Analysis of the performance structure of the Olympic combined climbing format

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Abstract

The aim of the project is to develop performance diagnostics for the *Olympic Combined* competition in sports climbing. Therefore, the performance structure of the sport discipline need to be analyzed. To create scientific knowledge of this structure, our first step was to perform expert interviews with coaches of the German, Austrian and Swiss national squads. The coaches agreed that competition performance depended on others than only fitness components. Coordination, tactics and psychological components seem to play an important role as well. They also compared the three disciplines discovering differences mainly in speed climbing in comparison to bouldering and lead climbing. The influence of all those components on climbing performance has to be empirically tested. Therefore, existing test batteries like the IRCRA test and new tests for the other relevant components will be applied to different levels of climbers to determine the relevant parameters and to develop a structural performance model for sports climbing.

Keywords: performance analysis; Olympic combined format; bouldering; speed climbing

Analyse des déterminants de la performance au format combiné olympique d´escalade

Résumé

L´objectif du projet est de développer des diagnostics qui permettent d´analyser la performance au combiné olympique d´escalade sportive. Pour cela, les déterminants de la performance de cette discipline sportive doivent être analysés. Afin de produire du savoir scientifique de cette structure, nous avons donc en premier lieu mené des entretiens d´experts avec des entraîneurs de l´équipe nationale d´Allemagne, d´Autriche et de Suisse. Selon les entraîneurs la performance en compétition est non seulement déterminée par les facteurs physiques, mais aussi par les capacités coordinatives, tactiques et psychologiques. En comparant les trois disciplines ils ont trouvé des différences notamment entre l´escalade de vitesse par rapport aux disciplines de bloc et de difficulté. L´influence de tous ces déterminants de la performance en escalade sportive doit être testée empiriquement. Pour cela, des batteries de tests tels que la IRCRA et des nouveaux tests permettant d´analyser les autres facteurs en question sont appliqués sur les grimpeurs de tous niveaux afin d´une part de saisir les paramètres essentiels et d´autre part de développer un modèle structuré des déterminants de la performance en escalade sportive.

Mots clés: analyse de performance ; format combiné olympique ; bloc ; vitesse

Introduction

In 2020, sports climbing will be in the program of the Olympic Games for the first time. The format will be a combination of bouldering, lead, and speed climbing. To prepare the athletes optimally for the combined format it is necessary to know exactly the discipline-specific requirement profile. By now, most investigation on climbing specific components is on the isometric maximal strength of finger and arm flexors. As a result, elite climbers show a better finger strength to body mass ratio than advanced climbers and novices do (Baláš, Pecha, Martin & Cochrane, 2012; Laffaye, Collin, Levernier & Padulo, 2014; Macdonald & Callender, 2011; MacLeod et al., 2007; Wall, Starek, Fleck & Byrnes, 2004). The same applies to the strength endurance of the finger and arm flexors for intermittent loads (Macdonald & Callender, 2011; MacLeod et al., 2007; Philippe, Wegst, Müller, Raschner & Burtscher, 2012). Many more parameters were considered by Magiera et al. (2013), which led to the first published data of the performance structure of sports rock climbers in general. However, they did not differentiate between the three competition disciplines, nor did they consider the combined competition format. Additionally, no competition components like tactics or psychological components have been regarded in the analyses. Consequently, the aim of our study is to construct and validate a model of components, which explain the performance in competitions. This model will give valuable suggestions for training control.

Methods

In a first step, it is important to consider all hypothetically relevant parameters of performance in climbing competitions. To achieve this, we conducted expert interviews. Six German, Swiss and Austrian coaches of national, national youth and regional youth squads agreed to participate. We performed the guideline-based interviews personally or via skype. The guiding question was: "Which attributes make an elite climber?" After the coaches had named some parameters, the interviewer asked for more details and for an assessment, if those parameters were different for bouldering, lead and speed climbing. All interviews were recorded, transcribed and two of the authors independently analyzed the content. After that, the results were presented all coaches for validation.

Results

Answering to the opening question the coaches gave psychological components a quite high priority. Often named was also a good "Bewegungsgefühl", which may be translated as feeling for the appropriate movement. As physical components, the coaches mentioned flexibility and strength.

