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Peaking for the World Para Athletics Championships: Case study of a World Champion female Paralympic shot putter

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ABSTRACT

Tapering is used to maximize performance and reduce fatigue levels before athletic competitions. However, scientific evidence regarding Paralympic athletes is scarce. Moreover, no study has assessed the effects of tapering practices on performance in a world champion female Paralympic shot putter (FPSP). Therefore, the aim of this study was to assess the effects of a short tapering period on the performance of an elite FPSP. A world champion FPSP (sport class F54; age 42.2 y; body mass 74 kg; height 1.67 m) was monitored during both overload (2 weeks) and tapering (2 weeks; training volume and intensity decreased) blocks previous to Dubai 2019 World Para Athletics Championships. The internal training load (ITL) (through session rating of perceived exertion) and self-reported wellbeing (using a questionnaire) were assessed daily. Shot put performance was assessed at the beginning and after tapering. The ITL decreased 37.9% with tapering, shot put performance increased 7.6%, there were no differences between weekly wellness scores. No significant correlations were found between ITL and wellbeing indicators. It was concluded that two weeks of tapering induced a rather large improvement in shot put performance. Surprisingly, self-reported wellbeing did not improve with taper as expected.

Keywords: Athletic performance; Exercise; Disabled persons; Sports for persons with disabilities; Adaptive sports, Para-Athletes.

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INTRODUCTION

The shot put is one of the field events in Para Athletics, in which either ambulant or wheelchair athletes compete, divided into sport classes. Shot put throwing performance requires several key physical fitness traits in order to achieve a high release speed during attempts, the main determinant of performance (Schofield et al., 2019). Among such key physical fitness traits; muscle power, velocity, and strength are considered more relevant (Kyriazis et al., 2009; Terzis et al., 2008; Zaras et al., 2014). To increase such physical fitness attributes, athletes normally include training sessions focused on the development of maximum strength, speed, and plyometric ability, in line with technical training (Oliveto, 2004). In order to maximize training results (Hartmann et al., 2015) and to prevent non-functional overloads (Schwellnus et al., 2016), fatigue and risk of injury (Bourdon et al., 2017), an adequate control of training loads is required (Simim et al., 2017), to help in the assessment of athlete's response to exercise and to adapt training programs accordingly (Halson, 2014).

In order to monitor the athletes internal training load (ITL), fatigue levels, and recovery from training sessions, several laboratory methods are available (e.g. hormone levels measurement) (Lee et al., 2017). However, aside from being invasive, the use of such methods on a daily basis to control the athlete's ITL is unpractical, consuming a great deal of time and resources. As a valid and reliable alternative to monitor athlete's ITL, the rating of perceived exertion (RPE) emerged (Foster et al., 2017; Franciotti et al., 2017). The RPE is derived from the athlete's perceived exertion during training, usually on a scale of 0 (rest) up to 10 (highest effort) (Foster et al., 2001). Subsequently, the RPE is multiplied by the duration of training session (minutes) to obtain the session RPE (s-RPE), representing the ITL and expressed in arbitrary units (AU) (Foster, 1998; Foster et al., 2001; Wallace et al., 2009).

In sports such as shot put, were competitive performance is based on a single short-duration maximal effort, a periodized training load is usually incorporated into one or more seasons (e.g. 4-year Olympic training cycle) (Afonso et al., 2019; Travis et al., 2020). During such periodized training model, athletes incorporates training blocks (i.e. weeks) with either high or low loads. Commonly, a training block with a high load (i.e. overload block) is planned before a competition (Mujika, 2010), immediately followed by a reduction or taper of the training load, a preparation strategy usually known as tapering (Mujika & Padilla, 2003). Tapering would allow a reduction in accumulated fatigue during the overload block and improved competitive performance after the taper block (Mujika, 2009). In sports such as shot put, tapering usually involves a reduction in training volume before competition, while training intensity is either maintained or increased (Issurin, 2010; Zaras et al., 2014). However, to our knowledge, no study has investigated the effect of such training periodization model on Paralympic throwers, nor high-performance Paralympic throwers (Perret, 2017). In addition, there is a lack of research in female Paralympic shot putters (FPSP) (Costello et al., 2014). In this research scenario case reports become important, providing useful information regarding participants with exceptional characteristics or for those not previously considered by the scientific literature (Alsaywid & Abdulhaq, 2019). Therefore, the aim of this study was to assess the effects of a short tapering period on the performance of an elite (i.e. world champion) FPSP on her preparation to the 2019 Para Athletics World Championships.

