

Summary (Trials with 67 Pro Athletes)

INTRODUCTION

We are excited to have had a biomedical researcher assess our first relatively ample set of before and after data using the **Wingate** and **Astrand** test. Before getting to the data, we should briefly review some background material on the test, and also the scientific data on pre-cooling and athletic performance, to put those data into a clinical context.

WINGATE TESTING

The Wingate test (also known as the Wingate Anaerobic Test [WAnT]) is an anaerobic test, most often performed on a cycle ergometer (although it can be completed on several types of bicycle ergometers) that is used to measure peak anaerobic power, as well as anaerobic capacity. Anaerobic exercise is a physical exercise intense enough to cause lactate to form; it refers to any form of exercise which is at a near maximal intensity during which the body can no longer process oxygen for fuel fast enough to meet the demands of the muscles. It is used by athletes in non-endurance sports to promote strength, speed and power and by body builders to build muscle mass. Muscle energy systems trained using anaerobic exercise develop differently as compared to aerobic exercise, leading to greater performance in short duration, high intensity activities.

The Wingate test, which can also be performed on an arm crank ergometer, consists of a set time pedaling at maximum speed against a constant force. The Wingate test is believed to show two things: (a) all-out peak anaerobic power and (b) anaerobic capacity. These two values have been reported as important factors in sports with quick, all-out efforts. Short sprinting, rowing and similar events rely heavily upon the anaerobic energy pathways during execution which leads to the theories that greater performance in a Wingate test can predict success in these events.

As in every physical exertion there are several outside factors, which can play a role in Wingate performance. Although cognitive motivation has not been shown to influence Wingate performance, emotional motivation has been found to improve peak power ratings. Another factor, which is important to consider is warm-up. According to some literature, a 15-minute intermittent warm-up improved mean power output by 7% while having no impact on peak values. These findings suggest that a warm-up is an unimportant factor in peak power levels, but if mean power is the variable of interest it is important to standardize the warm-up.

ASTRAND TESTING

The Astrand test is one of the submaximal tests for calculating aerobic endurance capacity (measure of the oxygen consumption at the maximum level of energy output). The test protocols do not reach the maximum of the respiratory and cardiovascular systems. Submaximal tests are used because maximal

tests can be dangerous in individuals who are not considered normal healthy subjects and for elite athletes maximal tests would disrupt training load balance.

What is aerobic fitness? - Aerobic fitness (cardiovascular endurance) is the body's ability to deliver oxygen to your muscles, which allows them to do work or engage in activity. The lungs take in oxygen from the air we breathe where it gets perfused into the blood stream; the heart and blood vessels deliver it into the working muscles; and the skeletal muscles utilize that oxygen to execute muscular contractions and produce work. A cardiovascular assessment is a good tool to measure the efficiency of the aforementioned physiological functions.

REVIEW OF THE LITERATURE

There is an ample body of literature supporting the use of pre-cooling and post-cooling on athletic performance and recovery. We should take a quick look at that literature prior to discussing our own initial data based on Wingate and Astrand testing. Periodic heat extraction from the palm has been shown to improve strength training responses and mitigate fatigue onset.¹ Pre-cooling improves cycling performance^{2, 3}; has been demonstrated to serve as a recovery tool from heat stress⁴; and reduces thermal strain and improved markers of muscular damage and discomfort among bowlers, while maintaining medium-fast bowling performance on consecutive days in hot conditions.⁵ Following pre-cooling, rugby players were able to sprint for greater distances⁶; and a group of firefighters experienced improved recovery during a short period of rest and prolonged performance time in subsequent bouts of exercise.⁷ Palm cooling reduced heat strain, measured through changes in core, mean skin, mean body temperatures, and thermal sensation in resting hyper-thermic subjects; delayed fatigue during high-intensity bench press exercise; and also during resistance exercise in women.⁸⁻¹⁰

The highest order, most powerful research studies take the form of reviews of the literature and meta-analyses. A systematic review of the literature finds the relevant original articles, rates their methodological quality, and draws the conclusions from the best among them. Meta-analysis combines the data from a group of relatively small studies for the purpose of analysis, which enables deriving a more evidence-based conclusion than could have come from any of the individual studies. A review of the literature on pre-cooling concluded: "Local intermittent cooling during short-term, high intense exercise may provide possible beneficial effects; first, by pain reduction, caused by an 'irritation effect' from hand thermal receptors which block pain sensation, or second, by a cooling effect, whereby stimulation of hand thermal receptors or a slight lowering of blood temperature might alter central fatigue."¹¹

