*Systematic Review*

**Systematization of Previous Studies of Exercises on the Rings in Men’s Artistic Gymnastics**

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DĐ, MP, SV, PV and MS—conceptualization; LP and GS—methodology; DR and DM—software; IJ—validation; LP—formal analysis; GS and DR—investigation; DĐ, MP, SV, PV and MS—resources; GS—data curation; IJ—writing - original draft preparation; GS and LP—writing - review and editing; DR and DM—visualization; GS—supervision; GS—project administration. All authors have read and agreed to the published version of the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

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Abstract

**Background**: One of the six apparatuses in men’s artistic gymnastics is rings, which differs from other apparatuses by the fact that rings can move free in all possible directions. Thus, a high fitness performance level is decisive in men’s artistic gymnastics to fulfill exercises technical requirements, in order to effectively perform the wide range of complex elements. The study aim was to identify, summarize and examine the scientific evidence regarding exercises on rings in men’s artistic gymnastics. **Methods**: The search and analysis were performed in accordance with PRISMA guidelines. The database search (Google Scholar, PubMed, Web of Science and Research Gate) have identified a total of 5759 potential studies. For inclusion criteria, we have reconsidered original scientific studies, cross-sectional studies, studies published between 2000 and 2022, studies written in English language, active male gymnast as a sample of participants who do not suffer from injury and studies who evaluated different types of elements on the rings. **Results**: A total of 15 full-text studies were identified, with a total of 292 male participants. A total of 7 elements were evaluated, four strength elements (swallow, Azarian, iron cross and support scale), two dismounts (double back flip straight and double back flip straight with a 360° turn) and one swing element (backward giant swing). Two studies have conducted kinematic analysis of dismounts, four studies have conducted electromyography on strength elements, while two studies have used force plates to evaluate the required specific strength for their successful performance. **Conclusions**: Of the total of 146 recognized elements by the FIG Code of Points, only 7 elements were identified and presented. Based on this finding, there is a scarce of studies that have evaluated swings to strength hold elements and dismounts. This study can be a good starting point for future directions, whereas studies about mentioned elements should be created and evaluated more.

Keywords

rings; men’s artistic gymnastics; strength; swing; dismount

# 1. Introduction

Artistic gymnastics is a type of activity that requires very high levels of both anaerobic and flexibility capacities for successful performances [1]. According to several authors [2–5], this sport is pure promotion of jumping, pushing, explosive strength, pulling skills development, balance and artistry. The performance itself depends on the perfect trade-off between the physical fitness level and the complex technical skills required on each apparatus [6]. Thus, a high fitness performance level is decisive in men’s artistic gymnastics to fulfil exercises technical requirements on different apparatuses [7]. In other words, the gymnast should achieve high strength, flexibility and coordination levels, in order to effectively perform the wide range of complex acrobatic skills [8,9].

One of the six apparatuses in men’s artistic gymnastics is rings, who’s differ from other apparatuses because of their design, which requires static, concentric and eccentric muscle contractions [10]. The rings can move free in all possible directions, which adds bigger instability and additional difficulty to the elements. Hence, this apparatus is different by the technique of the elements realization in comparation to other apparatuses. That is why gymnasts must pay attention to the movement of individual parts of body, as well as deviation of the rings itself [11].

Elite athletes have to train in a very specific way in order to achieve optimal performance. In this context, the optimization of specific physical prerequisites, such as strength, power or muscular endurance is indispensable [12]. In artistic gymnastics, coaches with their gymnasts must improve the technique and the acquisition of more difficult skills, along with physical prerequisites. Hence, these two components must be developed simultaneously, especially in the preparatory phase, which allows gymnasts to improve their sport-specific performance in a short period of time [13]. At competitions, gymnasts are performing a 9 different kind of difficult elements, along with the dismount as the last element, in order to increase the D score as much as possible. In other words, to receive a full evaluation of the elements groups, the exercises on the rings consists from elements of kip and swing elements and swings through or to handstand (2 sec.), strength elements and hold elements (2 sec.), swings to strength hold elements (2 sec.) and dismounts [14,15].

Previous studies [16,17] have attempted to systematize the studies that are relevant to men’s artistic gymnastics. First time, authors [16] have dealth with kinematic and kinetic profiles of straight arms in giant swings and their optimized solutions, streched double-feldge backward to forward swing in hang (so-called “O’Neil”) and twisting techniques of dismounts. Second time, it was concluded that biomechanical studies in artistic gymastics had grown, however, most of them were focused on generalization [17]. A summary of mentioned studies on the rings are presented in the Table 1.

