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# Potential health benefits and risks associated with bouldering, a sport of rapidly increasing popularity – a literature review

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**SUMMARY**

**Introduction and purpose:**

Bouldering is a type of rock climbing activity, which can be practiced on objects usually no higher than 6 meters. It does not require any equipment besides a pair of climbing shoes and chalk, used to enhance the grip quality and to dry up the climber's hands. Due to its approachability, great availability of indoor climbing centres, as well as no need for special equipment, it is becoming an increasingly popular sport among people in various age groups in recent years.
The purpose of our article was to gather information on potential health benefits from bouldering and most common injuries associated with it.

**A brief description of the state of knowledge:**

During a bouldering session, a sport of rapidly increasing popularity, participants are faced with a variety of mental and physical challenges to overcome, which can lead to health benefits, as well as an increased risk of injury. The most common injuries affect athlete's fingers and shoulders, due to dominant use of upper extremities in the sport. Health benefits are plentiful, ranging from physical, in the means of increased cardiovascular and muscular strength, to psychological, with bouldering being part of depression therapy, not inferior to standard methods such as cognitive-behavioral therapy.

**Conclusions:**

Incidence of injuries is relatively low in bouldering, and undeniable health benefits are present – both mental and physical. Furthermore, bouldering is a solid choice for those planning to develop core muscular strength

**Keywords:** bouldering; rock climbing injuries; bouldering health benefits; pulley injuries; bouldering psychoterapy; overuse syndromes

## 1. Introduction and purpose

Bouldering is a sport of rapidly increasing popularity. In the year 2020, competition climbing (including bouldering, lead climbing and speed climbing – different varieties of rock-climbing) was first held official at the Summer Olympics, which has led to a sudden increase of interest in this activity. Bouldering, being the most approachable, not requiring any specialized equipment besides a pair of climbing shoes, attracts most new climbers. It is defined as climbing without the need for ropes or harnesses, due to moderate heights of structures one climbs upon – whether it be natural rock formations or artificial rock walls located in indoor gyms, created with rock-imitating plastic covered with sandpaper. Bouldering has a positive impact on climbers' health, but also poses some injury risks, often exclusive for this type of activity, with finger and shoulder injuries being the most common, in male and female climbers respectively. [1,2,5,9,26]

The aim of this work is to collect and share available knowledge on bouldering, both its benefits and risks, in accordance with modern research papers.

## 2. Description of the state of knowledge

During a bouldering session, participants are faced with a variety of mental and physical challenges to overcome, which can lead to health benefits, as well as an increased risk of injury. [8,10]

Bouldering can be practiced both outdoors and indoors, with the use of climbing gyms. The latter are becoming increasingly available, and due to European safety regulations and facility standards, occurrence of accidents stays relatively low – studies have shown 0,06% and 0,016% chance of getting hurt per visit respectively in the UK and German indoor climbing gyms. [2]

Injuries in rock climbing are categorized into acute injuries and overuse syndromes, the first being most frequent. [2,10]

**ACUTE INJURIES**

As previously mentioned, bouldering is a relatively safe activity, with research showing small injury rate, minor injury severity and few fatalities. [11,18]

Fingers are proved to be predominant site of damage, irrespective to climber's gender and their level of experience. [12,17] The most common injury in adults during rock climbing is a finger flexor tendon pulley injury. Attached to the proximal phalanx, the A2 pulley is the most strained, especially in crimping position of the hand [2,13], whereas in children and adolescent climbers an epiphyseal stress fracture of the base of the middle phalanx tends to occur most often [1,16].

There is a strong association between the movement dynamism and injury prevalence. The more rapid style a climber utilizes, the higher the risk for upper extremity harm. [14]

Although relatively rare, a pectoralis major tendon rupture is a possible severe consequence of bouldering, requiring early identification and treatment, thus enabling satisfactory outcomes for active individuals. [15]

The knowledge on knee injuries, as results of bouldering, is limited, however research has shown a risk of significant damage to the joint (most frequently a medial meniscal tear) through four different trauma mechanisms, with the most common accompanying a climbing technique called 'heel hook', which puts significant pressure on the knee. [32]

Data on head injuries in rock climbing is limited. Research shows they are mostly associated with outdoors climbing rather than inside a bouldering gym and happen most often as a consequence of falling off a wall or an object falling on one's head. Helmets are generally regarded as beneficial. [20]

