

Types of weights trajectory in snatch used by female weightlifters of various build.

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Abstract:

The expanded base of technical indicators in weightlifting will greatly simplify the formation of models of motor actions of the athlete. *The aim of the research* is to determine type of motions trajectories of snatch weightlifting for high-class female heavyweights depending on athletes' weight group and body. *Materials and methods.* In the research, data of 263 successful weightlifting snatches by 119 best female weightlifters in the world were used. Analysis of biokinematic characteristics of motions was done via videograms processing automated systems on the basis of "Weightlifting analyzer 3.0" video-computer complex (Germany). *Results.* In the research done by us, a certain tendency of motions trajectories possession on the basis of athletes' weight and body type can be seen. Thus, the degree of possession of various types of motions trajectories of female athletes with dolichos form build of lightweight categories is distributed more proportionally with a slight prevalence of trajectory (B); however this distribution changes with increase of weight categories in the advantage of the other type of trajectory (B). Thus, the research shows that most female weightlifters of heavyweight categories perform the snatch using the second trajectory type (B). Female weightlifters of mesomorph and brachimorph physique show the opposite tendency. Thus, most weightlifters of lightweight category possess the second type of snatch trajectory (B). At the same time, with the increase of weight categories, the share of the second type significantly decreases while the share of the first (A) and third (C) type increases. *Conclusions.* The research showed significant prevalence of the use of the second type (B) of motion trajectory for snatch weightlifting by highly qualified weightlifters of dolichos form, mesomorph, and brachimorph build. It has been revealed that with the increase of weight category, the percentage of female athletes of dolichos form build that perform the snatch by the second type of trajectory (B) increases, while by the first (A) and third (C) type it decreases. It has been revealed that with the increase of weight category, the percentage of female athletes of mesomorph build who perform the snatch by the second type (B) decreases, while percentage of those doing it by the first (A) and third (C) type increases. It has been revealed that with the increase of weight category, the percentage of female athletes of brachimorph build who perform the snatch by the second type (B) decreases, while percentage of those doing it by the first type (A) insignificantly increases, and by the third type (C) – increases significantly.

Key words: anthropometric measurements, horizontal weights movement, trajectory types, kinematic characteristics, build.

Introduction

Weightlifting is an Olympic kind of sport. Its objective is to lift the heaviest possible weights without violation of motion technique Antonio U., (2011). One of the ways to improve sports achievements is improvement of athletes' motions technique Hamaliy V. (2013).

Nowadays in the world of sports there are many changes. Weightlifting is not an exception. One of its changes is gradual implementation of new innovation technologies in the system of training of male and female athletes Tovstonoh O., (2019). Now it is impossible to imagine training of an athlete at any level without modern innovations.

Currently, every researcher, coach, and athlete can use technologies that allow to perfect ideal motion technique without profound knowledge, due to possibility to immediately process video records of athletes or apparatuses with the help of a mobile phone and various software installed on it. Therefore, effective correction of error in motions calls for creation of the basis that would be supplemented with versatile model indices of athletes' motions technique in weightlifting. These are the indices that developers will focus on when creating software for motions technique automated analysis.

Topicality of the research is determined by the needs of practical use, primarily by the need to supplement the model indices database of the snatch technique, namely the type of weights motion trajectory in snatch depending on athletes' weight group and build.

The aim of the research is to determine types of weights movement trajectory in snatch of high-class female weightlifters depending on their weight group and physique.

Materials and methods

Participants

In the research, data of 119 best female weightlifters ranked as master of sports and higher were used. Their distribution by the weight group is the following: 48kg – 13, 53kg – 12, 58kg – 23, 63kg – 15, 69kg – 18, 75kg – 16, +75kg – 22.

Research organization. Analysis of motions biokinematic characteristics of qualified female weightlifters was done with the help of modern hardware complex which is based on application of videograms processing automated systems on the basis of “Weightliftinganalyzer 3.0” video-computer complex (Germany). To determine the type of weights motion trajectory in snatch was the basic aim of our research. The analysis envisaged singling out 3 basic types of weight motion trajectory (Fig. 1).