MATERIAL AND METHODS

Procedures

In a descriptive case study design, a world champion FPSP was followed during her last 4 weeks of training before the 2019 Para Athletics World Championships. The athlete was followed during an overload period (OP) of 2 weeks, and a tapering period (TP) of 2 weeks. On a daily basis, her ITL and general wellbeing

(GW) were assessed. Her shot put performance was also assessed. Athlete's daily training plan was not altered in any way as a result of her participation in this study.

Participant

An elite female Paralympic shot putter (age = 42.2 years, height = 1.67 m, sitting height = 1.33 m, weight = 74 kg, sport class = F54) agreed to participate in this study during her preparation to the 2019 Para Athletics World Championships. The study was approved by the Finis Terrae University Ethics Committee and conformed to the Declaration of Helsinki.

Measures

Training sessions

Training sessions were monitored, including physical (*n* = 20; morning sessions) and technical (*n* = 20; afternoon sessions) training sessions. The physical training sessions included resistance training and plyometric training drills. The technical training sessions included shotput and discus throwing drills.

Internal Training Load

In order to assess the athlete ITL, her RPE was measured on a daily basis. To this aim, the Borg CR-10 scale was used, with a 0-10 numerical range and 0.5 increments, where 0 = rest and 10 = maximum effort (Foster et al., 2001). The score was obtained 30 minutes after the end of the training sessions (Singh et al., 2007; Tibana et al., 2018) by asking the athlete: *How hard was your training?*. Subsequently, the RPE value was multiplied by the duration of the session in minutes (including warm-up) in order to obtain the session s-RPE, which was considered the final estimation of the ITL, expressed in AU (Foster, 1998; Foster et al., 2001; Wallace et al., 2009).

Perceived ratings of general wellbeing

The athlete's GW was measured daily, using a psychometric questionnaire (McLean et al., 2010). The questionnaire measured five subjective items: fatigue, sleep quality, muscle pain, stress and mood, on a scale from 1 to 5, where 1 represents a very negative state (negative GW) and 5 a very positive state (positive GW). The GW status was determined by summing the score of the five items, with a possible maximum of 25 points. The questionnaire was answered 6 hours after the last training session of each day.

Shot put performance

Shot put performance tests were carried out to evaluate shot put distance (m) at the beginning of the OP and at the end of TP (competition day). The OP test was carried out as follows: at the beginning of the technical training session, the athlete was instructed to warm up in the same way she does on competition. This included upper limbs mobility, and 3-4 warm-up throws. Finally, the test is carried out, giving the athlete 6 attempts to throw the shot put (3 kg) as far as possible, having one-minute rest between each attempt. Each throw was measured according to the World Para Athletics Rules and Regulations 2018-2019. The longest throw was recorded.

Statistical analysis

Before using nonparametric statistical procedures, data distribution was analysed by the Shapiro-Wilk test. As data was not normally distributed, we used non-parametric methods of analysis. Spearman correlation coefficients were calculated to determine the relationships between ITL and GW variables. The Friedman's test was used to evaluate potential weekly differences between the four weeks in ITL and WB variables. The Wilcoxon's signed rank test was used to analyse the differences on ITL and WB, between the OP and TP. Effect size (ES) were calculated using Cohen's *d*, where values of 0.2, 0.5 and 0.8 represent small, medium and large effect sizes, respectively (Cohen, 1988). Statistical significance was set at $p < .05$. Non-parametric data are shown as median, interquartile range (IQR, i.e. 25th and 75th percentiles), minimum and maximum. All data analyses were carried out using GraphPad Prism version 8.0.1 for Windows (GraphPad Software, San Diego, CA, USA).

RESULTS

The weekly physical ITL, technical ITL, total ITL, GW, and shot put performance during both the OP and the TP are shown in Table 1.

Table 1. Internal training load, general wellbeing and performance during overload and tapering training periods.