Table 1. Summary of analyzed studies on the rings

|  |  |
| --- | --- |
| **Skill** | **Information** |
| Giant swings | Reaction forces, body configuration, optimization solutions to remove residual swing in the handstand |
| Dismounts | Twisting techniques (contact vs. aerial) and segmental contributions |
| Double salto without releasing the rings (O’Neil) | Centre of mass velocity and displacement, timing |

Based on the knowledge of authors, there are no systematic review of recent date, that identifies, summarize and systematize previous studies, of exercises on the rings in men’s artistic gymnastics. Hence, the aim of this study is to identify, summarize and examine the scientific evidence regarding exercises on rings in men’s artistic gymnastics.

# 2. Materials and Methods

*2.1 Literature Identification*

Analysis and the review itself were performed according to PRISMA guidlines [18,19]. Using the relevant electronic databases (Google Scholar, PubMed, Web of Science and Research Gate) searches were conducted with following keywords: (“exercise” OR “training” AND “rings” OR “strength” OR „static“ OR “swing” OR “dismount” OR “movement” AND “gymnastics” OR “artistic gymnastics” OR “men’s artistic gymnastics”).

A descriptive method was used to analyze the obtained data and all abstracts and titles were reviewed for possible inclusion. After a detailed identification process, studies were considered relevant, if they met the inclusion criteria. Study search, value assessment and data extraction were independently conducted by three authors (M.P., P.V. and D.Đ.), and the list of references from previously assessed and original research were also reviewed. After that, each authors cross-examined the identified studies, which were taken for further analysis or rejected.

*2.2 Inclusion Criteria of Studies*

Inclusion criteria of studies were defined for the selection of studies included in the final analysis: original scientific study, cross-sectional study, study published between 2000 and 2022, study written in English language, active male gymnast as a sample of participants who do not suffer from injury and studies who evaluated different types of elements on the rings.

*2.3 Exclusion Criteria of Studies*

Тhe exlusion criteria was related to studies conducted before 2000, studies written in other language than English, women’s artistic gymnastics, other types of gymnastics or studies who evaluated elements on different apparatuses.

*2.4 Risk of Bias Assessment*

According to the Physiotherapy Evidence Database (PEDro scale), the risk of bias was assessed to determine the quality of studies [20]. This scale was developed to identify studies that were likely to be internally valid and have sufficient statistical information to support clinical decisions. It is a valid measure of the methodological quality of clinical trials and is a valid way to sum scale item scores to obtain the total score, which can be treated as an interval-level measure and subjected to parametric statistical analysis. Two independent reviewers (M.P. and D.Đ.) assessed quality and risk of bias using checklists and concordance between reviewers was estimated using k-statistics data to review the full text and assess relativity and risk of bias. In case of discordance as to findings of the risk of bias assessment, the obtained data were assessed by the third reviewer (S.V.), who also made the final decision. The k-rate of concordance between reviewer’s findings was k=0.91.

*2.5 Data Extraction*

After the cross-examination and only if the data were adequate, the information were extracted. The standardized data extraction protocol was applied (Cochrane Consumer and Communication Review Group’s) to extract the necessary characteristics, such as first author and year of publication, study aim, sample size, age, competition level, information about evaluated element on rings and results obtained.

# 3. Results

*3.1 Quality of Studies*

Based on the points each study scored on the PEDro scale, the final quality assessment scores were defined. With a grand total of 0–3 points, studies were classified as “poor” 4–5 “fair” 6–8 “good” and 9–10 “excellent” In addition, for studies evaluating complex interventions (e.g., exercise), a total score of 8/11 may be optimal [21]. Of all the studies included in this systematic review, 12 studies showed fair quality, while rest of 3 of them showed good quality. The results obtained from analyzing the study quality and potential risk of bias are presented in Table 2.

