

TRAINING SYSTEM HAST FOR THE DEVELOPMENT OF STRENGTH ABILITIES IN ARMWRESTLING

<https://doi.org/10.5817/CZ.MUNI.P210-9631-2020-44>

Gabriel Harčarik

Faculty of Manufacturing Technologies of the Technical University of Košice with the seat in Prešov, Slovakia

ABSTRACT

In the opening the author describes the current situation in an armwrestling training. Based on the experiences and the study of literature he states that in practice there is almost no systematic guided training with a sparingpartner at a table. He perceives this as a problem. In the results he presents his own program HAST where he describes the individual training parametres. They are important for a quality training program with a sparingpartner at the armwrestling table. He points out the mistakes often made at the armwrestling training and he proposes suitable solutions within the scientifically based informations used in strength training. In the discussion he describes in detail the key parts of HAST and the experiences from the realization of this program with his trainees. In the end he states that the similar program should be a part of the preparation of armwrestlers and at the same time he adds that the scientific attesting is needed.

Keywords: specialized training; RPE; exercises with a sparingpartner; parametres of training

Introduction

In the strength training with dumbbells, on pulleys or on trainers, determination of training load is simple and explored. In an armwrestling training with sparing partner it is a lot more difficult. The main problem is the absence of programing, periodization and a registry of trainings with sparingpartners at a table. Based on our foundations, 99% of the trainings take place at the table with sparingpartners disorganized, in the form of wrestling where only technical mistakes are corrected. Training load is not set even though there is a supposition of performance increase. Therefore it is very difficult to evaluate the effectivity of this kind of training and later adjust and lead the training process. Usanov and Chugina (2010) have written the most comprehensive book on armwrestling in Russia, but the whole monograph does not show what training on a table with a sparring partner should look like. Similarly Tivora, Rachmanov (2001), Kondraškin, Larin (2005) and Babaje (2005) focus only on strength training using dumbbells, pulleys or special machines during training. They show the classic number of series 1–5, repeats 3–10 and the intensity 50%–100%, which they derive from the maximum weight in the exercise. They recommend performing both static and dynamic exercises. Jarombek (2003) indicated the structure of training unit at the table within the technical preparation but it wasn't aimed at the development of strength abilities. Harcarik (2011) in his dissertation thesis proved that strength abilities are able to develop thanks to the table training while this program in the experimental fold significantly affected strength abilities, the sportsmen achieved important changes in the evaluation of the result in the armwrestling match. They recorded more victories in comparison to control fold. Essentially there is no methodology or training system concerning strength training at the table with sparingpartner. Therefore we decided to develop the training system HAST (Harcarik Armwrestling Sparing Training), which

is specially developed for armwrestling needs. It tries to define as many training parameters for effective development of strength abilities as possible. When studying of foreign literature (there is a lack of fit and it is difficult to obtain it) we didn't come across to any similar and integrated training system which would be devoted to this problem. The program HAST is about needs and specifics of this sport, it was improved to today's appearance.

Methods

Based on the results, which have been achieved in our dissertation thesis with the "Table Program", we have decided to further develop this program. We have seen its potential as this is an unexplored area of the training process in which there is a large number of variables that can have a major impact on the development of strength skills in armwrestling. So far, no one has paid attention to them, even though training with a sparring partner is very important in our opinion, as the match itself takes place between two opponents and not between an athlete and a barbell or machine. When creating HAST, we focused on training parameters that we can influence and which, based on our long-term observations, proved to be important for the development of strength skills in armwrestling. Based on previous experience with "table" training, we were able to determine how much armwrestlers can handle. In determining the breaks between the series, we started from research dealing with the issue. We see the problem of rest pause in the fact that armwrestling is a unilateral sport and the rest and training time is doubled as we need to train the right and left hand. Another indicator related to the development of strength abilities and adaptation to strength training is the pace and thus the time under tension. In our opinion, this data is very important and we are able to monitor and modify it according to the goal. However, literature on armwrestling does not give concrete examples and therefore we were looking for inspiration in other sources. Determining intensity / exertion is a decisive parameter for developing strength abilities. That was one of the biggest problems. In the literature, the intensity was determined only when practicing with the equipment, but we needed to evaluate it when training with the sparring partner. After a long search and subsequent verification in practice, we have proven to use the scale for perception of exertion. We have included all these training parameters in our HAST program and set them up for armwrestling training with a sparring partner.

