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ABSTRACT

The aim of this study was to evaluate and compare the effect of two training protocols on the women's arms strength by using the patented equipment of PowerBall® and Shake Weight®. 39 females, aged 21.6 ± 1.1 yrs with body mass 60.3 ± 7.4 kg and stature 164 ± 0.6 cm were randomly divided into three groups: the PowerBall® (PGr), the Shake Weight® (SGr) and the Control (CGr). The participants of the PGr & SGr trained for 18 days by using specific arms exercises while the women of the CGr did not perform any training program. In all studied women the hand-grip test as well as the forearm and arm girths of the dominant hand was evaluated before and after the completion of the testing protocol. The interaction among the variables in each group was assessed with the use of the factorial Analysis of Variance (ANOVA). The results showed that the women in PGr had a marginal improvement in the final hand-grip measurement (18.78 ± 3.1 kg) in relation to the participants of the SGr (18.65 ± 3.1 kg). In addition, the forearm and arm girths of the women of the PGr were slightly larger than those

Key Words: *Inertia, Hand grip, Adaptations, Arm strength*

reported in the participants of the SGr. In conclusion, the present study justifies the effectiveness of the training with the use of the innovative PowerBall® and Shake Weight® which are the proper equipment for the upper limbs muscular strength in moderate trained women.

INTRODUCTION

In the modern multi-tasking societies both athletes and exercising individuals are continuously looking for faster and more efficient methods to improve their physical fitness. Every year a variety of innovative sport equipment is presented in order to make the exercise more attractive to a wide range of population. In the USA, it was recorded that the sports industry had made a profit of more than 5.8 billion dollars because it had offered low budget equipment which improved the human body in a safe and effective way (4). Recently, the research in technology has led to many radical changes in the sports science offering more efficient products which not only maintain but also increase physical fitness. Concerning the professional equipment, the technology in sports has released low-cost innovative products for the physical improvement of exercising individuals. Examples of these highly reliable products include the Bodyblade® (14), Ab Circle Pro® (19) and Perfect Pushup® (20).

Nowadays, the muscular strength is an important component in physical fitness. The development of strength is a main priority for both men and women who use the sport technology in order to imitate the professional training of top-level athletes by using similar training equipment. More specifically, a kind of training products based on the racket (tennis, badminton, etc.) and combative sports (judo, wrestling, etc.) has been presented in the fitness trade, which focuses on the women's upper body stamina development (8). In addition, relevant studies have proved the interaction between the forearm and arm strength with the ideal performance in individual sports such as boxing and tennis (17,13). Similarly, another study reported that the specific arm training prevents the female athletes from muscular injuries in baseball and softball (6).

Recently, in sports and rehabilitation market the revolutionary equipment of PowerBall® (a spherical hand-held gyroscopic exerciser) and Shake Weight® (dumbbell shaped fitness device) are presented. According to our knowledge, limited research analyzing the effectiveness of the above innovative products on the women's physical fitness has been conducted. Therefore, the objective of this study was to evaluate and compare the potential beneficial effect of the two training protocols with the use of the patented equipment of PowerBall® and Shake Weight® on the arms muscular strength in moderately trained women.

MATERIALS AND METHODS

Instruments

PowerBall® is a hand-held gyroscopic exerciser which literally explodes with mind numbing inertial forces once you activate its internal rotor. First patented as a therapeutic device or an exerciser in 1973 in USA as Dynabee (15) it was later implemented under different names such as Roller ball or Gyrotwister (10). PowerBall® does not demand batteries while it generates resistance between 1 and 75kg depending on the rotor speed. The NSD PowerBall® (*Nano Second, Taiwan*), which was used in the present study, was the Regular type with digital counter (Picture I). The above female plastic version weights 280gr with a diameter of 7cm and it generates resistance of approximate 18kg in a maximum of 15.000reps.min⁻¹ (<http://www.PowerBallnsd.com>).