	Overload period		**Tapering period**	
	Week 1	Week 2	Week 3	Week 4
Physical ITL (AU)	536 [287 (300, 792)]	544 [294 (304, 855)]	428 [141 (210, 525)]	135 [145 (125, 330)]
Technical ITL (AU)	210 [77.0 (175, 384)]	234 [279 (168, 624)]	225 [54.0 (175, 315)]	196 [37.0 (140, 256)]
Total ITL (AU)	746 [78.0 (552, 967)]	858 [150 (712, 1076)]	649 [90.5 (525, 700)]	391 [117 (265, 535)]
Total ITL, weekly sums (AU)	3,710	4,404	3,089	1,950
GW (points)*	18.0 [3.5 (10, 22.0)]	14.0 [5.0 (10, 20.0)]	13.0 [1.5 (11, 19.0)]	16.0 [3 (10.0, 21.0)]
Shot put (m)	7.61	-	-	8.19

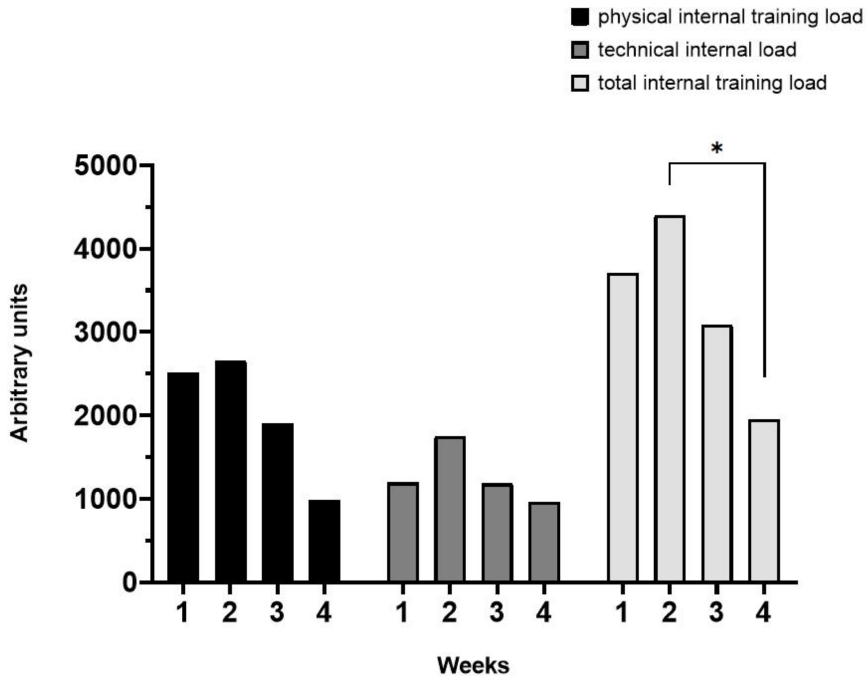
Abbreviations: ITL=internal training load; AU=arbitrary units; RPE=rating of perceived exertion (0 - 10 points scale); GW=general wellbeing, were 25 points is the possible maximum (i.e. better GW). Values expressed as median [IQR (min, max)].

Total ITL (physical ITL + technical ITL) was 37.9% greater during the OP compared to the TP ($p = .008$, $d = .64$), and at week 4 was 55.7% lower compared to week 2 ($p = .023$, $d = 1.01$) (Figure 1).

The GW, although showed some weekly variations across the 4 weeks of study, no significant differences were found between weeks ($p = .159$) (Figure 2).

No significant correlations were found between total ITL and GW ($r = -.110$, $p = .645$) or between total ITL and any of the five domains of GW (i.e. fatigue, sleep, muscle pain, stress and mood) ($r = -.06$ to $-.24$, $p > .3$).

At the end of the TP, an increase in shotput performance of 7.6% was observed compared to the commencement of the OP (Table 1).



** Indicate significance at p < .05. Total internal training load during weeks 1+2 was greater (p = .008) compared to weeks 3+4.*

Figure 1. Physical, technical and total (physical + technical) weekly internal training loads (expressed in arbitrary units [AU]).

