



Research paper

The effect of acupressure stimulation of ST-36 – Zusanli, point on lower limbs explosive strength



Dariusz Mucha*, Tadeusz Ambroży, Dawid Mucha

The Faculty of Physical Educ. & Sport, University School of Physical Education, Krakow 31-871, Poland

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ABSTRACT

Introduction: Improvement in motor ability and activity in terms of qualities such as strength, speed and stamina is important to overcome external resistance and to improve muscle function. The aim of this study was to determine the effect of stimulating the BAP – Biological Active Point (ST-36 – Zusanli) on the lower limbs, and its explosive strength in young men.

Methods: Subjects studying physical therapy were recruited from the Podhale State Higher Vocational School in Nowy Targ, Poland. Two measurements of lower limbs explosive strength were conducted within one week of each other on the same subjects. During the first measurement the participants' "a placebo" point BAP (UB-60 – Kunlun) was stimulated by acupressure. A week later, the identical measurement of explosive strength, preceded by a stimulation of BAP (ST-36 – Zusanli), was carried out at the same time. Participant's body weight, height and lower limbs explosive strength were measured by means using aof bio-impedance scales, an altimeter and Myotest. A 15 min warm-up was conducted before the experiments. The experiments were set in advance by a sound signals made by an acupuncturist. Participants taking part in the study set their feet at the width of their shoulders, the belt with the tool was fastened with strips at the height of the greater trochanters and the participant had his hands placed near the anterior superior iliac spine to exclude the option of components of upper limbs action. After hearing the signal and "hop" command, the participant performed 5 jumps as high as possible. The experiment was finished after a second sound signal of the tool, following which the measurement was recorded.

Results: Stimulation of BAP ST-36 resulted in a 0.35 cm increase in jump height and 11.5 cm/s increase in speed, both differences being statistically significant (where $p < 0.05$ and $p = 0.02$, respectively). The strength (W/kg) and level of generated power (N/kg) were also significantly increased, where $p = 0.047$ and $p = 0.03$, respectively. Using UB-60 as a "placebo" point showed no statistically significant differences.

Conclusion: Stimulation of BAP ST-36 point improved the level of strength and speed abilities on the lower limbs explosive strength in men.

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1. Introduction

There is great interest from scientists, coaches, teachers, doctors and physiotherapists' about the issue of humans' motor abilities, such as: strength, speed or stamina. Motor activity, which underlies the above mentioned abilities, displays itself not only in simple everyday activities which guarantee the fulfilment of basic human needs, but also for the specialized motor activities which are required in the domain of sport.

The aspects of motor activity were initially addressed by Galen in the second century, who described human systems in detail, indicating the importance of stimuli running through nerve channels to skeletal muscles. Further attempts to describe motor activity, starting from Leonardo da Vinci's mechanistic perspective, through Weber's physical-mechanical analysis, Smith's theory of chains to Pavlov's experiment to groundbreaking works by Bernstein and Meinel lead to a holistic perspective of human motor activity in modern science. Holism enforces an interdisciplinary approach to motor activity in which movement is not separated from its creator (a human being). Movement is an objective element of human activity, perceived externally, manifesting itself in changes of body part location, which is a result of muscle activity regulated and secured in terms of energy

* Corresponding author.

by nervous system. Each human movement is related to counteracting gravity which is possible to muscle tension. Therefore, human motor activity always requires using muscle strength. Muscle strength is a motor ability of condition (energy) character [1]. Most often it is defined as an ability of the muscular and nervous system to produce physical strength capable of overcoming external resistance [2] or an ability to overcome external resistance or oppose them at the expense of muscle effort [3].

The subject of interest of the authors of this article is the so-called explosive strength and indirectly related strength scaled on the body weight of a subject. So far it has been proven that training exerts influence on the level of explosive strength through stimuli repeated multiple times. However, there has been little information on the influence of a single stimulus on the increase of the level of lower limbs explosive strength. It has been proven repeatedly that warm up exercises affect muscle functioning, which can be treated as an influence of a single stimulus on the level of explosive strength. When looking for a stimulating stimulus, the authors' interest was directed toward Chinese medicine, which is based on the fact that by stimulating Biologically Active Points (BAPs), one can affect the functioning of internal organs [4] as well as selected motor abilities. BAP are the places on the body with special properties, which either by needling, pressing or stimulated in some other way are the basis of the healing impact on the organism. THE BAP are located within 14 meridians and there are approximately 670 and around 800 so called Extra points.