Picture I. *The patented equipment of PowerBall®.*

Shake Weight® is a dumbbell-shaped fitness device that oscillates, purportedly increasing the effects of exercise. The above modified dumbbell firstly designed specifically for women and it is a non-motorized mechanical device based on “vibration plate technology” (*Fitness IQ, LLC, USA*). While gripping the Shake Weight® with one or both hands, users vigorously shake the weight back and forth. Springs on both ends allow the weight to move back and forth, creating a resistance. Per official company press releases, “based on a groundbreaking workout technology called Dynamic Inertia, which engages the muscles in the arms, shoulders and chest in an entirely new fashion, the Shake Weight® increases upper body muscle activity by more than 300% compared to traditional free weights” (<https://www.theshakeweight.com>). The women version (Classic) which was used in this study weights 1.130gr (Picture II).



Picture II. *The patented equipment of ShakeWeight®.*

Research Design

For the nature of this study the subjects were randomly divided in three (3) groups of thirteen (13): the PowerBall® group (PGr), the Shake Weight® group (SGr) and the Control group (CGr) in which the women did not perform any training program. The testing protocol was fully explained to each subject but they were not informed of the specific purpose of the study. A week before the beginning of the testing, the subjects were familiarized with the training equipment by the researchers. The participants of the groups PGr and SGr exercised in 18 consequently training sessions (7d.wk⁻¹) with the specific program depending on the equipment. The training protocols of the PGr and SGr were applied according to each product manufacturers' recommendations for exercise commonly aiming at the development of the subjects' forearm and arm muscular strength.

Training procedures

Upon firstly reported at the University lab, body mass and stature of the studied subjects were measured. Body mass was measured at the nearest 100g on a calibrated floor scale (Seca 770). The subject was standing in the center with relaxed arms, without shoes and wearing only light sportswear. Stature was measured with a stadiometer (Seca 240) at the nearest 0.1cm in bare feet with the head in Frankfort horizontal plane. In the total amount of the women who participated in the present study, the hand-grip test (Takei 5101) and the forearm and arm girths of the dominant hand were measured before and after the completion of the testing protocol. From a standing position, the women who participated in the PGr trained with dynamic, continuous and maximal exercise (Picture III).



Picture III. *Pictorial presentation of the dominant hand exercise by using the PowerBall®.*

In addition, the training of the women of the SGr was based on 2 double-handed on the even plane front exercises aiming at the improvement of the local muscle (forearm & arm) endurance (Pictures IV,V).



Pictures IV, V. *The exercises which were applied by using the ShakeWeight®.*

All the testing sessions were carried out at the same time of the day in identical training conditions with the ambient temperatures ranging from 18°C to 22°C. During the training sessions verbal motivation and a kind of feedback about their performance was provided. The programs of the training groups are presented in Table 1.

Table 1.

The training programs which were applied in the women who participated in the PowerBall® and ShakeWeight® groups.

	Training equipment	
	PowerBall®	ShakeWeight®
Volume	4set per arm	2 exercises x 4set each
Duration	20s per arm (5s preparatory-15s normal)	15s in each exercise
Intensity	Maximal-Constant-Continuous (250Hz)	Maximal-Continuous
Intervals	20s (1:1) per arm	2min between the set in each exercise 4min between the 2 exercises

Participants

A total of 39 moderate trained female volunteered to take part in this study in response to a request for participants. The subjects' mean age was 21.6 ± 1.1 yrs, the body mass 60.3 ± 7.4 kg, the stature 164 ± 0.6 cm and they had a similar fitness level (4-5yrs). All were on good health, physically active with varied sporting backgrounds but none had a high degree of specialist training. Prior to the beginning of the testing procedures, all subjects completed a questionnaire on their medical history and it was confirmed that they had no previous history of upper limb injuries. The study was performed according to the rules of the Ethics Committee of the Democritus University of Thrace.

Statistical analysis

Descriptive statistics with exploration was firstly generated for all categorical variables while the scatterplots were used in order to determine whether a linear model is reasonable for the studied variables. The statistical design for the evaluated variables of this study was based on the factorial analysis of variance (ANOVA). The interaction of the 18 training sessions on the measured variables in each group (3 x 2) was assessed in the analysis of the depended factor "measurement" (hand grip-forearm/arm girths) and with independent factor "time" (pre-post training). The Tukey's HSD test (*post-hoc* multiple comparisons) was applied in order to identify the inter groups (PGr-SGr-CGr) statistically significant differences in the measured variables of this study. The acceptable level of significance was set at 0.05 and all results were reported as mean \pm standard deviation. IBM-SPSS

statistical software version 19.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for data management and statistical calculations.