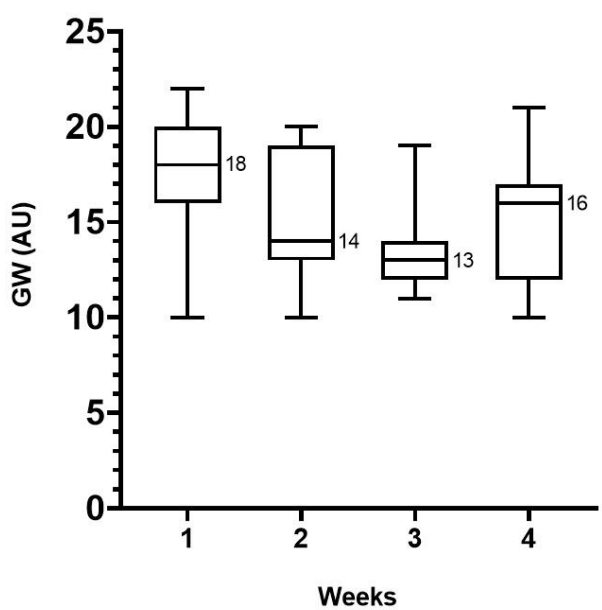


Figure 2. Box plots of interquartile range (25th and 75th percentiles), minimum — maximum (no outliers), and median (values at the right of each box indicates the median of each week) weekly general wellbeing (GW) scores (expressed in arbitrary units [UA]).

DISCUSSION

The aim of this study was to assess the effects of a short tapering period on the performance of an elite (i.e. world champion) FPSP on her preparation to the 2019 Para Athletics World Championships. The main findings were: i) the reduction in ITL during the TP induced an improvement in the athlete's shot put performance, and ii) surprisingly, the athlete's GW did not increase in line with the decline in training load during the TP.

The ultimate goal of a thrower is to express his peak performance in competition; therefore, coaches must ensure that the training variables and multiple stressors to which the athlete is subjected during the preparation process are correctly manipulated in the previous days. In the present study, the four weeks prior to a high-level competition such as a World Championship were monitored, a period in which the delimitation between OP and TP was clearly appreciated, mainly due to the decrease (37.9%) of ITL in TP.

Although RPE by itself has shown to be a reliable tool for ITL quantification in resistance exercises (Bazyler et al., 2017; McGuigan et al., 2004); We have opted for the use of the s-RPE which also incorporates the training duration; as this method has been used successfully in strength sports (Day et al., 2004; Sweet et al., 2004). From this we were able to identify the maximum (4404 AU, in OP) and minimum values (1950 AU, in TP) in our athlete. These loads were clearly higher than those recorded by able-bodied college throwers in their preparation for a national-level championship (3,250 AU in OP; and 1,000 AU in TP) (Bazyler et al., 2017). A possible explanation for this is that it has been due to the lower training frequency with which university athletes trained, since it was reported that they performed between 2-4 physical and 2-3 technical training sessions, compared to our athlete who completed 5 physical plus 5 technical sessions each week.

Surprisingly, no correlations were found between ITL variables (Physical and Technical s-RPE, and Total s-RPE) and the subjective recovery variables (fatigue, sleep, muscular pain, stress, mood, and GW). These results differ from the works that have investigated the associations between ITL and this GW variables. For example, in a case study of a professional soccer goalkeeper, the GW showed an inverse correlation with internal loads ($r = -.31$, $p < .05$) (Malone et al., 2018). A similar case was observed in another study in water polo players, in which GW scores increased as training intensity decreased ($p < .001$), being higher in TP than in OP ($p = .001$) , the players showed higher GW scores during week 4 compared to weeks 1 and 2 of the OP ($p = .001$, $d = 1.46$ and $p = .001$, $d = 2.28$, respectively) (Botonis et al., 2019). A possible explanation for the lack of correlation in our results is that this has been a consequence of stress and residual fatigue caused by the long trip to the championship host country (~16 h flight, 8 hours' time difference), if that was the case, is something that should be analysed in subsequent studies.