Results

In armwrestling the strength training (with dumbbells, pulleys and on the specialized trainers) is followed by standard rules of strengthening and methodology is taken from other sports sectors. Here we can see some mistakes, but this will not be our concern. Training load, rest, training intensity, exertion are training parameters, which determine quality of the training process. We are going to define these parameters for HAST program.

Training volume defines the amount of work we made in a training. Often, it is set by number of series, repetitions or total overweight (can be defined with the table training). The most common the total number of repetition in an exercise or training is used. We used Prilepin's Table (Table 1.), which is a result of long lasting experiences of Russian coaches for weightlifting. Weightlifting together with armwrestling are the speed-power sports. Based on this chart we can choose the optimal number of repetitions, series or intensity in % of 1RM – cannot be set in the table training.

Table 1 Prilepin's Table

Intensity	Reps Per Set	Optimal Total Reps	Total Rep Range
< 70 % of 1RM	3-6 reps per set	24 total reps	18-30 total reps
70-79 % of 1RM	3-6 reps per set	18 total reps	12-24 total reps
80-89 % of 1RM	2-4 reps per set	15 total reps	10-20 total reps
90 > % of 1RM	1-2 reps per set	7 total reps	4-10 total reps

We know that for development of strength the best method is the method of maximal exertion where the weights from 85% of 1RM are used - that means 2–4 repetitions. In the case that we start with the strength preparation, we start at 3 repetitions. The optimal number of the total repetition is 15 so that means 5 series. So, with the weight (resistance) on 85% level we make 5 series of 3 repetitions to achieve an ideal training impulse for strength growth. The total range says that we can make 3–4 series of 3 repetitions or even 6–7 series of 3 repetitions. Practice is very important here together with coach's experiences and it's up to him what training load he sets. Performance of a sportsman is also one of the key elements along with his health, the etape of sport preparation or the period he is currently in. When starting, it is sufficient to use the optimal number of repetitions, because we don't know to set exactly 85% of 1RM for maximal strength development. Therefore we searched how to set the intensity of the training.

Intensity is indicated by weight of a dumbbell in strengthening. This entry can be defined absolutely in kilograms or relatively, that means by percentage of maximum. One maximal repetition (1RM – repetition maximum) is 100% of lifted weight. It represents the heaviest weight you are able to lift in given exercise only once. In other sports this can be speed, height, pace, etc. In the case of the table training with sparingpartner it is not possible to define it as it is defined with dumbbell. Therefore we focused on the concept of intensity or effort.

Exertion and perceiving it is influenced by physiological, psychological and other factors. By other factors we mean signals from working muscles and joints, blood lactate, heart rate, ventilation, oxygen consumption, hormonal secretion, pain caused by exercise, etc. (Watt et al., 1993, Mocková, 2000). The studies proved that for majority of these mediators there is a certain threshold which equals to anaerobic threshold (ANT). Psychological factors participate by 33% on perceiving the exertion mainly at lower and medium intensity. At high intensity there are more physiological stimulus. The other factors that affect perceiving the volume are: environment, sex, age, physical training, smoking and medications. Borg's researches in 1993 showed the relationship between perceived effort, heart rate, lactate, % VO_{2max} and the rhythm of breathing of a sportsman. Borg's scale ranges from 6 to 20 (Slezakova, 2009). In sport, the exertion is a subjective evaluation of how difficult an individual series appears to you. For example: If we lift 100 kg dumbbell 6 times or 8 times, then the intensity in both cases equals to 100 kg, but the exertion is higher for 8 repetitions. When searching for criteria for evaluation of factor of perceiving the effort we come across to RPE scale (Rated Perceived Exertion). In HAST RPE scale (Table 2.) from 1–10 proved itself where 1 is the easiest and 10 feels the hardest. We orientate according to our feeling of how many repetitions we would be able to make or how many are left in reservoir until the complete breakdown.