During the process of data collection for this article a single case report of triceps tendon rupture following a bouldering session has been discovered, however this type of injury is uncommon in general, let alone in association with rock climbing. [23]

The overall injury distribution is comparable between younger and older climbers, studies have shown however that the latter suffer more frequently from shoulder impingement syndrome, as well as osteoarthritis of the fingers. Therefore, in order to minimize risk in older boulderers, it is recommended they proceed with the sport under specific medical supervision and with proper guidance, in consideration with age specific factors. [24]

Subclavian vine thrombosis, called a Paget-Schroetter syndrome, is an axillary-subclavian thrombosis, which leads to full occlusion of the vessels. Nowadays the general prevalence is low. However, the condition is expected to become more frequent, due to a constant increase in bouldering's popularity. Rock climbers are more susceptible to subclavian vine thrombosis, due to a constant stress on the upper extremities when practicing the sport. [25]

**OVERUSE SYNDROMES**

An overuse syndrome is an injury that took time to build up, often associated with pushing one's body over their physical limitations, causing small damages to the tissues that accumulate over continuous sessions. [2]

Studies have shown that incidence of chronic overuse syndromes is dependent on age, sex, and years of systematic strain during bouldering sessions. [10,22,24]

Overuse syndromes may cause prolonged pain and lead to impairment in the field of sport related activities as well as everyday tasks. [19]

Due to a very tight fit of modern climbing shoes with a downturn, concave shape and asymmetry concentrating pressure mainly on the big toe, overuse syndrome often affects climbers' feet. They often downsize their shoes two to even three sizes in order to improve performance, even if this means having to put up with pain in their feet. Supinated position of feet while wearing climbing shoes creates a lack of lateral stability, favoring ankle sprains. Retrocalcaneal bursitis is a common result of posterior portion of the shoe putting too much pressure on the heel. Increased pressure on toes leads to nail diseases, often presenting themselves with hematomas located beneath the nail plate. [2,27]

Tendosynovitis, being the most often overuse syndrome in bouldering is the inflammation of the flexor tendon sheath. Constant use of crimp holds generates massive load on muscle tendons, thus impact stress is transferred to the tendon sheaths, causing inflammation. Occurrence of this process is more probable if prior pulley damages were present. [28]

Functional Compartment Syndrome of the forearm flexor muscles, also known as chronic excertional compartment syndrome is another example of an overuse syndrome. It develops

when forearm muscles tend to grow without an increase of the muscle fascia volume, leading to larger amount of pressure being put on only compressible structures left in the fascia compartment, i.e. blood vessels and nerves. The constricted bloodflow and nerve compression leads to chronic pain, weakness, and paresthesia. Ischemia causes lactic acid buildup, leading to the persistent burning sensation. Conservative therapy includes stretching, ice application, massage. When those fail, there is a surgical procedure called fasciotomy, which helps relieve intracompartmental pressure by creating an incision of the fascia. Postoperative results are very promising and there is a vast chance of full recovery to the previous climbing performance. [30]

**HEALTH BENEFITS**

PHYSICAL

There is a proven association between practicing rock climbing and cardiorespiratory endurance connected with overall muscular strength. [8]

Attending bouldering sessions regularly leads to improvements in strength of body core muscles, trunk mobility, as well as handgrip strength, the latter of which remains even when regular training is no longer performed. [34]

Recent scientific research proves high-level (elite or competitive) bouldering to be beneficial for youth's health, providing them with enough physical activity to fulfill official recommendations. Nevertheless, recreational level rock climbing does not promote adequate aerobic fitness in the youth, according to research. [21]

MENTAL

Practicing bouldering is proved to have a positive impact on mental health. Climbing sessions can be useful in treating depression, in a form of bouldering psychotherapy (BPT), a combination of psychotherapeutic intervention with a physical activity of bouldering, proven to be equally effective as compared to cognitive behavioral therapy. [4, 6, 7] BPT is also effective at increasing the perceived level of self-efficacy in people suffering from depression, with the effect being proven to be superior to that of physical exercise alone. [29] BPT is a promising means of depression management, however questions arise on its cost-effectiveness, which should be subjected to further research. [31, 33]

## 3. Conclusions

When bouldering, participants are undergoing a variety of mental and physical challenges to overcome – which results in health benefits but also poses a risk of injury. However, incidence of injuries is relatively low, and undeniable health benefits are present – both mental and physical. Bouldering is a good form of activity to develop muscular strength.

**Disclosure**

**Author's contribution:**

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