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Lab #601
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Immediate Effects of the Power Balance™ on Strength, Endurance, and Balance Performance

Abstract

The sports industry has seen a rise in demand for cheap and effective athletic-performance enhancers. Recently, the Power Balance Bracelet has risen to the forefront because of its popularity as well as its notoriety. Power Balance claims that their product utilizes eastern philosophies to increase an athlete's power, recovery time, and balance. However, there has been a rising vocal concern about the true nature of the product. Here, we compare the Power Balance Bracelet against a plastic Livestrong Band that is simply a fundraising tool with no claims of performance enhancement in a series of physiological tests to determine the validity of the Power Balance claims. Our data demonstrates that there is no significant difference in subject's maximum grip strength, recovery, and balance when wearing either bracelet and provides evidence that the Power Balance Bracelet lacks performance-enhancing characteristics. Our findings remind the public to remain aware of product marketing and the shortfalls of cheap performance enhancers.

Introduction

There is a growing trend in the sports industry to find a cheap and effective method of increasing athletic performance (6). With the variety of sports supplements available, companies are moving on to other modes of performance enhancers. Recently, none have caught the

attention and scrutiny of the sports and media world more than the Power Balance bracelet (PBB). The popularity of the PBB is evident by its extensive use throughout professional sports. According to their website, Power Balance products "have been worn during the last world series, NBA finals, and the super bowl champions" (1). With popular athletes like Derrick Rose and Drew Brees endorsing their product, Power Balance has been able to reach a broad audience as it "sold $8000 merchandise in its first year and expects more than $35 million in sales in 2010" (2).

Power Balance claims, "the thin polyester film hologram is programmed through a proprietary process, which is designed to mimic Eastern philosophies that have been around for hundreds of years" (1). In this way, the hologram improves a person's strength, recovery time, and balance by redistributing the body's energy. The company, however, has not provided any scientific evidence to back their claims. Rather it has relied solely on the testimony of athletes with some even being paid by the company just to wear the bracelet. For their marketing campaign, the company claimed that the PBB enhanced athletic performance by having athletes perform various tests twice: the first trial without the PBB and the second trial with the PBB. For all cases, the athletes did better on the second trial with the PBB (3). There is no incentive for Power Balance to provide credible scientific evidence as such data could potentially destroy their credibility

In a recent study by UW-La Crosse, researchers concluded that the PBB has no effect on balance and power. John Porcari, a UW-La Crosse professor of exercise and sports science, conducted a double blind experiment consisting of 42 UW-L athletes (4). Each athlete participated in tests assessing strength, balance, flexibility, and power. The tests conducted were similar to those carried out by Power Balance in their marketing campaign. In both cases, most

of the data was qualitative, not quantitative. All tests were done twice with participants wearing the PBB for one trial and a non-PBB (NPBB) for the other trial. To account for better performance on a second trial, the bracelets were randomly selected for the first trial. For all the tests, most athletes performed better on the second trial regardless of which bracelet they wore. John Porcari explains, "The first time I push you over, you don't know what to expect. But the second time you brace yourself" (4). Although there was a difference between the two trials, the data found no effect by the PBB. According to John Porcari, "Power balance wristbands are designed to optimize energy flow. If a product like that were ionized theoretically, something might happen. But the Power Balance wristbands are not ionized. They just have a hologram" (4). Given that their data has yet to be published, we performed a formal experiment to prove the illegitimacy of the company's claims. The purpose of our experiment was to demonstrate whether the Power Balance Bracelet improves a person's strength, recovery time, or balance as marketed by the company.

Materials and Methods

This study evaluated the effect of the Power Balance bracelet. The subjects are 10 age-matched college students (5 males and 5 females). Each subject was tested with the Power Balance bracelet (PBB) and a non-power balance bracelet (NPBB). To account for better performance on a second trial, the bracelets were randomly selected for the first trial. The order of the tests was also randomized. The NPBB was a Livestrong bracelet, which does not claim to have any effect of performance. As a blind experiment, a sweatband covered both bracelets so that each subject was unaware of the bracelet they wore during testing. The three physiological measurements tested maximum grip strength, endurance, and balance. The trials were completed

over the course of two days, with two sets of grip measurements taken each day with thirty minutes in between.