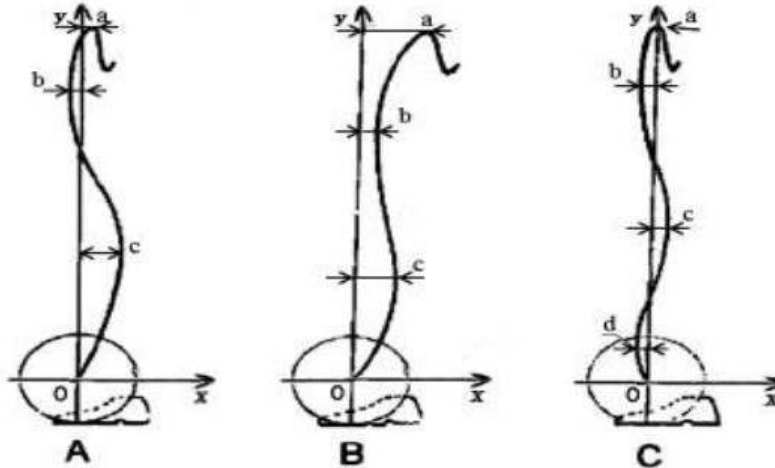


Fig. 1. Types of weights motion trajectory in snatch.

Type A envisages movement of the weights from starting position upwards onto the athlete to the position (point c) from which the motion trajectory changes – upwards from the body to the point (b) crossing vertical line drawn from the starting position of the weights. After the weights have passed point b, direction of its motion trajectory changes again in the direction to the body crossing the vertical axis and finishing the move with a peculiar “hook” in point (a). Type B envisages weights movement from the starting position towards the athlete in the period of first pull till the top pull.

Then, the movement changes its direction from the athlete in the phase of final acceleration and finishes with a peculiar final “hook” directed again to the athlete in the phase of squat. Type C denotes weights motion in the first pull phase, it is directed from the starting position upwards to the athlete and, crossing the vertical line drawn from the weights starting position, reaches point (c), then it move away from the athlete again crossing the vertical and move towards point (b), from which it changes its direction towards the athlete and is finished with a peculiar “hook”.

The data were obtained at Europe Championship, Budapest; Europe Championship, Minsk; World Championship, Istanbul; World Championship, Wroclav. Overall, 263 successful weights snatches were analyzed.

With purpose of processing the obtained data, clusterization of all female athletes by morphometric indices (build, body weight) was done. The research was done taking into account three groups of weight categories: first - 48, 53, 58 kg; second – 63, 69 kg; third – 75 and over 75 kg.

Statistical analysis. Statistical processing of the material of research was done with the help of Microsoft Excel 2010 software.

Results

Analysis of the results of competition activity of highly-qualified female weightlifters of various build, namely snatch lifting, showed the following results.

Thus, of overall 48 female weightlifters, 13 athletes with dolichos form build, 20 athletes with mesomorph build, and 15 athletes with brachimorph build constitutes the *first* weight group. Analysis of this weight group revealed that female weightlifters with dolichos form build mostly, namely 46.2% of athletes, perform the snatch by the second type (B) of weight motion trajectory, while the first (A) and the third (C) trajectories are used by 23.1% and 30.8% of athletes respectively (fig. 2).

