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# **Acute Effects of N.O.-Xplode® on Muscle Contraction**

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**Abstract:**

Many studies have been performed to identify the physiological effects stimulants used in pre-workout supplements have on muscle performance, but an experiment that breaks down the effects of a pre-workout supplement to its simplest of forms has never been performed. The experiment was designed to assess the acute effects the supplement N.O.-Xplode® has on muscle performance. N.O.-Xplode® contains many common ingredients used to enhance performance, such as creatine monohydrate, taurine, beta-alanine, citrulline malate, and caffeine. Studies have identified the benefits of using the ingredients individually, but it will be much more practical to perform a study in which a popular product is tested instead. This was done through a paired functional study using a frog model as the subject. Change in performance was found through testing the muscle's strength of contraction before and after use of the pre-workout supplement.

**Background:**

The supplement market is a booming economy in the US, playing into the “get results without putting in the work” mantra that is becoming ever-present in our society. Supplement companies can make claims regarding their products that go unchecked by the government literally due to the status of their name, simply being called “supplemental” to proper exercise and diet in increasing muscle performance. Despite this, many still believe any and all statements placed on the containers, such as “enhanced endurance” or “maximum performance” (two descriptions found on the website of the parent company,

BSN®, regarding their product and our research subject, N.O.-Xplode®). These claims always include the disclaimer: “These statements have not been evaluated by the Food and Drug Administration”. The FDA's role in the supplement industry is to prevent people from ingesting products that have the potential to harm their immediate or long-term health. The FDA does not require supplement companies to provide the proof of their product's effectiveness, just the product's safety for human consumption.

There are undeniable claims that the ingredients in pre-workout supplements

do have an effect on the cardiovascular system. Nitric oxide is a known vasodilator that plays a role in the delivery of nutrients and removal of metabolic wastes in skeletal muscles<sup>1</sup>. When these two jobs are performed efficiently, acute muscle performance increases as well<sup>2</sup>. Many of the ingredients listed increase natural nitric oxide levels in blood vessels, helping aid this effect<sup>6,8</sup>.

My decision to use a frog gastrocnemius as my research subject is based on its

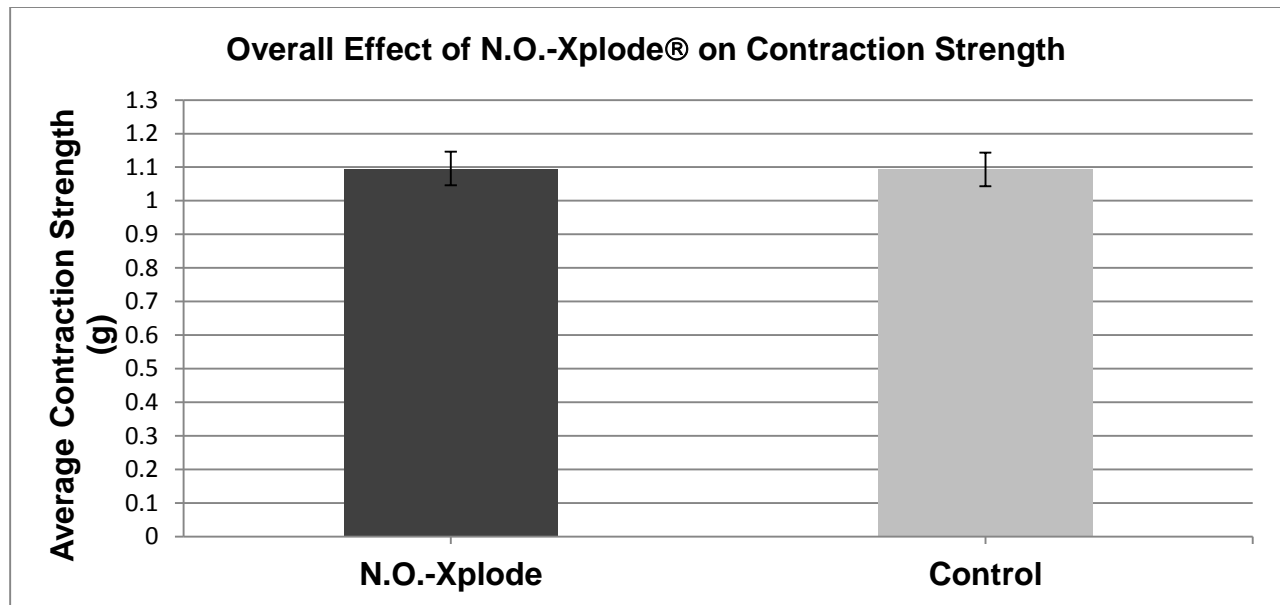
physiological similarities to human skeletal muscle. Through my experiment, I would like to identify whether the statements made by companies such as BSN® are scientifically valid. I believe studying the effects the supplement has on a single, isolated muscle fiber will allow for a revealing observation on the acute effects the pre-workout supplement N.O.-Xplode® has on peak muscle contraction.