Acupressure, also known as point massage, forms the basis of reflexotherapy. Qi energy flow channels cover the whole body and are interconnected through a network of channels called collaterals. Biological active points (BAPs) are located in them, and all pathological phenomena taking place in the body are related to a disturbance of Qi energy flow, which flows through the body 24 hours a day. The sensation which is felt by people with appropriate point stimulation is called the phenomenon of de qi – which means, “the arrival of energy” [5].

Research using functional magnetic resonance has indicated a dependency between acupressure stimulation and characteristic activity taking place at numerous levels of the limbic system of the brain and cerebellum, namely the so-called De-Qi sensation, which is the body's sensory reaction occurring in response to stimulation of an active point [6]. The above mentioned information became an inspiration to start new, interdisciplinary research on human motor activity.

2. Research aims

For many professional groups the efficiency of the muscles of the lower limbs determines the work performance. Working of the lower limbs muscles, and more specifically, their explosive force, has a decisive impact on the results in sport.

The overall aim of the study was to determine the influence of stimulating BAP (ST-36 – Zusanli) on lower limbs explosive strength, which, in turn, is related to seeking answers to the following research questions:

1. Does stimulation of BAP (ST-36 – Zusanli) influence the level of lower limbs explosive strength?
2. What is the level of lower limbs explosive powers in trials with stimulation of BAP (ST-36 – Zusanli) and a “placebo” BAP (UB-60 – Kunlun)?
3. Which of the examined parameters have statistically significant differences in stimulation results?

3. Methods

3.1. Study participants

After obtaining research ethics approval from the BioEthics Committee (no. 42/KBL/OIL/2015) . A random sample of male students studying physical therapy at Podhale State Higher Vocational School in Nowy Targ, Poland were asked to take part in the study, after providing their informed consent. These were all third-year students.

Of the 32 students who agreed to take part, the mean height was 181.17 cm and their average age 21.5 years. Their body weight in the first and second phase of the study was 85.92 and 85.70 kg respectively. Individual differences in body weight were taken into account when scaling the results of relative strength.

3.2. Methods

Two-fold measurements of lower limbs explosive strength were conducted in April 2015 in the gym of the school where the participants studied. The ambient air temperature was 21° C. The research was divided into two phases and was carried out over the span of one week to eliminate the influence of muscle fatigue on the results of the second measurement. During the first measurement the participants' “placebo” point UB-60 was stimulated. The stimulation took place by applying the pressure with an acupuncture needle for 2 min. A square-wave current was used. The placebo point was located and stimulated by the author of the research. UB-60 (Kunlun) was randomly selected, as it was blieved that its properties would have no effect on the muscles of the lower limbs. Placebo in Latin means “appeal”, and doctors use it to define the substance or an action neutral for health, but used as a therapy, which is not known by the patient. In this case – the stimulation of the UB-60, was selected at random, not because of its therapeutic characteristics. Subjects did not have any diseases that could be an indication for the stimulation of UB-60 point.

After a week, an identical measurement of explosive strength, preceded by a stimulation of BAP ST-36, was carried out at the same time. Point ST-36 was chosen intentionally because of its property, because its stimulation improved lower limbs' muscles functioning, among others, explosive force. The stimulation took place through 2 min long electroacupuncture with the frequency of 8 Hz, equally for both points in both phases of the study.

Basic statistical values were calculated and a student *t*-test was used to calculate statistical significance at the level of statistical significance of $p < 0.05$.

The body weight of students participating in the research was determined by means of Tanita bio-impedance scales. Their height was measured by means of an altimeter. Myotest was used to measure parameters characterizing the level of lower limbs explosive strength. This is a modern and precise research tool which is used for evaluating strength and speed abilities. Thanks to using a 3D Myotest accelerometer it was possible to measure: power (N/kg), strength (W/kg) and speed (cm/s) [7]. Before the trials a 15 min warm up was organized in line with the procedures of the test. The main part of the research consisted of performing 5 countermovement jumps in succession. The experiment was set in advance by sound signals made by a tool. Participants taking part in the study set their feet at the width of their shoulders, the belt with the tool was fastened with strips at the height of the greater trochanters and the participant had his hands placed near the anterior superior iliac spine to exclude the option of components of upper limbs action. After hearing the signal and “hop” command, the participant performed 5 jumps as high as possible. The trial

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