- **Grip strength:** To measure peak strength, a hand dynamometer was used. Following the guidelines of the BIOPAC student lab manual, three electrodes that connect to the BIOPAC measuring system were placed on the forearm of each participant. The electrodes measure EMG and the dynamometer measures force generated in kilograms. In its purest form, peak strength would be defined as one's '1 RM' (one repetition maximum) in a specific movement, in this case, grip strength. That is the maximum amount of force you can generate in a movement for one repetition. The subject was instructed to hold the dynamometer with the top of their hand directly below the tape on the top of the handle. Then, a subject was asked to grip the device as hard as they could and to maintain the force. Once max force was reached, timing began. The time it took the participant to reach their half-maximum grip strength (50-percent fatigue) was measured. This entire sequence was repeated after a recovery period as described below and is depicted in figure 1.

- **Endurance:** The recovery period is the rest interval between when a subject reaches their first half-max and when they are asked to reach their second peak strength and the subsequent half-max is measured. Recovery periods of both thirty seconds and one minute were used for both the PBB and the NPBB to measure the subject's endurance. A thirty-minute wait period separated each set of grip strength testing so that the subject's results were unaffected by fatigue. Only two sets of testing were done in one day. The other two

grip measurements were taken the following week. The thirty and sixty second recovery periods were randomized. The NPBB serves as the negative control in both hand dynamometer experiments. The positive control for the maximum grip strength measurement is the difference between max values after a longer recovery period versus a shorter recovery period. The positive control for the recovery period experiment is the difference between the max value and the time it takes to reach the half-max within each of the different recovery period intervals.

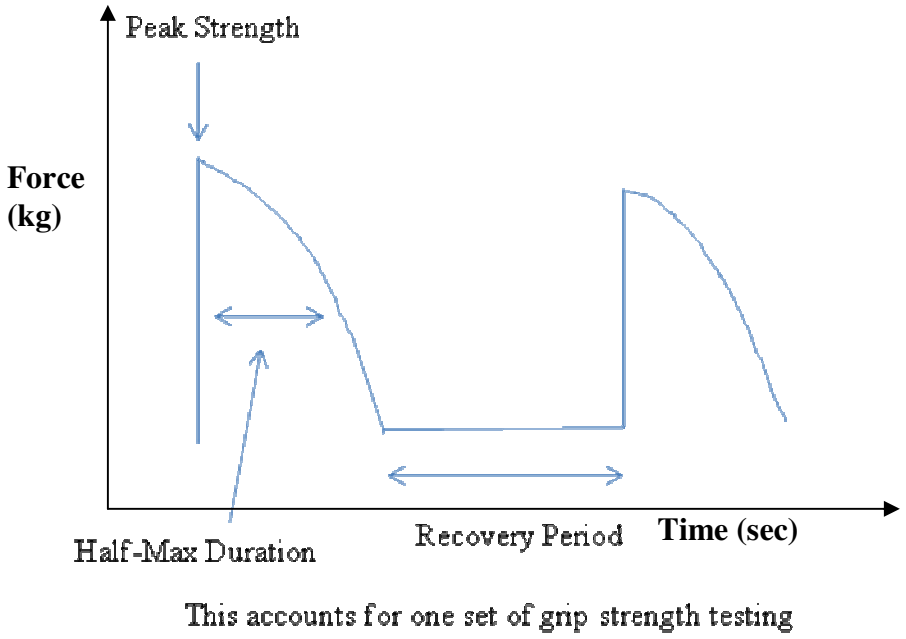

Figure 1: Generic BIOPAC readout of dynamometer data that shows maximum force exerted, time to half-maximum force, recovery period, and second maximum force and half-maximum force duration.

- **Balance:** The Star Excursion Balance Test (SEBT) is a thoroughly researched, yet easy way to test a person's unilateral balance (5). This protocol is "highly accurate and can be used for measuring pre and post rehabilitation performance, improvement after performance

enhancement programs, dynamic balance for fitness programs, and return to sport readiness" (5). The test is based on three measurements including anterior, posteromedial, and posterolateral movements while standing in a single leg stance. While standing in a single leg stance, the participants reach with the free leg in each of the three directions as shown in figure 2. According to a Plinsky, the significant learning curve involved with this test requires a subject to warm up with three practice trials in each of the three directions (5). Following the practice trials, participants had three recorded trials in each direction with the maximum distance being used in the composite score.