### **Methods:**

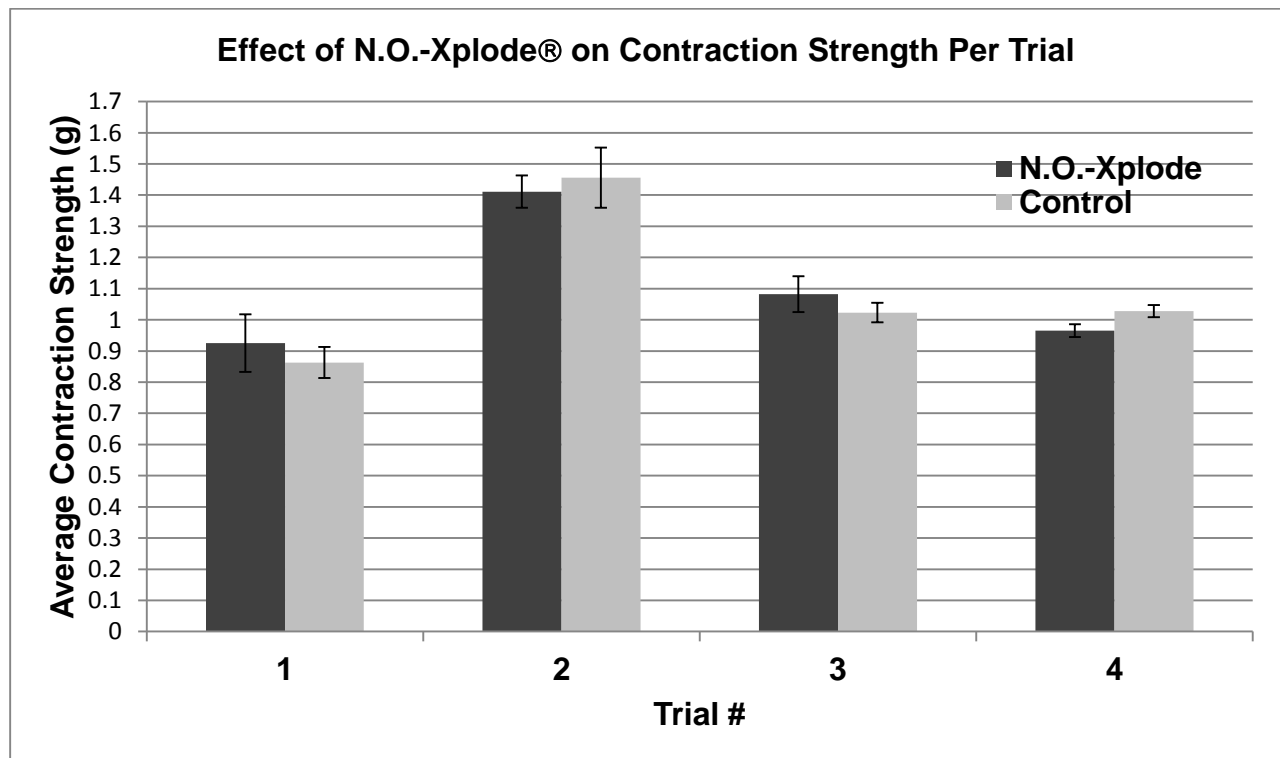
To determine the acute effects of N.O.-Xplode on maximal contraction strength in the simplest of settings, a frog gastrocnemius was chosen as it could easily be isolated, and contractions could easily be measured. The muscle was either doused in N.O.-Xplode® mixed with amphibian ringers solution for thirty minutes or doused in just ringers solution for the thirty minutes. Electrical stimuli were applied to the muscle immediately following the thirty minute interval to measure muscle contractions, each spaced so that the muscle returned to baseline before the next stimulus was applied. Following