Table 2. PEDro scale result

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Criterion** | | | | | | | | | | | |
| **Study** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **∑** |
| Brewin et al. (2000) | Y | N | N | N | N | N | N | Y | Y | Y | Y | **4** |
| Sprigings et al. (2000) | Y | N | N | Y | N | N | N | Y | Y | Y | Y | **5** |
| Yeadon & Brewin (2003) | Y | N | N | N | N | N | N | Y | Y | Y | Y | **4** |
| Bernasconi et al. (2004) | Y | N | N | Y | N | N | N | Y | Y | Y | Y | **5** |
| Bernasconi et al. (2006) | Y | N | N | Y | N | N | N | Y | Y | Y | N | **4** |
| Dunlavy et al. (2007) | Y | N | N | N | N | N | Y | Y | Y | Y | Y | **5** |
| Bernasconi et al. (2009) | Y | N | N | N | N | N | N | Y | Y | Y | Y | **4** |
| Campos et al. (2009) | Y | N | Y | Y | Y | N | N | Y | Y | Y | Y | **7** |
| Campos et al. (2011) | Y | N | N | N | N | N | N | Y | Y | Y | Y | **4** |
| Ningxiang et al. (2012) | Y | N | N | N | N | N | N | Y | Y | Y | Y | **4** |
| Bango et al. (2013) | Y | N | N | N | N | N | Y | Y | Y | Y | Y | **5** |
| Gorosito (2013) | Y | N | N | N | N | N | Y | Y | Y | Y | Y | **5** |
| Hubner & Scharer (2015) | Y | N | N | Y | N | Y | N | Y | Y | Y | Y | **6** |
| Scharer & Hubner (2016) | Y | N | N | Y | N | Y | N | Y | Y | Y | Y | **6** |
| Kolimechkov (2021) | Y | N | N | Y | N | N | N | Y | Y | Y | Y | **5** |

Legend: 1—eligibility criteria; 2—random allocation; 3—concealed allocation; 4—baseline comparability; 5—blind subject; 6—blind clinician; 7—blind assessor; 8—adequate follow-up; 9—intention-to-treat analysis; 10—between-group analysis; 11 —point estimates and variability; Y—criterion is satisfied; N—criterion is not satisfied; ∑—total awarded points.

*3.2 Selection and Characteristics of Studies*

Electronic database search and scanning the lists of references yielded 5759 studies. After removing duplicates, 5021 studies were screened. Based on the inclusion criteria, 4980 studies were excluded. After increased sesitivity and in-deeper check, another 26 studies with with nonrelevant outcomes, editorials, health concept, reliability and validity of judging studies and historical evaluation studies were additionaly excluded. In the end, a total of 15 full-text studies were included in the systematic review (Figure 1).

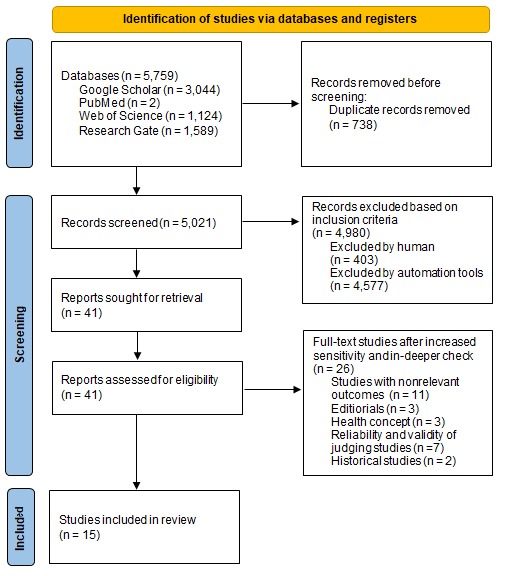
Figure 1. Study identificataion based on pre-defined criteria (PRISMA flow chart)

Table 3 shows in more details of included studies that met the inclusion criterias and entered the systematic review.