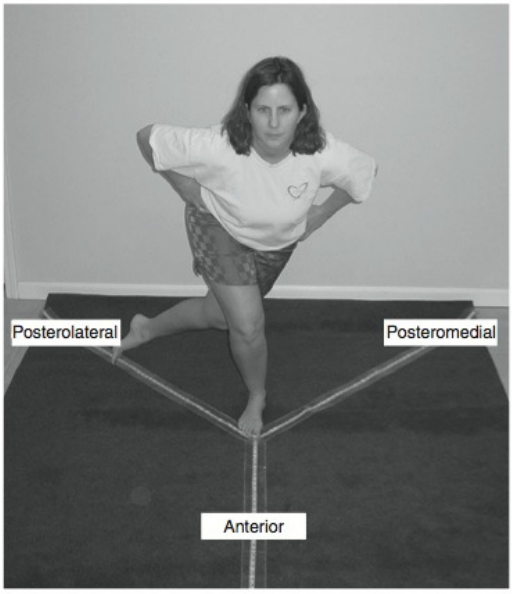

Figure 2: The three measurements for the dynamic balance test are in the anterior, posteromedial, and posterolateral directions (5).

The following equation was used to calculate the composite score:

$$\text{Composite Score} = \frac{(\text{Anterior} + \text{Posteriomedial} + \text{Posterolateral})}{(3\text{X Limb Length})} \times 100$$

Our positive control is repeating the test six times in each direction with actual measurement recording only during the last three trials. This allows the participant to be familiar with the test. The negative control is the difference in composite scores between the subjects wearing the PBB versus the NPBB.

Results

When conducting our experiment we tested ten people, five males and five females ages ranging from 20 to 35. To determine whether there was a significant difference in performance when subjects wore either the Power Balance Bracelet or the non-Power Balance Bracelet, we calculated the averages of maximum grip strength, the half-max times, and the Star Balance composite score as shown in Figures 3-6.

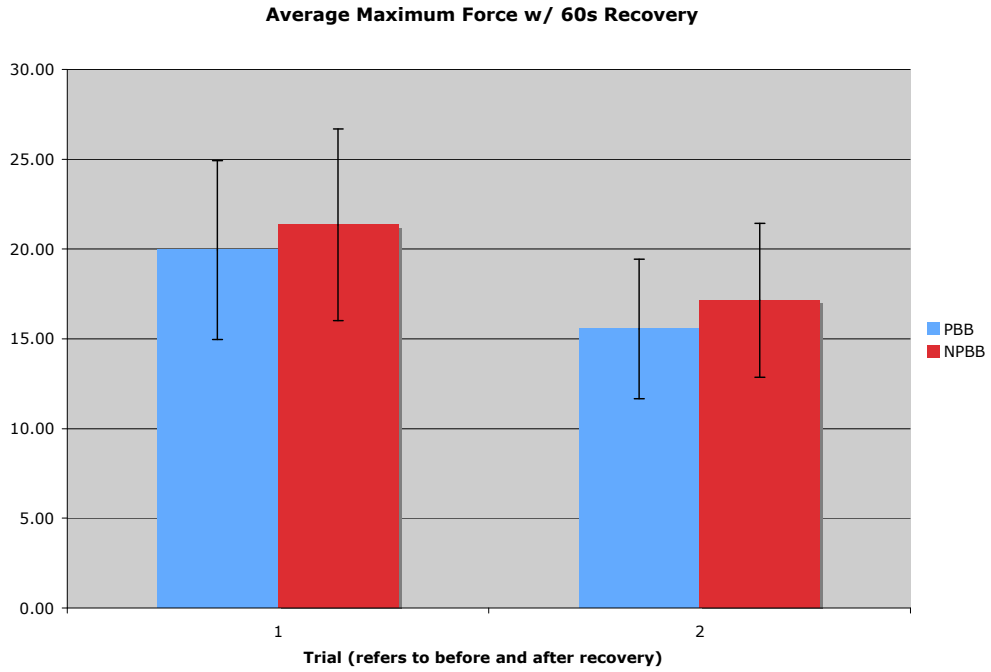

Figure 3: Hand dynamometer data for average maximum force with 60-second recovery