Table 2 RPE manual for armwrestling

10	Maximal effort. Could not have done another rep
9.5	MIGHT have been able to do 1 more rep
9	Could do 1 more rep for sure
8.5	Could definitely do 1 more rep, maybe 2
8	Could do 2 more reps for sure
7.5	Could definitely do 2 more reps, maybe 3
7	Could do 3 more reps for sure
5-6	Warm up weights
1-4	These are irrelevant

RPE scale is more exact for armwrestling training with sparingpartner. We even prefer it in strength training with dumbbells to using percentage of weight. Though, sportsmen have to understand it correctly when determining the exertion or how many repetition they would make in a set. RPE is

used with so called autoregulating trainings where the number of sets is modified during the training. A sportsman should perfectly perceive the signals of his body and note them down to his training diary.

The research shows that RPE is effective way of how sportsmen can dose the intensity of training. We have to say that there are certain differences when applying this scale in training of experienced sportsmen and unexperienced ones. Helms et al (2017) found out the strong relationship between the real 1RM and RPE in squat, bench press and dead lift while the average RPE in 1RM are nearly the same. He states that RPE is a valid scale of training exertion and that it can be used in various exercises and intensities. Mash (2019) claims that RPE cannot be effectively used by triathlon beginners and there can be certain differences in understanding of what is really 1RM and 10RPE. Without enough experiences from trainings, it can be difficult to estimate the maximal intensity. Meghan et al (2004) did the research about the reliability of perceived exertion scale (RPE) and quantification of exercise intensity with high (H) intensity, medium (M) intensity and low (L) intensity. RPE was measured after each of the sets finished and 30 minutes after exercising. RPE was higher when exercising H than it was with M and L ($p < 0,05$). Performing a lower number of repetition with higher intensity was considered to be harder than performing a higher number of repetition with lower intensity. They say that RPE is more reliable scale for quantification of various intensities of training.

Even though the percentage of training exertion is an effective way of periodization of strength programs, it does not take into account the stressful factors of everyday life. For example: Training with higher intensity for a long time which might lead into burnout syndrome or overtraining but it is programmed in a way that a sportsman can train for a few weeks with high intensity. By using RPE we can avoid overloading, injuries and it seem to be an effective way to listen to body signals and for establishing a deload week. There is a table (Table 3.) of conversion of RPE rate to percentage for individual number of repetitions which can ease the relationship between the RPE exertion and the intensity of training. It is a very important chart for HAST.

Table 3 Relationship with percentage 1RM, repetitions and PRE Helms et. al (2017)

RPE	Repetitions performed							
	1	2	3	4	5	6	7	8
10	100%	95.0%	91.0%	87.0%	85.0%	83.0%	81.0%	79.0%
9.5	97.0%	93.0%	89.0%	86.0%	84.0%	82.0%	80.0%	77.5%
9	95.0%	91.0%	87.0%	85.0%	83.0%	81.0%	79.0%	76.0%
8.5	93.0%	89.0%	86.0%	84.0%	82.0%	80.0%	77.5%	74.5%
8	91%	87.0%	85.0%	83.0%	81.0%	79.0%	76.0%	73.0%
7.5	89.0%	86.0%	84.0%	82.0%	80.0%	77.5%	74.5%	71.5%
7	87.0%	85.0%	83.0%	81.0%	79.0%	76.0%	73.0%	70%

In HAST we understand that it is important to distinguish 3 main functions of training when creating them (development, maintaining, recovery) and individual parametres which are important when creating and planning training days from the regeneration and training volume point of view. Arm-wrestlers make a mistake here and they have very intense trainings too often. They train every day or every other day (48 hours) and they don't have a time for volume and intensity regeneration they set. This is followed by overloading, tiredness, lower performance, arm pain, microtrauma or injuries. For better training volume setting we use (Table 4.).

Table 4 *Parametres needed for training creation Horniak (2015)*

Type of training	Volume/Intensity	Regeneration time	Training RPE
Development	Extreme	> 72 hr.	10
	High	48–72 hr.	9
	Significant	24–48 hr.	8
Maintaining	Medium	12–48 hr.	7
Recovery	Low	< 12 hr.	< 6