All the coached answered consistently, that strength endurance is the most important endurance component and that it is most important in lead climbing. Especially in competitive speed climbing and bouldering, a good recovery is needed, because the athletes have to climb several attempts in a short time.

According to the coaches, strength is one of the most important components of climbing performance. For maximal strength a threshold is predicted, which has to be exceeded by elite climbers. Beyond this threshold, there is no benefit of an increased strength. For example, one coach claimed that a male athlete should be able to accomplish a single-arm pull-up, but there is no need of being able to execute more than five. In accordance with the literature, the coaches concede finger and arm strength a good share of climbing performance. Additionally, strong shoulder and trunk muscles as well as a good body tension are relevant. In terms of leg strength, the

coaches differ between the disciplines. In lead climbing, it seems not to be as important as in bouldering and speed climbing.

Speediness is hardly classified as a determining factor by the coaches. Even in speed climbing, speed strength is estimated more important than speediness. According to the coaches, speed climbing is the discipline with the highest impact of speed strength, but also in bouldering speed strength of the legs accounts for a better performance. Additionally, the coaches mentioned short reaction times as a criterion for successful speed climbing.

The coaches also specified flexibility as important parameter for good climbing skills. They think the body regions that need most flexibility are hips, lower limbs, and the trunk. Limitations in rotating the hip outwards would remove the climber's center of gravity away from the wall. It is also helpful to be able to put the foot up as high as possible and to twist the upper trunk.

As basic competence for elite climbers, the coaches regard a good movement coordination. For competitive climbing, it seems to become more and more important to the coaches to have an extensive repertoire of skills. This is especially necessary for solving boulder problems. For bouldering and lead climbing, the advantage of a good movement coordination is the energy efficiency.

For the tactical abilities of competitive climbers, the coaches differ between the three disciplines. Tactics tend to play a subordinate role in speed climbing. For boulderers and lead climbers, however, the reading of the routes before the first attempt is an important tactical element. In boulder competitions, it is very relevant to divide the number of attempts in the boulders over the course of the competition well. In lead climbing, according to the coaches, the climber has to plan his moves after having viewed the route and has to find optimal positions for resting and shaking the arms.

From the view of the coaches, a successful climber needs to be highly motivated for a hard training. Especially for bouldering, there should be a certain curiosity to solve problems. During the whole competition, the athlete has to be focused and concentrated. For speed climbing, a cognitive component is to know the standardized route by heart.

The coaches agree that the constitution of climbers differs in the various disciplines. Body mass should not be too high for lead climbers. Body height, however, does not play a role in lead climbing. Speed climbers can be compared with athletic sprinters and have strong leg and upper trunk muscles. The constitution of boulderers is also muscular, but with focus on the upper body. In general, it seems to be an advantage to have long arms. For the combined format, the coaches recommend a middle size athlete and a good power-body weight ratio.

The coaches did not see a difference in discipline-specific requirement profiles between male and female athletes.

Discussion and future research

As a result of the expert interviews, we identified relevant differences between the three disciplines, which should be taken into account when considering training goals. In addition to the well-investigated strength and endurance, the coaches identified several relevant components for performance in competitive climbing, which

have not been considered in the existing test batteries so far. Specifically, coordinative skills and mental factors seem to differentiate between the top athletes. Consequently, the influence of all the components on climbing performance has to be empirically tested. The next step of our project is to apply existing test batteries like the IRCRA test (IRCRA, 2015) to different levels of climbers. In addition, we will derive a competition-specific profile of requirements from the analysis of international climbing competitions in all three traditional disciplines as well as the Olympic combined format. One of the main part of our project will the development of new tests for the so far neglected relevant components, which we identified in the previous steps. For each of the tests we will assess the criteria for test quality and analyze the statistical correlation between the tested components and climbing performance. In a last step, we will cluster similar components together using factor analysis. Thus, the relevant components and their relative importance for climbing performance will be determined for bouldering, lead, and speed climbing and a structural performance model for each discipline as well as for the combined format will be developed. With the help of these models, we will develop a standardized test manual and collect normative data. This may improve performance diagnostics by generating individual performance profiles and quantifying individual strong and weak points in the single disciplines. Together with the underlying structural performance models, this procedure may help national coaches to work out training plans for the elite athletes to prepare them optimally for the Olympic Games.

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