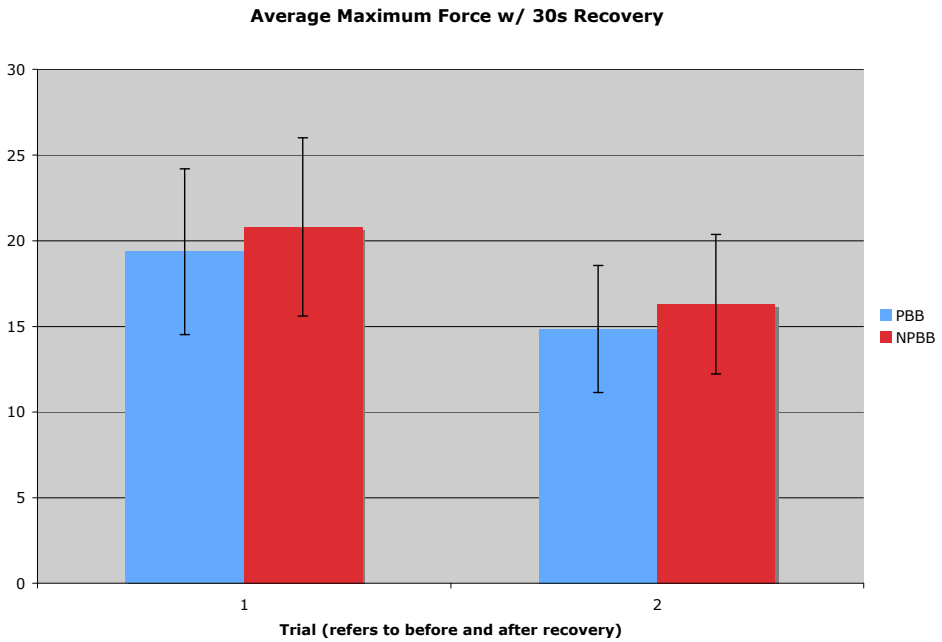

Figure 4: Hand dynamometer data for average maximum force with 30-second recovery

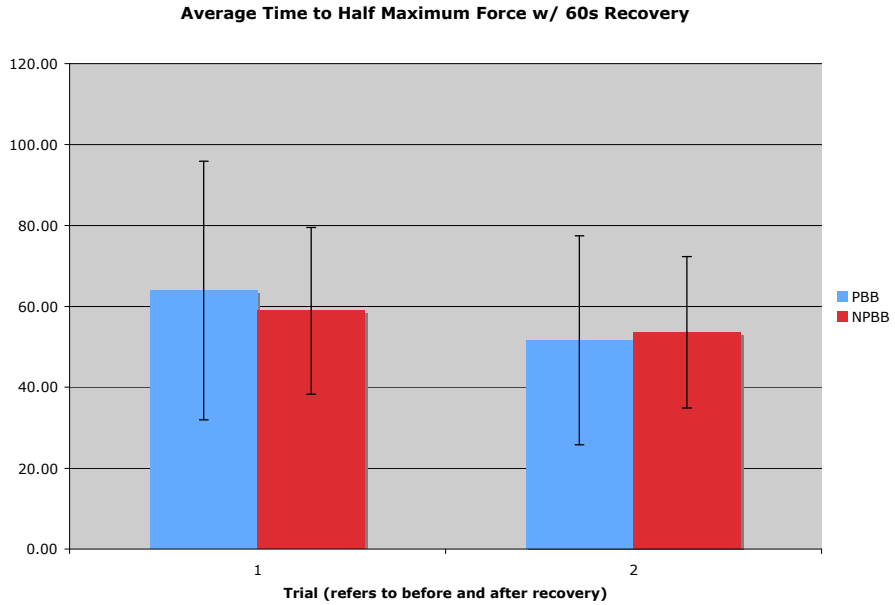

Figure 5: Hand dynamometer data for average time to half maximum force with 60-second recovery