Pace can affect the training exertion so it affects also RPE. The standard writing of pace is e. g. 4012 (4 seconds excentric phase, 0 seconds endurance in down position, 1 second pull up in concentric phase, 2 seconds isometric stamina in starting position). In armwrestling all the exercises are performed at the table from starting position and we move to concentric phase (attack/victory). For HAST needs we use the opaque writing of pace as not to confuse sportsmen. For better understanding here is an example: We start the movement by concentric phase where we try to wrestle the rival to the winning position. Then in the winning position there should be a 1–3-second break according to needs and abilities of a sportsman to push or hold the rival in this position. Return to starting position should be slow and lasting from 2 to 4 seconds. Now, there should be a short break that can be entirely without muscle effort or only with a short break 1–2 seconds and then there is another repetition. The writing is: 122P concentric phase 1 second (maximal exertion) 2 second stop in down position, 2 seconds excentric phase (maximal deceleration) P (pause for breathing up to 3 seconds without muscle exertion, but I do not allow the grip. In HAST we very often use static stamina at different levels of a match according to the needs of a sportsman but mostly it is in the starting position (0009) or in the winning position (0900) (if not stated differently). The problem is if the static stamina lasts longer than 10 seconds and the other number would distort the description of a pace. This is why the static position is divided by two slashes, e. g. 0/20/00.

In HAST we place importance on movement Dynamics (the speed of muscle contraction) and that's why we have to develop it systematically by suitable training methods. In preparation period and with the beginners we start with the medium movement speed with a higher number of repetition. A performance racer lowers the number of repetition in competition period with movement acceleration (contraction) at the same time. If we need to produce certain speed in competition, the training exercises should be at the same speed. Sirucka (2009) states that the intended speed of exercise performance is one of the most important factors for strength growth. It is important to have a maximal speed in the concentric phase of movement. This way we maximize muscle tension and at the same time we achieve a unique nerve adaptation. Van Cutsem, Duchateau, Hainaut, (1998) state that maximal increase of the intended movement speed leads to a higher production of the strength, higher occurrence of doubled activations and lowering of activating threshold of motorical units. Aagaard, Simonsen, Anderson, et al. (2002), Gabriel, Basford, J (2001) and Maffioletti, Martin, (2001) found out the similar conclusions and that it is like that in both dynamical and isometrical contractions cases. The fact that this adaptation applies also for isometric contraction is another proof that the real movement speed is not so important as the intended movement speed because within the isometric contraction the length of the muscle stays the same. Decreasing of activating threshold can be an asset for strength production. If MVT are activated sooner during the contraction, which should occur in the contraction with maximal intended acceleration, they have more time for increasing the strength (Sirucka, 2009).

Table 5 relationship between training goals and training parameters

Training Objective	% 1RM	Reps per set	Sets per exercise	Rest interval	TUT	Predominate fuel source
Maximal Strength	80/85–100%	1 to 5	4 to 7	2–6 minutes	5–10 sec	ATP/PC
High Power Output	70–100% %	1 to 5	3 to 5	2–6 minutes	4–8 sec	ATP/PC
Contractile Hypertrophy	75–85%	8 to 15	4 to 8	60–90 sec	20–60 sec	ATP/PC and Lactate
Cyloptasmic Hypertrophy	60–75% to	8 to 15	4 to 8	60–90 sec	20–60 sec	Lactate
Muscle Endurance	< 60%	15+	2 to 4	30-60 sec	80 sec	Lactate and/or oxygen

Time under tension (TUT) relates to pace. Poór (2015) states that even though we have an established number of repetitions in each set, we still can work with the pace of repetitions. The total time of a set can be different and leads to completely different results. If we perform for example 8 quick repetitions and each of them lasts 0,5 sec., the resultant TUT is 4. We run out of the actual supplies of ATP-CP when recruiting high threshold motor units. Even though there was this unit recruitment they are not totally exhausted. In armwrestling there is often performed the training with a sparing partner, where in a set, there are 8 repetitions and each of them last 5 sec. (resultant TUT is 40 seconds). This rate recalls the high degree of anaerobic glycolysis. As a result of a big exhaustion of motor units the training effect lies in increase of energetical supplies and it leads to muscle hypertrophy. That is not always wanted in armwrestling because the muscle mass increase doesn't mean the increase of the maximal strength. We have to choose the number of repetitions so that the resultant TUT leads to desired goal. In HAST we take into account that editing the number of repetitions and TUT is necessary if the training leads from volume to intensity. By lowering the number of repetitions you lower TUT (at the same movement pace). The similar effect can be achieved if you accelerate the pace and the number of repetitions stay the same. It is up to a coach and a sportsman to establish such a pace and a number of repetitions that will correspond the goal they want to achieve. In armwrestling training with sparingpartner this important parameter is not used at all. We consider this as a big mistake (Table 5). In our HAST program, using TUT proved itself, even though the sportsmen are not happy about it as it is very difficult (mainly if a sparingpartner checks the time with stopwatch). We recommended to change the pace of one repetition from 3 to 5 seconds and to perform 4–5 repetitions in one set in a way that TUT is around 20 seconds. The lower number of repetitions is more appropriate to maintain the right technique at high intensity.