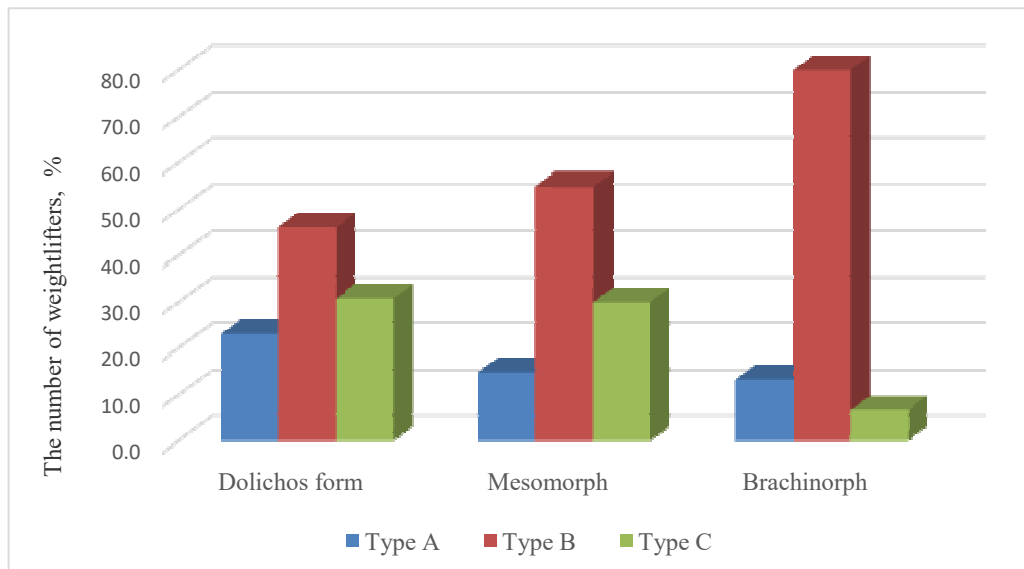


Fig. 2. Types of weights motion trajectory in snatch used by female weightlifters of different build from the first weight group category.

Majority of female weightlifters with mesomorph build use the second type (B) of weights motion trajectory, namely 55%. The first type (A) is used by 15% of female weightlifters, while the third type (C) – by 30%. Most of female weightlifters also use the second type (B) of weights motion trajectory – 80% of athletes perform the snatch in this way. At the same time, female athletes with this type of build do not use type (A) and (C) – 13.3% and 6.7% respectively.

Analysis of weights motion trajectory (snatch) in the *second* wight group, consisting of 33 female weightlifters showed the following (fig. 3).

Thus, six out of ten female weightlifters with dolichos form build perform the snatch using the second type (B) of weights motion trajectory – 60% while the fist type (F) and the third type (C) are used by 20% and 20% pf athletes resepectively.

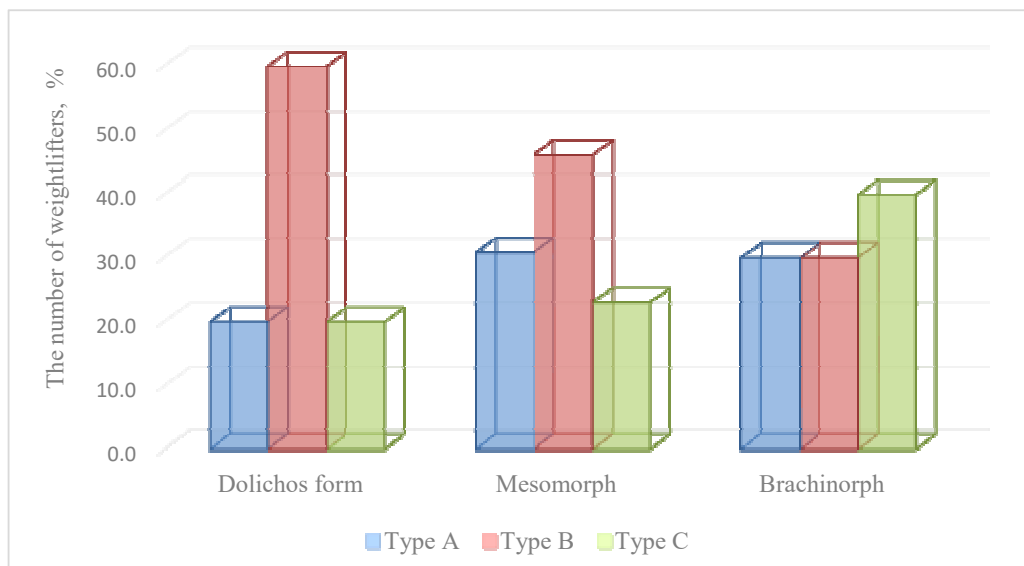


Fig. 3. Types of weights motion trajectory in snatch used by female weightlifters of different build from the second weight group category.

Female weightlifters of mesomorph group have the folowing distribution of the use of weights motion trajectory. Most athletes, six out of thirteen use type (B) – 46.2%, ehile type (A) is used by foir athelets – 30.8%, and type (C) is used by three athelets – 23.1%.

In this weight group, female weightlifters with brachimorph type perform the snatch using all trajectory types almost equally – trajectory (A) and (B) – by three athletes each; trajectory (C) – by four female athletes out of ten presented in this subgroup.