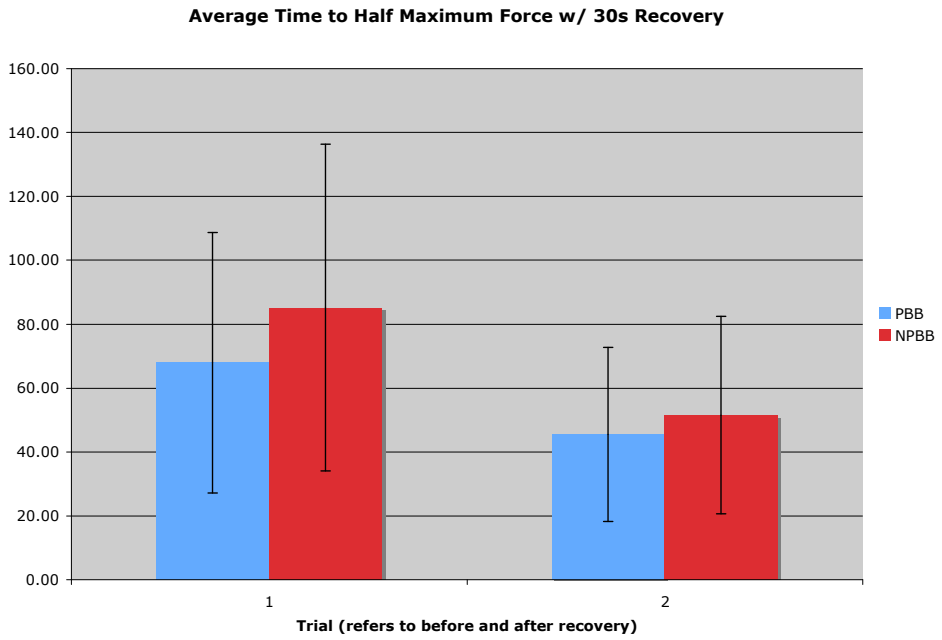

Figure 6: Hand dynamometer data for average time to half maximum force with 30-second recovery

The standard deviations of these averages were quite large, but this is to be expected because the individuals in the study vary in sex, age, and overall strength and balance. While there may be a large difference between person A and person B in max grip strength for example, this is not of great importance to this study, which only needs to consider the effect of the PBB on both individual A and individual B. To compare the grip strength and half-max time values, we therefore used the T-Test, in which the same measurements were paired for the 10 individuals.

A p-value of less that 0.05 in a two-tailed distribution suggests that two sets of data (their means) are significantly different, and as the p-value approaches 1, the evidence for a significant difference becomes extremely weak. In the comparison of average maximum grip strength values, the p-value was greater than .48 for all four measurements (Table 1). This suggests that the Power Balance Band did not have an effect on the subjects maximum grip strength.

Furthermore, all four of the average maximum grip values were actually slightly larger for the NPBB.

Trial	p-value
1st Max 60s Rest	**0.59**
2nd Max 60s Rest	**0.51**
1st Max 30s Rest	**0.58**
2nd Max 30s Rest	**0.48**
1st ½ Max 60s Rest	**0.71**
2nd ½ Max 60s Rest	**0.87**
1st ½ Max 30s Rest	**0.46**
2nd ½ Max 30s Rest	**0.66**

Table 1: P-Values for Hand Dynamometer Data

Data shows that the PBB effect on recovery period is similarly non-existent. The average time to reach ones half maximum force was 51.65 seconds for the PBB after a 60 second rest and 53.6 for the NPBB. For the 30-second rest period, the time to reach half maximum force was 45.5 and 51.5 respectively. The T-Test revealed p-values of 0.87 for the 60-second rest period and 0.66 for the 30-second rest period (Figure 7). For both rest periods, the data suggests that the PBB provides no significant benefit, and again, in fact, there was slightly better recovery when wearing the NPBB.

The third measurement is the Star Balance composite score. The average score when subjects were wearing the Power Balance band was 87.96, and when wearing the non-Power Balance band 88.60 as shown in Figure 7.

