INSTABILITY TRAINING—HELP OR HYPE?

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Activities of daily living and sport performance present a multitude of situations in which an individual must exert force while in unstable and potentially compromised positions. Thus, it has been suggested that due to the concept of training specificity, one should mimic an unstable condition to elicit adaptations that would allow the individual to excel when placed in such a situation (3). As a result, instability training has been a popular and common method of resistance training used in strength and conditioning and general fitness facilities for a number of years. Instability can be achieved through various devices such as medicine balls, exercise balls, balance trainers, balance boards, and foam pads. More recently, gymnastics rings and other forms of suspension training have only added to the abundant list of methodologies that utilize instability training.

Most anecdotal claims for instability training include improved core strength and endurance, increases in functionality of daily activities, improved stability and balance, promotion of lean muscle tissue growth, as well as reductions in body fat. While it has been shown that these instability training devices may be useful, a debate remains within the current literature with regards to their efficacy on overall performance and physical development (3,7,15,16,20,23). With a growing body of evidence elucidating both the benefits and downsides of instability training, this article will briefly examine the most popular devices and ultimately conclude as to how instability training may be incorporated into traditional resistance training programs.

MOST POPULAR INSTABILITY DEVICES

EXERCISE BALLS

Exercise balls, also known as stability balls or Swiss balls, are large, inflatable vinyl balls that typically come in a variety of sizes (e.g., 45, 55, and 65 cm) (Figure 1). These commercial devices are capable of movement in all directions and can provide a base for a plethora of common exercises (e.g., bench press, crunches, etc.). Purported benefits include improved balance, core strength, and coordination while improving joint alignment.

BALANCE TRAINERS

Balance trainers, also known as BOSU® Balls, are double-sided, inflatable instability devices that offer users either a flat or rounded base to perform exercises upon (Figure 2). Depending on which side is against the ground, the balance trainer may provide various levels of instability. For instance, if the dome side is down, then it is capable of multidirectional movement because of the rounded surface. However, if the flat base is against the ground it provides an unstable surface top on which to perform movements.

SUSPENSION TRAINERS

Suspension trainers are a newer fitness trend that involves the use of hanging straps and handles. Typically secured overhead, this device mimics the Olympic rings and is offered with a single or dual attachment point, depending on the manufacturer (Figure 3). The lengths of the straps may also be shortened or lengthened to accommodate the performance of a variety of exercises. Unlike

other instability products, suspension trainers allow the individual to perform pulling movements that cannot be done with the other devices (e.g., inverted rows, pull-ups, etc.).

BALANCE BOARDS

Balance boards, also referred to as wobble boards, have typically been used in rehabilitation and outpatient settings. These boards are usually made of a flat hardwood or plastic platform with a small, rounded surface underneath to promote instability (Figure 4). Depending on the manufacturer, the board height may be adjustable as well. This adjustment in height is claimed to provide an increased challenge to the individual during exercise, due to the increased distance between the platform and the ground.

LITERATURE REVIEW

Much of the current literature focuses on abdominal wall and primary agonist activity during traditional exercises performed on instability devices. For instance, multiple studies have examined bodyweight push-ups performed on various types of surfaces including balance trainers, exercise balls, and suspension devices (2,5,8,14,15,20,23). Most of the studies have reported increases in activation within the abdominal wall (e.g., rectus abdominis [RA], external oblique [EO], erector spinae [ES], etc.), prime movers (e.g., pectoralis major, triceps brachii, and anterior deltoid), as well as secondary and supporting musculature (e.g., latissimus dorsi, serratus anterior, and trapezius).

While most of the literature focuses on whole body movements (e.g., push-ups, squats, etc.), abdominal movements (e.g., crunches, planks, etc.) are typically the most commonly performed exercises when incorporating instability devices into an exercise routine. However, some findings in the literature are conflicting. For example, a recent study by Saeterbakken et al., showed no differences in RA activity when subjects performed sit-ups with and without a balance trainer (18). In addition, researchers found significantly reduced activity in the obliques when sit-ups were performed sitting on the balance trainer (18). However, Duncan found that curl-ups, jack-knives, and roll-outs performed on the exercise ball activated the RA to a significantly greater extent when compared to performing the exercises in a stable manner (7).

Another popular abdominal wall exercise, the plank, has also been shown to increase activation of the core musculature under conditions of instability. Exercise balls and suspension devices elicited a significant increase in activity in the RA, EO, and lower back musculature during unstable planks compared to stable floor planks (4,12,22).

One of the most common strength training exercises performed on instability devices in commercial gyms and personal training studios is the bench press. A deeper look into the research on this movement reveals inconsistent results. A study by Norwood et al. revealed that with decreased stability, stabilizer muscles (e.g., latissimus dorsi, internal obliques, and erector spinae) increased in activation (primary musculature was not examined during this study) (17). The exercise ball bench press has also been shown to elicit increased activation of the deltoids and RA when compared to the traditional method (13). However, not all studies have shown differences in activation or weight lifted between surfaces. Goodman et al. demonstrated that there were no differences in one repetition maximum (1RM) values between a stable and unstable surface (9). Researchers also showed no differences in muscle activity of the primary movers or ranges of motion during the movement (9).