Analysis of the *third* weight group showed the following use of weights motion trajectory by female weightlifters (fig. 4).

Thus, 70% of female weightlifters with dolichos form build perform the snatch using the second type of motion trajectory (B), while the first type (A) and the third type (C) are used by 10% and 20% of female athletes respectively.

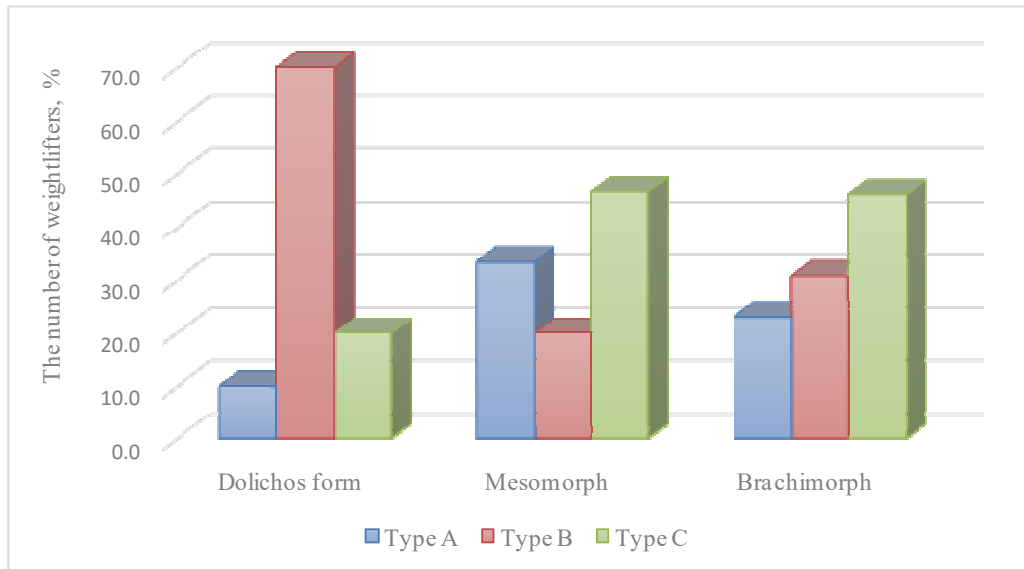


Fig. 4. Types of weights motion trajectory in snatch used by female weightlifters of different build from the third weight group category.

This weight group is represented by 15 female weightlifters with mesomorph build. Distribution of the use of motion trajectory types in this group is slightly different. Thus, only 20% of athletes in this group use trajectory type (B), 33.3% use type (A) and 46.7% - type (C).

The number of female athletes with brachimorph build in this group is 13. The analysis showed that type (C) in this group is used 46.2%, while type (B) – by 30.8% and type (A) – by 23.1% of female athletes. If we consider each type of build independently, with the increase of weight group (and category respectively), the number of female weightlifters with dolichos form build who use the second (B) type of build increases from 46% to 70% respectively. At the same time, the share of female weightlifters with dolichos form build who perform the snatch using the first (A) type of trajectory motion decreases from 23.1% in the first weight group to 10% in the third. The share of using the third (C) trajectory type by female weightlifters with dolichos form build also decreases, with the increase of weight category, from 30.8% in the first weight group to 20% in the third (fig. 2-4).

In its turn, female weightlifters with mesomorph build display other tendency, namely the decrease of percentage correlation of female athletes who perform the snatch using the second (B) trajectory type from 55% to 20% with the increase of weight category. At the same time, the share of using the first (A) type of weights motion trajectory by female weightlifters with mesomorph build increases from 15% to 33.3% with the increase of weight category. The analysis of the use of the third (C) trajectory type by female weightlifters with mesomorph build does not show a clear tendency. Thus, we may state the fact that it decreases from 30% in the first weight group to 23.1% in the middle one, and significantly increases and has the biggest share – 46.7% in the third weight group.

The share of using the second (B) trajectory type in snatch by female weightlifters with brachimorph build decreases from 80% in the first weight group to 30% and 30.8% in the second and third respectively. The use of the first (A) type by female weightlifters with brachimorph build slightly increases with the increase of the weight group categories; however, there is no clear tendency. From the other hand, we observe a clear tendency to the increase of the share of third (C) trajectory type among female weightlifters with brachimorph build with the increase of weight category from 3.7% in the first weight group to 40% in the second and 46.2% in the third group respectively.