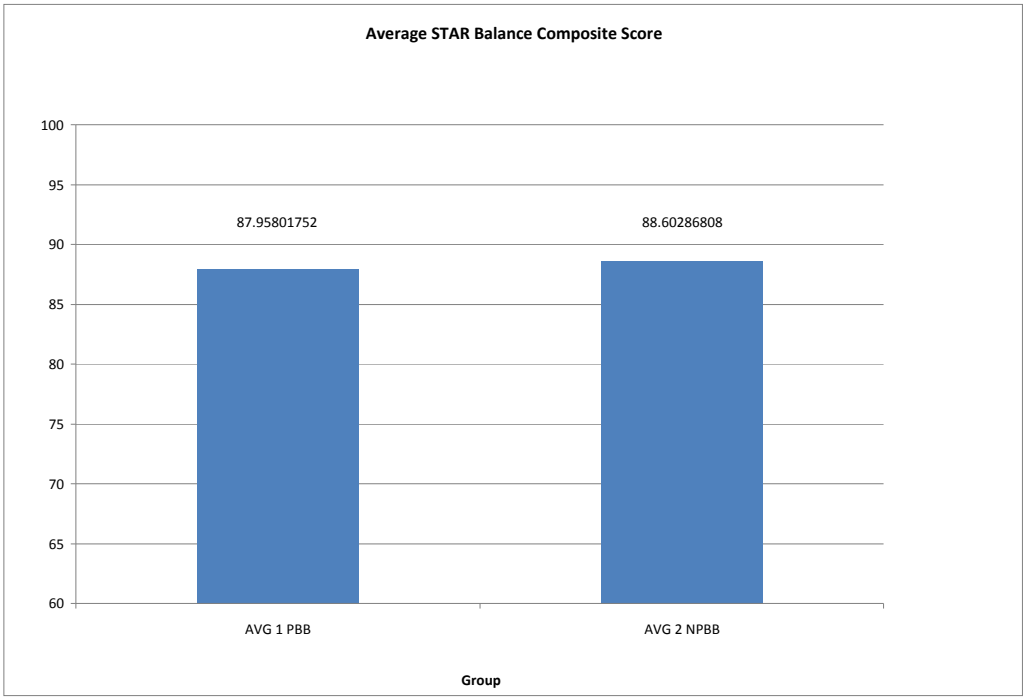

Figure 7: STAR Balance Composite Score PBB vs. NPBB

The T-Test was again used to compare means. A p-value of 0.86 provides essentially no evidence that the two groups are significantly different. Again, the data show that one actually has slightly better balance when using the NPBB.

Discussion

The experimental results indicate that the Power Balance Bracelet does not improve a person's strength, recovery time, or balance as marketed by the company. There is no significant difference between the performances of the subjects when they were wearing the PBB compared to when they were wearing the NPBB. This conclusion is based off the calculated p-values; for maximum grip strength values (p-value=0.48), recovery periods (p-value 60 sec=0.87 and p-value for 30 sec= 0.66), and Star Balance composite score (p-value=0.86) see table 1. Since none of the p-values were under 0.05, we concluded the difference insignificant. This can also

be seen in the graph comparing the calculated averages of maximum grip strength, the half maximum times, and the Star Balance composite score (figure 3-6 and 7).

Furthermore, all four of the average maximum grip values and balance were actually slightly larger for the NPBB (figure 3-6), however, since the p-values comparing these averages with the averages of the PBB are greater then 0.05 (figure 4) we can not conclude that the NPBB improves performance. We can only conclude there is no difference between the two bands.

Factors that limit our external validity are the small sample size and the lack of diversity among our subjects. A larger sample size that more accurately reflects the population would provide data that better generalizes the entire population. The effect of repetition on the subject's performance also affects our external validity. Optimally, the experiment would have been done over four days with one trial, which consists of two grip measurements per day. To save time, however, we conducted two trials a day with a thirty-minute rest period. We did not believe this had a significant effect on the values, but to further the validity of our data, we randomized the order of the thirty and sixty-second trials.

Finally, the participant's enthusiasm and response to our motivation to continue squeezing the hand dynamometer must be taken into account. Some participants may have responded to the motivation better than others and this may affected our data. Similarly, because we required a total of four separate measurements with the hand dynamometer over two days, some of the subjects grew tired of performing the same task.

With respect to our internal validity, the strength of our data was in the consistency of the measurements. We divided into two groups with each group assigned to either conduct the hand dynamometer or SEBT balance test. For the tests, each person had a specific role and only one person recorded the data. For example, for the hand dynamometer test, two people placed

electrodes on the subject and gave instruction, but only one person told the subject when to stop after they reached their half max and extracted the data off the graph on the computer. For the SEBT balance test, one person explained the test to the subject, while the other person read the measurement off of the meter stick.

It is clear that in the sports world there will continue to be a demand for cheap and effective athletic enhancers. With the rise in performance enhancing bracelets like the Power Balance Bracelet, it is important to remain aware of the true nature of these products. It should seem skeptical to most that a holographic sticker on a plastic band probably will not improve athletic performance, but as with most things, a good marketing campaign can sell just about any product. This experiment has shown that behind their persuasive marketing, Power Balance has failed to deliver a product that does what is says: improve strength, endurance, and flexibility.

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