Table 3. Review of studies

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **First Author and Year of Publication** | **Study Aim** | **Sample of participants** | | **Element Evaluation** | **Result** |
| **Number** | **Age (years)** |
| Brewin et al. (2000) | To investgate the contributions of apparatus and gymnasts El and technique to minimize peak force at the shoulders during BGS | N-1 | / | BGS | Gymnast and apparatus contribute to minimising peak shoulder force. The contribution of gymanst’s technique is considerably greater |
| Sprigings et al. (2000) | Objective information on the role of flexor/extensor of the hip and shoulder joints during BGS and to examine the timing strategy to reduce ReSw in a held handstand by doing BGS | N-2 | / | BGS | The shoulder flexors/extensors are main source of energy generation. Gymnast performed from initial 16° to 6-7.5° of ReSw |
| Yeadon & Brewin (2003) | Can be ReSw be reduced to 0° using detailed simulation model and what are practical limits? | N-1 | / | BGS | Gymnast performed from initial 2.1° to 0.8° of ReSw. The optimal body configuration must be timed within 15miliseconds |
| Bernasconi et al. (2004) | To compare MA and coordination during IC on the R and H and to determine whether the H usage induced functional adaptations of shoulder muscles | N-6 | 23±3 | IC (EMG) | Normalized RMS  R  10.024±1.488\*  H  7.976±0.896\* |
| Bernasconi et al. (2006) | To compare the activity of 11 shoulder muscles during AZ when gymnasts used  the B and the H | N-7 | 21-26 | AZ (EMG) | RMS (B) > RMS (H)  (p<0.05) |
| Dunlavy et al. (2007) | To determine if FP placed on supports to simulate a IC position could demonstrate the fidelity necessary to differentiate between athletes who could perform a IC from those who could not | N-10  P-5  NP-5 | P-23.8±1.3  NP-14±1 | IC (FP) | Sum of mean arm forces P-654.7±35.4 (p=.007)  NP-306±201.4  Sum of peak arm forces  P-676±41.5 (p=.005)  NP-330.3±213.5 |
| Bernasconi et al. (2009) | To determine the activity of 8 shoulder muscles during a S, and to compare the muscle activity and coordination between the S and 3 training movements | N-6 | 22±3 | S (EMG) | Compared to S (R), pectorialis major participates less in shoulder flexion during the counterweight exercise, while deltoideus is more activated during dumbbells exercise (p<0.05). Barbell exercise reduces the participation of serratus anterior in stabilizing the scapula (p<0.05) |
| Campos et al. (2009) | Verifying the contribution of the S as a structural framework and to evaluate it within the R routines | N-212 | / | S | 41% of total competitors presented S 56% included at least one S (119 gymnasts) 119 gymnasts (73% of them) made two variants of S |
| Campos et al. (2011) | To characterize the S in order to identify the MA of the different muscles to create strategies of progression to learn this skill | N-1 | / | S (EMG) | Stabilizing shoulder joint, infraspinatus (69.3%), serratus anterior (53.3%) and trapezius inferior (45.1%) should be activated, during S |
| Ningxiang et al. (2012) | Kin characteristics and apparatus features after D (dbfs360°) | N-1 | 27 | D  (dbfs360°) | D realisation  dbfs-1.6s  dbfs360°-1.6s  Vertical distance-3.33m  0⁓90°  0.2s (7.58rad/s)  0⁓180°  0.12s (13.08rad/s)  80⁓270°  0.16s (9.81rad/s)  70⁓360°  0.2s (7.58rad/s) |
| Bango et al. (2013) | To develop a tool for measuring Sstr production of the gymnast performing S using a single FP | N-8  P-4  NP-4 | P-24±3.6  NP-17±1.2 | S  (FP) | P\*, NP\*  ICC  MxIF–ARF (N)-0.993  MxIF–%RF (%)-0.998  MxIF–RRF (N\*kg-1)-0.988  MnIF–ARF (N)-0.995  MnIF–%RF (%)-0.992  MnIF–RRF (N\*kg-1)-0.992  CVSEM (%)  MxIF–ARF (N)-3.82  MxIF–%RF (%)-3.14  MxIF–RRF (N\*kg-1)-3.14  MnIF–ARF (N)-4.00  MnIF–%RF (%)-3.24  MnIF–RRF (N\*kg-1)-3.24 |
| Gorosito (2013) | To analyze the correlation between gymnasts Rstr and the time in seconds that gymnasts can hold the S and to identify the minimum Rstr required for the proper execution | N-14 | 18-30 | S | + Rstr and holding the S (r = 0.952, p<0.001).  Body structure (height, sitting height and wingspan) is not important factor for proper execution of S |
| Hubner & Scharer (2015) | To investigate the correlation between strength in seven preconditioning exercises and performance of S, IC and SS | N-10 | 21.5±2.5 | S, IC, SS | + S with preconditioning S supine position (r=0.71, p=0.031) and BP (r=0.71, p=0.046)  + SS and S supine position (r=0.69, p=0.039)  + IC with IC-B (r=0.66, p=0.051) and BP (r=0.67, p=0.069) |
| Scharer & Hubner (2016) | To determine the MX in terms of counterweight or additional weight, at different holding times based on the MX of S, IC and SS | N-10 | 21.5±2.5 | S, IC, SS | \*↓ in MX as holding time increases (t-test: p<0.001) |
| Kolimechkov (2021) | To conduct a Kin analysis of dbfs and dbfs 360° | N-2 | / | D (dbfs, dbfs 360°) | Ankle speed  1 gymnast-11.11m/s  2 gymnast-11.29m/s  Angular velocity  1 gymnast-10.0rad/s  2 gymnast-9.05rad/s |