The rest between the sets is the last parameter of the training which we focus in HAST on and we thanks to it we know how to influence the total strength increase and a performance. The reality in an armwrestling trainin with sparingpartner is that the rest time is not monitored and the start of the match or set is only according to the feeling. Many times sportsmen succumb the challenge of the rival (sparingpartner) and they compete tired which worsens their performance but also increase the level of injury risk. Petr and Stastny (2013) state that to reach the full concentration and maximal free exeration every other set will be performed in conditions of full recovery of energetical supplies. The authors claim that the bier resistance is used in a set, the more time the body needs to recover. Schoenfeld er al. (2016) say that the group of trained young men who rest 3 minutes trained 13% more training volume to the other group who rest for 1 minute. The authors bring the evidence that longer rests support the bigger increase of muscle strength and hypertrophy with young trained men. Willardson (2006) states that more sets are better than one set for a maximal strength development. Though, whether we achieve the maximal strength growth can depend on the abilities to maintain the repetitions in following sets. The key factor which determines the ability to maintain the repetitions in a set is a length of the rest interval between the sets which is established according to the aim of the training. For maximal strength growth where we perform the set fully (RPE 9–10)

in the range of 4–8 repetitions, we need approximately 3 minute for full recovery. It has to be said though, that the length of the rest interval doesn't secure wanted effect if there are no other component (intensity and volume) established accordingly.

Discussion

What need to be said about HAST? The first time we dealt with the table training with sparingpartner was in dissertation thesis. Harcarik (2011) found out that for armwrestlers who had worse left arm competition results, the specialized table training program is suitable for them. Right-handed sportsmen have a tendency to underestimate the training of their left arm. In this program they keep the same training volume for both arms which lead into improvement their performance of their left arm. As the table training is complicated, the sensitive and individual approach is inevitable. More sportsmen were complaining about its difficulties even when performing 3 sets per training. We recommend to start at two sets of 6–8 repetitions while the resistance intensity of the sparingpartner should be regulated by words so that the trainee had 2 repetition supply in each set (that equals the current rate of RPE 8, but this scale wasn't part of the original table program). In other training the sportsmen could increase the number of repetitions up to 12 repetitions. This number was a limit as an arm pumped and this prolonged the rest time between the sets. In current program HAST (Table 6) we do not recommend to perform more than 6 repetitions. Working with pace and TUT seem to be a better option. During the realization of the experiment we found out that it is not suitable to perform more than 5 sets per exercise. Sportsmen were describing significant fatigue of their arm on the second, sometimes even on the third day. Within the HAST program, ideally, we start with 2 sets and we try not to make more than 5 sets. When we talk about the number of repetitions, we start at 6 and make no more than 12 repetition per exercise. The training was performed two times a week, on Monday and Friday, with a sparingpartner. On Wednesday we had a training devoted to general strength with the exercise such as bench press, pull ups, dead lifts and triceps extension with a rope.