Although multiple studies exist supporting the use of these devices, not all studies have shown increased muscle activity; in fact, some have even provided evidence to suggest reduced activation. For example, Schoffstahl et al. examined a traditional crunch in comparison to isometric pikes upon an exercise ball, suspension device, and ab wheel while measuring activity of the abdominal wall (19). The researchers found no significant differences between any of the exercises performed (19). A separate study was performed to determine if switching an exercise ball for an exercise bench would increase abdominal wall activity during traditional exercises, such as the shoulder press, biceps curl, triceps overhead extension, chest press, etc. Results indicated no differences in the core musculature regardless of the base of support during weight training (11).

Most of the literature on instability training focuses on either abdominal movements (e.g., crunches) or pushing movements (e.g., push-ups). To the authors' knowledge, only two studies to date have examined pulling movements (e.g., traditional and inverted row) with varying levels of stability. These studies had subjects perform the traditional and inverted row with a suspension device while the electromyography (EMG) of the traps, lats, biceps, and posterior deltoids were examined. Results indicated that no differences existed between the two types of rows except that the biceps showed greater activity during the traditional method than during the inverted row (16,21).

While increased muscle activation is one of the primary motives for using instability devices, other key factors to consider are power, strength, and force production. Studies have shown decreases in force production from as little as 6% to as much as 60% in exercises such as the bench press and squat when performed on unstable surfaces (1,10). Zemkova et al. further reinforced this by demonstrating the loss of peak and mean power when comparing stable bench press to the exercise ball bench press (24). Participants also suffered from a greater fatigue index when the bench press was performed on the instability device, which would affect power production negatively (24).

HOW TO USE INSTABILITY DEVICES PROPERLY

As previously indicated, there is conflicting research in regards to the effectiveness of instability training. While most research shows significantly increased abdominal wall activity, primary musculature may suffer or have no measurable differences when performing traditional resistance exercises upon these devices. Therefore, it is recommended that the practitioner consider the goals and specificity of the training program for the individualized client.

For instance, if the primary goal of the individual is strength, power, or hypertrophy, then performing multi-joint, compound movements (e.g., squats, bench presses, shoulder presses, and deadlifts) on a stable surface should form the foundation of the program. Performing these compound movements on instability devices may decrease force production and thereby limit the maximal load that can be utilized during a particular exercise

(1,10). On the other hand, if the goal is increased core activation or local muscular endurance, then instability training may be occasionally supplemented into workouts to introduce unstable environments and thus increase abdominal wall endurance and stability. In addition, performing compound exercises with reduced loads and increased volume on instability devices may still be of benefit to individuals wishing to improve or maintain the general health benefits of exercise, as well as individuals in a deload training phase who need to decrease forces and velocities to allow for recuperation. The latter approach would be most recommended with upper body movements (6). Table 1 provides an example of several movements that can be performed under varying levels of instability.

There are clearly some negative consequences to utilizing instability training. However, there is significant evidence indicating that when utilized properly, with appropriate specificity in regards to the goals of the individual, instability training can be a valuable supplemental tool. As with any form of exercise, the use of instability training should be introduced progressively to beginners to allow for proper adaptations prior to moving to more advanced movements.

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FIGURE 1. EXERCISE BALL

FIGURE 3. SUSPENSION TRAINER

FIGURE 2. BALANCE TRAINER

FIGURE 4. BALANCE BOARD

TABLE 1. SAMPLE INSTABILITY TRAINING MOVEMENTS AND PROGRESSIONS

EXERCISE	BASIC MOVEMENT	INTERMEDIATE PROGRESSION	ADVANCED PROGRESSION	SETS X REPS
Exercise Ball Crunches	Bodyweight	Hold medicine ball at chest level	Hold medicine ball with arms extended overhead	3 x 20
Exercise Ball Planks	On knees with the forearms on the ball	Feet on the exercise ball with arms extended and hands on the ground	Feet on the ground with arms extended and hands on the ball	3 x 30 s
Balance Trainer Push-Ups	With flat side on the ground	Dome portion on the ground	Dome portion on the ground and one leg off the ground	3 x 10
Suspended Planks	With feet in the device and forearms on the ground	Hands in device and feet on the ground	Forearms in device and feet on the ground	3 x 30 s
Suspended Push-Ups	On knees	On toes with legs extended	Feet elevated	3 x 10
Suspended Inverted Rows	With 90° knee bend and feet on the ground	Legs extended and heels on the ground	Feet elevated	3 x 10
Suspended Pull-Ups	With knees bent and feet on the ground	Legs extended and heels on the ground	L-sit (knees and hips at 90°)	3 x 6