Response to Opponent's Report on PhD thesis "*The performance enhancement of professional weightlifters and treatment of patella tendinopathy in competitive sports athletes*"

Dear Dr. Gábor Katona,

Thank you for your report for my PhD thesis, entitled "*The performance enhancement of professional weightlifters and treatment of patella tendinopathy in competitive sports athletes*". The suggestions offered by the reviewer has been immensely helpful, and we also appreciate your insightful comments on the structure, context, thesis points, and specific questions.

After receiving your report, I immediately read them carefully and thought deeply about your questions. Your comments and opinions are a huge help in the accuracy of my research, thank you for your continued interest in my research. According with your comments, we carefully checked the relevant content in the thesis and thought deeply about the research methods. All of your questions were answered below.

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Specific questions

1. *In terms of the subjects involved in this dissertation, my first question is: what is the conceptual difference between top- and sub-elite weightlifters? In addition, why did the author choose 6 top- and sub-elite weightlifters as the subjects? Is it because of the limited number of athletes in these two levels?*

Answer: The data were collected during the Chinese National Championship and the Chinese Olympic Trials. The top six place getters at the Olympic were considered to be top-elite athletes. These six athletes were members of the Chinese National Weightlifting Team. Between them, they had won three Olympic Games gold medals, two World Championships gold medals, and one Asian Games gold medal. Athletes ranked from second to seventh at the Chinese Championships (second-tier weightlifting event in China) were considered to be sub-elite athletes. The lifter who won the gold medal was eliminated because he was included within the top-elite group.

There are two reasons why only 6 top- and sub-elite lifters were selected in my thesis. First, in order to eliminate the technical differences between weightlifting categories, my thesis only discusses the 69-kg category. In the past four Olympic Games (2004, 2008, 2012, and 2016) Chinese male lifters have won the gold medals in the 69-kg class which provides an adequate ground for my investigation. The second reason, as the reviewer pointed out, is the limited number of weightlifters in these two levels in 69-kg category. Only lifters of 69-kg category were analyzed, which lead to a relatively small number of subjects included in the study.

2. *This dissertation used sports biomechanics methods to evaluate the changes in the snatch process. Thus, my second question is, "to perform a 3D kinematic analysis, each point should be visible from at least two cameras." How was the right ankle visible by the left camera? How did the author calculate the center of gravity of the body and the barbell?*

Answer: All the video data in my thesis were captured under completion conditions. In video parsing, it is common that body joints are hidden by local limbs or are not visible on the side camera. In this case, first of all, we zoomed in the local joints, such

as the ankle bone, in the SIMI°Motion7.50 3D analysis system in order to find the joint points of human body more clearly and accurately (the specific positions of the joint points of human body are detailedly descripted in the **2.1.4 Definition of variables** on page 61 of the thesis). Second, the staff who processed video data is familiar with human anatomy, and he has more than ten years experiences in using SIMI°Motion7.50 3D analysis software. These guarantee the accuracy of the data.

In order to determine the kinematic parameters of the barbell and the human body, video and a computerized technique were employed. Two cameras were set up in the horizontal plane, approximately 10 meters away from the subjects. The optical axis of each camera formed an angle of 45 degrees with the frontal plane of the subject. Before the start of the competition, a PEAK 3D framework was used to calibrate the movement space. The spatial coordinates of various points were calculated from the collected video by means of direct linear transformation (DLT) method. Set the 3-D coordinates of the center of gravity of barbell before the snatch to (0, 0, 0.225), and the corresponding 3-D coordinates of joint points of human body are processed accordingly, so that the 3-D coordinates at the beginning are consistent.

The center of gravity position of human body was calculated using Hanavan Body Mathematical Model in the SIMI°Motion7.50 3D analysis software. The center of gravity position of the barbell was obtained by calculating the geometric center from the coordinates of the two endpoints in the SIMI°Motion7.50 3D analysis software.