Legend: N-total number of participants P-performers, NP- non performers, BGS-backward giant swing, EMG-electromyography, SEMG-surface electromyography, IC-iron cross, RMS-root-mean-square value, S-swallow, SS-support scale, AZ- Azariam, D-dismount, dbfs-double back flip straight, dbfs360°-double back flip straight with a 360° turn, El-elasticity, ReSw-residual swing, Kin-kinematic, Sstr-specific strength, Rstr-relative strength, R-rings, H-herdos, B-belt, MX-maximal resistance, MA-muscle activity, FP-force platform, ICC-intra-class correlation coefficient, CVsem-coefficient of variation of the standard error of measurement, BP-bench press, MxIF–ARF-maximal isometric force–absoulute released force, MxIF–%RF-maximal isometric force–percentage of released force, MxIF–RRF-maximal isometric force–relative releaced force, MnIF–ARF-mean isometric force–absoulute released force, MnIF–%RF-mean isometric force–percentage of released force, MnIF–RRF-mean isometric force–relative releaced force, \*-significant difference between groups (P>0.05), \*↓-significant decrease, +-significant positive correlation

There were a total of 292 male participants. The youngest participants was 14 years old [22], the oldest was 30 years old [10] and there were a group of studies that did not present the sample age [23–28]. The highest number of participants was 212 [24], while the lowest was only 1 participant in several studies [24,26,28,29].

Giant swing backward, as the only evaluated swing element on rings were conducted by three studies [26–28], while 9 studies overall evaluated different strength elements, such as swallow [10,24,25,30–33], Azarian [34], iron cross [22,30,31,35] and support scale [30,31]. Kolimechkov et al. [23] evaluated double back flip straight with a 360° turn, as well as double back flip straight only, while Ningxiang et al. [29] evaluated only double back flip straight with a 360° turn. Four studies have conducted electromyography of muscle activation on strength elements, such as iron cross [35], swallow [25,33] and Azarian [34], whereas two studies have used force plates to evaluate the required specific strength for successful performance of the iron cross [22] and swallow [32].

# 4. Discussion

The aim of this systematic review was to identify, summarize and examine the scientific evidence regarding exercises on the rings in men’s artistic gymnastics. The main findings of this systematic review is the fact that, of the total of 146 elements recognized by the FIG Code of Points (2022-2024) [15], 7 elements in total were identified and presented. There were investigated only four strength elements (swallow, Azarian, iron cross and support scale), two dismounts (double back flip straight and double back flip straight with a 360° turn) and one swing element (backward giant swing). Overall, two studies have conducted kinematic analysis of dismounts, four studies have conducted electromyography on strength elements, while two studies have used force plates to evaluate the required specific strength for the successful performance.

Maintaining a static strength element on rings may be considered as an eccentric muscle contraction due to the decelerating muscle work required in order to overcome gravity while maintaining the static positions. That is why a high level of relative maximum strength of the upper limbs and advanced balance skills in the hold positions are crucial for the gymnast in order to perform these types of elements [22,30,32]. Most of these skills are relatively slow moving or held (i.e., isometric), occur in extraordinary postures and require months or even years of evolvent. Scharer & Hubner [30] have identified significant decreases in maximal resistance as the time in the holding element increses. This result is corresponding with the findings from Komimura & Ikuta [36], who have found a gradual decrease of maximal isometric grip strength ratios every second. This can be explained by the high intensity of maintaining a static elements [37]. Hubner & Scharer [31] have found that preconditioning exercises, iron cross with belt and bench press positively correlates (r=0.66, p=0.051; r=0.67, p=0.069, respectively) with iron cross on the rings. These results are in accordance with Starischka [38] and Starischka & Tschiene [39] who have observed a significant improvements of the iron cross specific maximal resistance if the hold element is trained at 90% of maximum intensity. On the other hand, Bernasconi et al. [34,35] have showed that conducting preconditionig exercises on herdos, iron cross or Azarian respectively, do not provide same shoulder coordination and activation as on the actual rings or belt, respectively. Hubner & Scharer [31] have also identified that preconditioning exercieses, swallow in supine position and bench press positively correlates (r=0.71, p=0.031; r=0.71, p=0.046, respectively) with swallow on rings. In addition, swallow in supine position, as preconditioning exercise also positively correlates (r=0.69; p=0.039) with support scale on the rings. These findings are in accordance with some previously reported studies [40,41], who have identified a higher predictability of the 1RM from lower repetition maximum testing than from 10 or more repetitions. Campos et al. [25] emphasize that infraspinatus (69.3%), serratus anterior (53.3%) and trapezius inferior (45.1%) should be activated the most during swallow. Furthermore, according to Gorosito [10], in order to perform a valid swallow or even support scale on the rings, a gymnast should be able to hold at least 30% of his body weight on each hand in preconditioning exercises in supine position. However, based on the fact that swallow and support scale have very similar performance, as well as the Azarian with the iron cross, it is of great importance the pectoralis muscles, teres major, deltoideus and serratus anterior, as well as the handgrip strength, in order to properly hold the static position of mentioned elements on the rings.

