOS ONE [internet]. 2020 [cited 2020 Feb 10]; 15(8). Available from: https://doi.org/10.1371/journal.pone.0237921.

Falch HN, Raedergard HG, van den Tillaar R. Association of strength and plyometric exercises with change of direction performances. PLOS ONE [internet]. 2020 [cited 2020 Feb 10]; 15(9). Available from: https://doi.org/10.1371/journal.pone.0238580.

Alikhani R, Shahrjerdi S, Golpaigany M, Kazemi M. The effect of a six-week plyometric training on dynamic balance and knee proprioception in female badminton players. JCCA. 2019; 63(3): 144-153.

Singh A, Choudhary A, Shenoy S, Sandhu JS. Effects of six weeks sprint specific plyometric training on gait variables of sprinters. Indian journal of physiotherapy and occupational therapy. 2019; 13(4): 6-10.

Krzysztofik M, Wilk M. The effects of plyometric conditioning on post-activation bench press performance. JOHK. 2020; 74(2020): 99-108.

Makaruk H, Starzak M, Sucheki B, Czaplicki M, Stojiljkovic N. The effects of assisted and resisted plyometric training programs on vertical jump performance in adults: a systematic review and meta-analysis. JSSM. 2020; 19: 347-357.