- Sparingpartner is a very important part of HAST. We need to realize that sparingpartner too during the training performs some muscle work, therefore ideally there are 3 sportsmen on the training. The first one is a performer and he follows the program. The second one is a sparingpartner and he make active resistance for a performer. The third one rests and checks the time.
- The intensity of sparingpartner resistance must be regulated by performer in each set by word so that the resistance is not too big or too small. The resistance should be in a way that RPE is adhered, with required TUT, pace and with optimal technique of exercise.
- Sparingpartner who make a resistance can do so:
 - By one arm – if he is strong enough, he doesn't prepare for a competition, is not injured or it is a coach who corrects the technique
 - By two arms (Figure 2) – if a training partner is as strong or weaker, has a different program, could be tired before the competition or is injured, trainer who wants to make as big resistance as possible.
- A sparingpartner who rests controls the pace, TUT, number of repetitions and a break time. It is suitable to use stopwatch (Figure 1) on the table so that everyone can see it.
- Sportsmen should write down fulfillment of the plan but mainly all the detail which influenced them during the training. For example: I had the arm pain, so I lower the exercise to RPE 6 and did only 3 repetitions at a lower pace 2222. TUT was 24, or I felt very well and went to RPE 10 with maintaining the other parameters, but in the last set I pumped my forearm. A coach should set the next training according to the notes.
- The disadvantage of HAST is that we cannot measure (quantify) the progress right on the training as it is with dumbbell training. We can check the effectivity only by motor tests or to apply it to achieved results at competition or to individual rival.

- It is a problem when a sportsman saves or lie about what exerate he made and he doesn't achieve desired training stimulus. Nor coach or a sparingpartner can estimate the exerate (even thought the RPE is set). That can be caused by many other factors such as: motivation, tiredness, unsuitable warm-up, injury, stress, psychic state, daily activities, sleep
- We don't know to estimate the deree of tiredness so the injury risks rises. This can be a problem with highly motivated sportsmen who pushed their pain level. They also have a high aspiration level before competition.
- Not suitable sparingpartner can also be a problem. He might not be well informed about the training, he is not experienced enough, he changes his techniques during the exercise, he doesn't respect the needs of a performer, he makes too big resistance so a performer cann fulfill established program.

Table 6 An example of training unit HAST

Exercise	Sets per exercise	Reps per set	Tempo	RPE	TUT	Rest Interval
„Hook“	4	3	122P	9,5	15 sec	3 minutes
pronation wrist	4	4	1121	9	20 sec	3 minutes
Side Pressure	3	6	2121	8	35 sec	2 minutes
Isometrci hammer curl	4	0	000/10	9	10	2 min

Note: The left arm aches in elbow. I decreased the Hook exercise and a side pressure RPE to 5

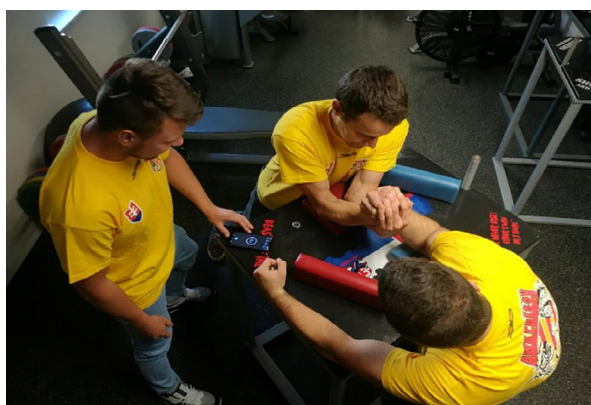


Figure 1 Technique “Hook“



Figure 2 Isometric Hammer Curl

Conclusion

Until now many coaches thought that strength abilities have to be developed only with the use of dumbbells, pulleys and other strengthening tools. Harcarik (2011) confirmed that the strength abilities can be developed by the table training with a sparingpartner in armwrestling. HAST is a systematic methodology of training which takes into account many parametres when creating a training plans. This program has not been used in armwrestling so far and it is a big asset for this sport. So far only the members of AWK Presov club make use o fit and some of the members of Slovak representation. We have to scientifically (statistically) attest the effectivity of HAST. But in practice it seems to be very effective for strenght abilities development of armwrestlers.