twelve to sixteen contractions, the muscle underwent dousing with either just ringers solution or the ringers mixed with the supplement, followed by another measuring of contractions. Preliminary work was done to determine the optimal electrical stimulus (3 volts) to be used, as well as the optimal passive tension (~1 gram) to be put on the muscle to get maximal contractions. A force transducer was used to measure the contractions, and the muscle was attached to the transducer via a fishhook and string. All responses were recorded using iWorx LabScribe software.

## Results:



**Figure 1. Overall Effect of N.O.-Xplode® on Contraction Strength.** The maximal contraction strengths produced by both the supplement and the control were not significantly different.



**Figure 2. Effect of N.O.-Xplode® on Contraction Strength Per Trial.** None of the individual trials produced significantly different values for maximal contraction strength.

	<b>NOX Contraction Average (g)</b>	<b>Standard Deviation</b>	<b>Ringer Contraction Force (g)</b>	<b>Standard Deviation</b>
<b>Trial #1</b>	0.925	0.092	0.863	0.050
<b>Trial #2</b>	1.411	0.052	1.456	0.096
<b>Trial #3</b>	1.082	0.057	1.023	0.031
<b>Trial #4</b>	0.965	0.021	1.028	0.019
<b>All Trials</b>	1.096	0.055	1.093	0.049

**Table 1. Summary of Contraction Strengths due to the Supplement and the Control. The contraction strengths for the individual trials all had reasonable standard deviations.**

Each contraction of the frog gastrocnemius that was preceded by an electrical stimulus, and was at the baseline prior to being stimulated, was counted while collecting the numbers to be used in the calculations to determine the results. Each individual trial had at least 12 contractions and never more than 16 contractions for either the N.O.-Xplode® or the control.

None of the trials individually, nor the compiled totals, showed significantly different maximal contraction strengths between supplementing with the N.O.-Xplode® and supplementing with the

control. Trials #1 and #2 used the same frog, a different leg each time, while trials #3 and #4 used a different frog, testing a different leg each time as well. The histograms show how consistent each trial was. Changes in contraction strength from trial to trial can be attributed to the different sizes of frogs being used, but all statistical analyses took this into consideration, as change in contraction strength relative to the original contraction strength was used in calculations seeking significant differences.

**Discussion:**

This study shows that in an isolated setting, and contrary to the manufacturer's claims, the pre-workout supplement N.O.-Xplode® has no effect on acute muscle contraction strength.

Further studies could look at the supplement in a less isolated setting, comparing the use of the supplement in workouts of human subjects, utilizing a paired test that compares change in strength between users of the supplement and users of a placebo. The experiment would need to measure the strength of all of the participants using no supplements prior to giving them either the supplement or a placebo to set baseline measurements. A study carried out in this manner would allow researchers to see the acute effects of N.O.-Xplode® on muscle contraction.

Other studies could look to see if the supplement has any chronic effects on maximal contraction strength after long periods of use. Test subjects would again need to be monitored prior to using the supplement to set baseline measurements. Subjects would then be assigned to one of two groups, a supplement group and a placebo group. After a period anywhere from two to six

months, researchers could compare subjects in the placebo group to subjects in the supplement group, seeing if the supplement allowed for significantly greater increases in maximal contraction strength.

Another angle that could be taken to test the manufacturer's claims regarding the supplement would be to look at its effects on muscle fatigue. Experiments similar to the ones outlined previously could be done to measure the endurance of muscles. An experiment similar to the original could also be performed, with a protocol designed to measure the duration of tetanus capable when a muscle is supplemented with N.O.-Xplode® compared to supplementation with a control.

In terms of improving this experiment, a different method could be used for better absorption of the N.O.-Xplode® supplement into the frog muscle. Instead of dousing the muscle with the supplement, the muscle could be placed in an organ bath with the supplement in solution, possibly allowing the supplement to be more easily absorbed.

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