Also, general selection of female weightlifters by the type of build in all weight categories has been analyzed (fig. 5).

It has been revealed that of 33 female weightlifters with dolichos form build in all weight categories, the highest percentage of use (in snatch) has the second trajectory type (B) – 57.6%, while the first type is used by 18.2% and the third – by 24.2% of female athletes respectively (fig. 5).

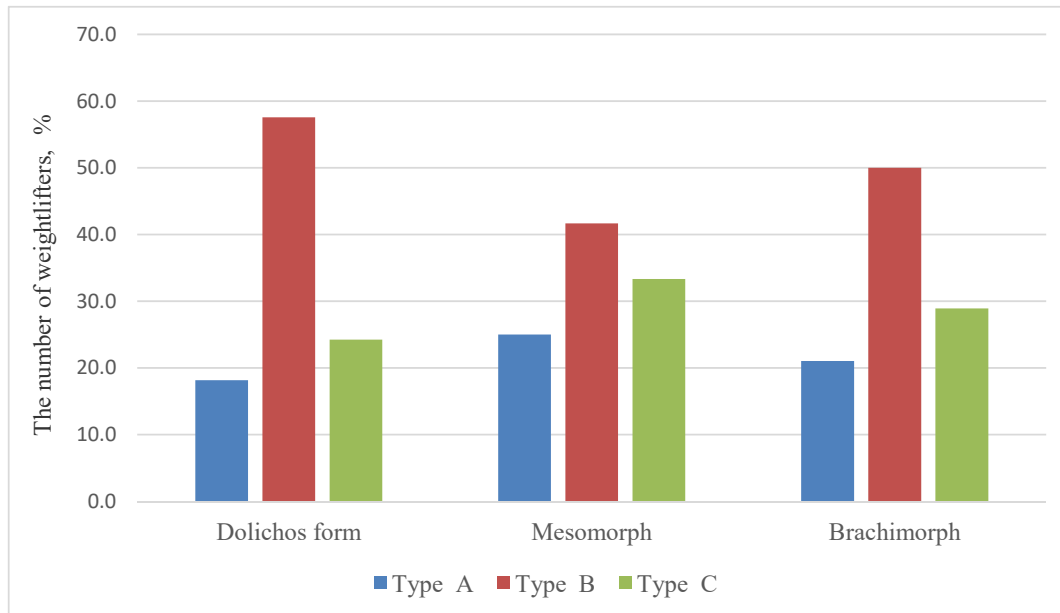


Fig. 5. Types of weights motion trajectory in snatch used by female weightlifters of different build.

The following difference in the use of various types of motion trajectory in snatch has been revealed in the group of female weightlifters with mesomorph build: the first (A) trajectory is used by 25.5% of female athletes, the second (B) type – by 41.7%, and the third (C) – by 33.3%. 38 female weightlifter had brachimorph build, who mostly use the second (B) trajectory type – 50%, while 21.1% use the first (A) type, and 28.9% - the third (C).

Discussion

The aim of our research was to supplement academic data on the snatch technique of highly-qualified weightlifters. A more specific aim of the research envisaged analysis of weight motion trajectory in snatch by weightlifters with various type of build, the percentage being calculated from a specific number of female weightlifters with certain build in group categories. That is we did not consider comparison of, for instance, the number of female weightlifters from the first weight category with dolichos form build with the general selection of female weightlifters by a group category or general selection of participants to be reasonable. This is because we assume the athletes should first understand how all athletes were divided and how all athletes with the same build in this category act, as the athlete can only change her weight category, but not type of build. Respectively, same recommendations may be applicable to coaches, whose task is to form the most suitable individual trajectory for athletes training in respect to their typological body build.

Based on the results of our research, we may assume that each weight group includes representatives of three types of build, which is proven by our previous research (Antonyuk O. V., 2012). In its turn, every type includes female weightlifters who use more or less one of the three types of weights motion trajectory.