RESULTS

The mean values of the hand-grip test in the final measurements were better (17.86kg) than the initial ones (15.95kg) for both training groups (PGr & SGr) although they did not present any statistically significant differences ($F=2.32$, $p=0.11$). In addition, the mean values in the final hand-grip measurement of the PGr were higher than those of the SGr without any recorded significant differences as well. The Bonferroni multiple comparisons showed that the mean values in the final hand-grip testing measurement of the females who performed in the PGr (18.78kg) and SGr (18.65kg) were better than those of the participants of the CGr (16.17kg).

Similarly, the mean values of the dominant hand girths of the studied women in both PGr and SGr did not significantly differentiate ($F=0.13$, $p=0.88$) from the first to the last measurement as far as the forearm (22.15cm vs 22.20cm) and the arm is concerned (26.35cm vs 26.82cm). Furthermore, the evaluation of the differences among the training groups (PGr & SGr) and the control group (CGr) during the final measurements showed that, the women in PGr and SGr increased the mean values in forearm and arm girths while the participants of the CGr did not present any improvement from the first to the last measurement in the above girths of the dominant hand. More specifically, the training program in the women of the PGr offered a higher increase in their forearm and arm girths in comparison to the program which was applied to the participants of SGr but without any statistically significant differences. The results of the measurements in all testing groups (pre-post) are presented in Table 2.

Table 2.

The measuring parameters of all studied groups (mean±SD).

Group	PowerBall®		ShakeWeight®		Control	
	Pre	Post	Pre	Post	Pre	Post
Measurements						
Hand-grip (kg)	16.41±3.7	18.78±3.1	15.77±4.5	18.65±3.1	15.68±3.7	16.17±4.1
Forearm girth (cm)	22.25±1.4	22.63±1.6	21.56±1.3	21.89±1.4	22.63±1.6	22.64±1.6
Arm girth (cm)	26.03±3.2	26.30±2.8	25.24±2.5	25.39±2.9	27.80±3.9	27.79±3.9

DISCUSSION

The major finding of this study was that the volume, the intensity and the duration of both training protocols which were applied in the studied women's by using the PowerBall® and Shake Weight® open the “window of muscular adaptations” (9). In accordance with the relevant literature which evaluates the above exercises with the surface electromyography (EMG), the current study confirms that both training programs with the use of the PowerBall® and Shake Weight® activate the involved muscles of the upper body in a quite satisfactory way (7). In conjunction with the bibliography which observed that the muscular endurance training reflects adaptations in upper limbs strength in female athletes, this study showed that the workout structure and the selected exercises of PowerBall® and Shake Weight® improve muscular endurance in the dominant hand in moderate trained women (1, 5).

More specifically, from the results of this study, it was shown that the women who exercised with the PowerBall® had greater hand-grip values in the final measurement of their dominant hand in relation to those who trained with the use of the Shake Weight®. The above findings were interpreted by the fact that the centrifugal power which was applied during the rotor spin-up exercise by the use of the PowerBall® primarily affected the tone in the wrist and the forearm (2) in comparison to the ShakeWeight® which, with the vibrated notion of training reflects a muscular activation in both exercised forearm and arm (3).

In addition, the training protocols which were applied by using the PowerBall® and Shake Weight® increased marginally the forearm and arm girths of the dominant hand from the initial to final measurement in the studied women. It is therefore interesting that the training with the PowerBall® offered a greater increase the women's arm girth (27mm) in the final measurements in comparison to the lower increase which was recorded in the arm girth (15mm) of the participants in the Shake Weight® group. The above findings are consistent with other studies which showed that the muscular endurance derived from the PowerBall® maximizes the training outcomes of each exercised hand (16, 18). In contrast, the exercises which are based on the vibration technology of Shake Weight® aim at the muscular fitness of both hands (11, 12).

CONCLUSION

In summary, this study showed that both PowerBall® and Shake Weight® are easy to use products and completely adjusted to the physical characteristics and demands of women, fulfilling their needs for safe and effective exercise. The above

innovative training equipment which is not only easy to carry and use but also of low cost is beneficial for the upper limbs muscle endurance in moderate trained women. Future research based on the use of the PowerBall® and Shake Weight® products in longer exercising periods and in a variety of muscle endurance or hypertrophy training programs could possibly be the “key” difference in the upper body muscular fitness in top-level or recreational athletes.

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