The backward giant swing is commonly used as a connecting element between two mandatory held handstands [42]. According to Yeadon & Brewin [26], the ability to perform a giant swing to a stationary handstand position is of great importance to elite gymnasts. Two decades ago, a gymnast had to realize both backward and forward swinging elements that are completed and held in stationary handstand position [43]. Today, a gymnast can realize one of mentioned swinging element, depending on the gymnasts individual predisposition [15]. Brewin et al. [28] have showed that increasing apparatus elasticity produces only a small reduction in peak force at the shoulders. Since this study was conducted more than two decades ago, a varius types of new apparatus manufacturer have showed up, such as American Athletic, Continental Sports, Gymnova, Spieth, Senoh, Taishan etc. [15]. But in order to examine the shoulders peak force on giant swing at different types of apparatus manufacturers, a further research is needed.

Sprigings et al. [27] and Yeadon & Brewin [26] have tried to analyze and minimize residual swing after performing giant swing, whereas results have showed initial 16° and 2.1°, respectively, to a final 7.5° and 0.8°, respectively. From a practical point of view, in order to successfully conduct a giant swing to stationary handstand, there should be taking in consideration six factors. First, the stable handstand should be provided, second, the lateral movement of the rings at the initial descending phase from a handstand and third, the active role of shoulder joint flexors in pushing the rings backwards shortly after the bottom swing arc. The fourth is the hip extensor muscle activity, as the legs swung upwards past the horizontal, the gymnast power profile is the fifth factor and the performance technique as sixth [27]. Although training modalities may differs from coach to coach, mentioned factors may provide more opportunities for the gymnast to make the performing task properly and successfully.

The final element on the rings is the dismount and in many cases, it is a crutial skill for scoring the rings routine [23]. Between 2000 and 2019, in 15 Worlds Championships and 5 Olympic Games, 75% of the 62 medallists performed either double back straight somersault or the double back straight somersault with a full twist [44]. Since the gymnasts body mass multiplies several times while tumbling and dismounting, Nissinen [45] have found that peak combined tension measured in the ring cables reaches up to 9 gymnasts bodyweight, whereas Čuk [46] have identified that recorded loads are over 13G on the hands. Further, the lateral arm movement during descending phase from handstad may minimize the shoulder force, which will reduce damage risk of ligaments and muscles. The bending (arching) must be in certain degrees, since the body movement is depending on the individual gymnasts capabilities [23,28]. The both mentioned studies [23,29] have showed similar results between gymnasts dismounts, such as performing time (2.48s vs. 2.3s, respectively), lateral movement of arms in descending phase from handstand and straight body with hands close to the body, in order to speed up the rotation needed for the twist around the longitudinal axes. According to the authors knowledge, there are no other conducted studies to compare the results, so future ones should be provided.

Teaching progressions on any element must be followed by basic pedagogic principles so that each progressive step includes a movement structure similar to the desired element [47], which referes to the main practical applicability. As far as the main study limitation, it lays in a fact that authors did not have an absolute access to some other databases, so only databases where authors had a total access was observed. Hence, there were not so many included studies from only four databases. But even if we have had set some other inslusion/exclusion criterias, such as elite sample or training experience/competition, the number of included studies will still be small.

# 5. Conclusion

Considering the great prospect of elements on the rings, any element can be upgraded. Likewise, having in mind the originality and creativity of gymnasts and coaches as well, the ability of upgrading the elements is widely expanded in recent years. This fact is confirmed based on the 146 recognized elements, whereas a lot of the them are named based on the gymnasts last names. But based on the included and presented elements, which were 7 in total, there is a scarce of studies that have evaluated swings to strength hold elements and dismounts. Hence, as a good starting point for future directions, the studies about mentioned elements should be created and evaluated more.

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