However, a constant subject of discussion in academic world still is what motion trajectory is the most effective and the most used by the athletes. Thus, Garhammer (1985) proposed to use trajectory (A) while Baumann et al. (1988), Schilling, B.K et al. described type (B) as the best one. In their turn, Hiskia (1997) and Aaron&Guy (2020) came to the conclusion that type (C) is the most used one compared to other types. Thus, The research by Aaron&Guy (2020) done with highly-qualified female weightlifters at World Championship 2015 (n=77) and Pan American Championship (n=75) proves type (C) to be the most used one – 56% and 55% respectively while type (B) was used by 29% of athletes and type (A)- by 13% and 12% respectively. In addition to this, researchers (Nejadian, S. L., Rostami, M., &Naghash, A., 2010) made conclusions and recommended model (C) as the best trajectory. It should also be noted that in the given research (Aaron&Guy, 2020), 5 female and 9 male weightlifters have identified as the ones that use the fourth trajectory type, established by Hiskia. G.(1997).

In general, a certain tendency of the use of motion trajectories depending on athletes' build and weight can be seen in our research. Thus, the degree of the use of various types of motion trajectory in snatch of female weightlifters with dolichos form build in lightweight categories is distributed equally with a slight prevalence of

trajectory (B); however, this degree of distribution changes with the increase of weight categories in favor of trajectory (B). Thus, we may conclude that female weightlifters of heavyweight categories mostly use the second trajectory type (B) when performing the snatch.

Female weightlifters with mesomorph and brachinorph build the picture is the opposite. Thus, in lightweight categories, most athletes use the second (B) trajectory types in snatch while with the increase of weight categories the share of the second type significantly decreases – the share of the first (A) and the third (C) types significantly increases (see fig. 2-4).

It should be noted that various researchers are trying to explain these phenomena with anthropometric size of body (Akkuş, H., 2012; Ford, 2000; Harbili, 2012). (Tovstonoh.O., 2012; Musser, Garhammer&Vargas, 2014). Thus, Garhammer, J. (1985) states that the optimal trajectory depends on relative length segments of the body and other important factors such as muscles fixation point. Other research of competition activity prove that weightlifters' technique can also be influenced by other factors such as anthropometry, weight category, and sex.

At the same time, it has been revealed that female weightlifters with different build generally use the second trajectory type (B) of weights movement in snatch (fig. 5), which is also proven by our research Antoniuk O.V., 2016) and research by other scholars (Garhammer, 2000; Musser, Leslie, 2010; Hancock, Wyatt, & Kilgore, 2012; Ikeda, Jinji, Matsubayashi, & Kikuta, 2012; Korkmaz, Harbili, 2016). Take research by Liu, G., & Gu, Y. (2018) done during China Championship 2015 and Olympic trials in China in 2016. 12 high-qualification weightlifters took part in the research, of whom 8 weightlifters, based on sex data, used the second type (B) of weight motion trajectory in snatch.

On the other hand, there are researches that contradict with our data. We have mentioned these researches before. These results prove conclusions made by Akkuş, H. (2012) who noticed that female world champions in weightlifting in 2010 used different types of trajectories. At the same time, the results by Aaron Cunanan, & Guy Hornsby (2020) show that the three best female athletes at Pan America Championship 2017 can probably also use various types of trajectory.

In general, such contradictions can probably be explained based on the fact that the researches were done in a 35-year span with different groups of athletes. These surmises can also be proven by the fact that during our research from 2009 to 2013 with video records, 4 female weightlifters who competed in also every tournament changed their weights motion trajectory type. No regularity was revealed; however the fact of this phenomenon was registered.

Conclusions

The research showed significant prevalence of the use of the second type (B) of weights motion trajectory in snatch by highly-qualified female athletes with dolichos form, mesomorph, and brachimorph builds.

It has been revealed that with the increase weight group categories, percentage of female athletes with dolichos form build performing the snatch with the second trajectory type (B) increases, the use of the first (A) and third (C) types decreases. It has been revealed that with the increase of weight group categories, percentage of female weightlifters with mesomorph build performing the snatch with the second trajectory type (B) decreases, while the use of the first (A) and the third (C) type – increases.

The research showed that with the increase of weight group categories, percentage of female athletes with brachimorph build performing the snatch with the second trajectory type (B) decreases, while the use of the first (A) type slightly increases, and the use of the third type (C) – increases significantly.

Conflict of interests

The authors declare that there is no conflict of interests.

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