References

- Aagaard, P., Simonsen, E., Anderson, J., et al. (2002). Increased rate of force development and neural drive of human skeletal muscle following resistance exercise. *Journal of Applied Physiology*, 93, 1318–1326.
- Babajev, R. (2005). *Metodika rozvoja sily prostriedkami športovej gymnastiky*: bakalárska práca. Charkov: Charkovskij polytechničeskij institut, Kafedra fizičnej vichovania, 2005. 80 s.
- Gabriel, D., Basford, J., An, K. N. (2001). Training-related changes in the maximal rate of torque development and EMG activity. *Journal of Electromyography and Kinesiology*, 123–129.
- Harčarik, G. (2011). *Vplyv rozdielnych tréningových programov na rozvoj silových schopností armwrestlerov*: dizertačná práca. Prešov: FŠ PU v Prešove, 107 s.
- Helms, E.R., Storey, A., Cross, M.R., Brown, S.R., Lenetsky, S., Ramsay, H., Dillen, C., Zourdos, M.C. (2017) RPE and Velocity Relationships for the Back Squat, Bench Press, and Deadlift in Powerlifters. *J Strength Cond Res.* (2017), Feb;31(2):292-297 Retrieved <https://www.ncbi.nlm.nih.gov/pubmed/27243918>
- Petr, M., Šťastný P. (2013) *Funkční silový trénink* ISBN 9788086317939, 214s., 2013 FTVS
- Jarombek, P. 2003 *Technika a technická príprava pretláčača*: diplomová práca, Bratislava: FTVŠ UK Bratislava, 2003. 57 s.
- Poór, O. (2015) *Zmenou tempa opakovania dosiahnete 3 odlišné výsledky (2. časť)* Published 28.09.2015 Retrieved from <https://www.zdravoafit.sk/clanok/zmenou-tempa-opakovania-dosiahnete-3-odlisne-vysledky-2-cast>
- Horniak, M. (2015) *Vlastný tréningový plán – časť 1*. Published 1.9.2015 Retrieved <http://www.ftr.sk/cesta-k-vlastnemu-treningovemu-planu-cast-1/>
- Kondraškin, E.N., & Larin, I.D. (2005). *Armsport – specializirovanye trenirovočnye programmy*. Ulianovsk: Ulianovskij gosudarstvennyj techničeskij universitet, 2005. 50
- Mash, M. (2019) *The Barbell Rehab Guide to RPE* Published 31.5.2019 Retrieved from <https://barbellrehab.com/rpe-gui>
- Maffiuletti, N., Martin, A. (2001). Progressive versus rapid rate of contraction during 7 wk of isometric resistive training. *Medicine and Science in Sports and Exercise*, 22, 1220–1227.
- Meghan L. D., Mc Guigan, M.R, Guigan, Brice G, Foster, CK. (2004) Monitoring exercise intensity during resistance training using the session RPE scale. *Journal of Strength and Conditioning Research*, 2004, 18(2), 353–358, National Strength & Conditioning Association.
- Schoenfeld, B.J., Pope, Z.K., Benik F.M., Hester, G.M., Sellers, J., Nooner, J.L., Schnaiter, J.A., Bond-Williams, K.E., Carter, A.S., Ross, C.L., Just, B.L., Henselmans, M., Krieger, J.W. (2016) Longer Interset Rest Periods Enhance Muscle Strength and Hypertrophy in Resistance-Trained Men. *J Strength Cond Res.* 30, 72016.
- Slezaková, J. (2009) *Subjektivní hodnocení intenzity zátěže (RPE) u obézních pacientů po akutní koronární příhodě v průběhu kardiovaskulární rehabilitace*: Diplomová práce, Brno, Katedra fyzioterapie Lékařské fakulty MU Brno, 2009, 71 s.
- Širůčka, M. (2009) *Tajemství maximální síly (II.)- tři triky pro maximální sílu* Published 9.6.2009 Retrieved <https://powerlifting.ronnie.cz/c-5448-tajemstvi-maximalni-sily-ii-tri-triky-pro-maximalni-silu.html>

Tivora, P. V., & Rachmatov, A. I. (2001) *ARMSPORT- Technika, taktika, metodika obučenia*. Moskva: Izdatel'sky centr akademia, 2001. 112 s. ISBN 5-7695-0671-7.

Usanov, E. I., & Čugina L.V. (2010). *Arm wrestling – Borba na rukach*. Moskva: Izdatelstvo Rossijskij univerzitet družbii narodov, 2010. 300 s. ISBN 978-5-209-03464-3.

Van Cutsem, M., Duchateau, J., Hainaut, K. (1998). Changes in single motor unit behavior contribute to the increase in contraction speed after dynamic training in humans. *Journal of Physiology*, 513, 295–305.

Willardson, J. M. A brief review: factors affecting the length of the rest interval between resistance exercise sets. *J Strength Cond Res*. 2006 Nov; 20(4), 978–84. <https://www.ncbi.nlm.nih.gov/pubmed/17194236>