Another systematic review of the literature, retrieving 55 studies involving pre-cooling on well trained subjects, concluded: "Most laboratory studies have shown improvements in exercise performance."¹² A meta-analysis combined and analyzed the data from 21 retrieved peer-reviewed randomized clinical trials addressing the effects of cooling on performance recovery in trained athletes. It found that post-exercise cooling seems to have positive effects that are large enough to be relevant for competitive athletes.¹³ Yet another meta-analysis combined data from 27 included studies, finding "pre-cooling can effectively enhance endurance performance, particularly in hot environments."¹⁴

METHODS

Wingate test results are reported as following:

$$RPP = PP / BW$$

This may be interpreted as follows: Relative Peak Power = Peak Power / Body Weight. The sample of athletes consisted of 67 young men, average age 21.0 years. Their sports included archery, boxing, fencing, weight lifting, wrestling, and “athletics” a grouping that includes track & field athletes and gymnasts. Two Wingate tests were performed for each athlete, one without the use of the dhamaSPORT™ wristband and the second, with sufficient time having elapsed between tests, using the dhamaSPORT™ wristband. Both average and peak power, with and without the band was measured.

For Astrand test results, the submaximal oxygen consumption VO_2 (ml/min/kg) is measured. Two Astrand tests were performed for each athlete, one without the use of the dhamaSPORT™ wristband and the second, with sufficient time having elapsed between tests, using the dhamaSPORT™ wristband.

RESULTS

For all 67 athletes the net gain in RPP was 0.22 watts/kg. That is very ample for an immediate before and after test and, in the real world, would translate into a very significant improvement in performance, as reflected in the particular sport the athlete practices. Was this net gain statistically significant in addition to being clinically significant? The answer is a resounding YES. In statistics, we generally use the value $p=.05$ as the litmus test for significance test. This means that the probability of the test result having happened due to chance alone is not more than 5%. (Nothing is ever certain, but we can make educated guesses based on the analysis.) In the analysis for all 67 athletes, the $p = 0.0000002$. Because the number is so small, we are able to state that the statistics firmly establish the dhamaSPORT™ device as being associated with a very significant performance gain.

The analysis of subsets of the data is also pretty interesting. The biggest improvement in RPP occurred among the track & field grouping of athletes, with a change of 0.39 watts/kg, a truly huge increase in energy output. Given the short burst energy demands of such athletes, this particularly large improvement almost seems expected, after the fact. Previous research has shown that the short sprint events require power outputs that suggest a high level of anaerobic power (i.e., short sprints, sprint hurdles, jumps). Once again, among these track & fielders, statistically this was no fluke, as $p = 0.00005$. The archers and wrestlers also did very well, with equal gains of 0.27 watts/kg, and also very statistically significant. Just because archery is a relatively stationary sport doesn't mean cardio isn't necessary. The truth is, archers with a lower resting heart rate perform best in competition. The boxers, fencers, and weight lifters also improved their watts/kg. In fact, each and every grouping among the first 67 pioneers who tested dhamaSPORT™ showed some degree of improvement in RPP.

On the other hand, the aerobic capacity VO_2 max (ml/min/kg) improved by an average of 3.8%.

For 67 Pro Athletes (averaged data),
Average Power (watts/kg) increased by **3.05%**
Peak Power (watts/kg) increased by **2.66%**
VO₂ max (ml/min/kg) increased by **3.80%**

DISCUSSION

Although the research is preliminary, it has already survived the first analytic test. This new category of Thermoregulation technology replaces 20th century technology (ice bags, hot water bottles, pads) with 21st century innovation! It offers athletes convenience, consistency (of temperature), and control (when it's needed and when it's not).

The dhamaSPORT™ device can be used for pre-cooling, during a workout and post-workout. When used to pre-cool, it ensures that the athlete is able to store the bulk of his or her energy for when it counts most, at any part of the overall workout. During a workout, the athlete can refine, enhance, and master his or her strength while harnessing mental clarity and focus. The dhamaSPORT™ device makes it possible to shave off seconds, if not minutes, from fitness routines. After a workout, dhamaSPORT™ speeds up recovery and helps to restore the body to peak form. It reduces muscle fatigue or soreness, which ultimately assists the athlete in getting back to training or playing sooner. When used on a consistent basis, dhamaSPORT™ can improve overall performance by decreasing the down time between workouts.

It's a simple anatomical truth: during resistance exercises, muscles break down; following this, strengthening naturally occurs. If one can safely improve and accelerate the recovery process, the benefits that ordinarily wouldn't be seen for days are expedited. It's a win-win for every aspect of an athlete's training.

CONCLUSIONS

Based on our proprietary patented Climacon® technology, dhamaSPORT™ is a new class of Thermo-dynamic™ products that represents the culmination of years of research helping athletes perform at optimum levels. It is changing the workout/performance paradigm. No longer is it about reaching a goal—it's now about going Beyond Boundaries™ to a whole new horizon, an uncharted level in the game.

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