Competition performance registered a substantial improvement (7.6%), probably caused by neural adaptations and reduction in fatigue levels as a consequence of the two weeks of TP (Bosquet et al., 2007). These results are slightly higher than those shown in previous studies on able-bodied throwers. For example, the group of national-level throwers from Zaras et al (TP = 2 weeks) improved on average by 5.2% after the TP (Zaras et al., 2014). On the other hand, the group of college throwers from Stone et al (8 weeks of training, maximum strength [weeks 1 to 4] and strength-power [weeks 5 to 8]; without TP) reported a performance improvement of 3.1% (Stone et al., 2003). The greatest improvement, and closest to the values of our athlete, was observed in the study by Bazyler et al, with also the longest TP (OP = 1 week, TP = 3 weeks), in which an improvement of 6.3% was observed (Bazyler et al., 2017). These values, in turn, remain close to the improvement percentages of ~ 3% (with range between 0.5 - 6 %) seen in studies in other types of athletes, such as runners, cyclists, swimmers, rowers and triathletes (Mujika & Padilla, 2003). It should also be taken into account the relative short training time of our athlete dedicated to shot put throwing (~ 2 years), since this sport requires a sequenced coordination of complex motor patterns executed at high speed, which inevitably needs of several years of experience and training to achieve technical mastery (Allen & Hopkins, 2015). With these antecedents in mind, in addition to the fact that intensity is considered the key to maintaining or improving physiological adaptations during TP (Mujika, 2010), future studies are necessary to determine the optimal duration of TP, in which different configurations are explored, both the OP / TP duration and variations in training intensity (maintaining or increasing it), with the ultimate goal of optimizing sports performance in Paralympic throwers.

CONCLUSIONS

This exploratory case study provides novel data about the ITL and subsequent wellbeing response undertaken by an elite wheelchair shot putter during the TP. The main findings of the study were that: (1) the tapering period was effective in expressing athlete's best performance on competition day, (2) surprisingly, the subjective wellbeing did not improve as expected although external load decreased substantially.

REFERENCES

Afonso, J., Rocha, T., Nikolaidis, P. T., Clemente, F. M., Rosemann, T., & Knechtle, B. (2019). A systematic review of meta-analyses comparing periodized and non-periodized exercise programs: Why we should go back to original research. Frontiers in Physiology, 10(AUG). https://doi.org/10.3389/fphys.2019.01023

Allen, S. V., & Hopkins, W. G. (2015). Age of Peak Competitive Performance of Elite Athletes: A Systematic Review. In Sports Medicine (Vol. 45, Issue 10, pp. 1431-1441). Springer International Publishing. https://doi.org/10.1007/s40279-015-0354-3

Alsaywid, B., & Abdulhaq, N. (2019). Guideline on writing a case report. In Urology Annals (Vol. 11, Issue 2, pp. 126-131). Wolters Kluwer Medknow Publications. https://doi.org/10.4103/UA.UA_177_18

Bazyler, C. D., Mizuguchi, S., Harrison, A. P., Sato, K., Kavanaugh, A. A., Deweese, B. H., & Stone, M. H. (2017). Changes in muscle architecture, explosive ability, and track and field throwing performance throughout a competitive season and after a taper. Journal of Strength and Conditioning Research, 31(10), 2785-2793. https://doi.org/10.1519/JSC.0000000000001619

Bosquet, L., Montpetit, J., Arvisais, D., & Mujika, I. (2007). Effects of tapering on performance: A meta-analysis. Medicine and Science in Sports and Exercise, 39(8), 1358-1365. https://doi.org/10.1249/mss.0b013e31806010e0

Botonis, P. G., Toubekis, A. G., & Platanou, T. I. (2019). Training Loads, Wellness and Performance before and during Tapering for a Water-Polo Tournament. Journal of Human Kinetics, 66(1), 131-141. https://doi.org/10.2478/hukin-2018-0053

Bourdon, P. C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M. C., Gabbett, T. J., Coutts, A. J., Burgess, D. J., Gregson, W., & Cable, N. T. (2017). Monitoring Athlete Training Loads: Consensus Statement. International Journal of Sports Physiology and Performance, 12(s2), S2-161-S2-170. https://doi.org/10.1123/IJSPP.2017-0208

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. L. Erlbaum Associates.

Costello, J. T., Bieuzen, F., & Bleakley, C. M. (2014). Where are all the female participants in Sports and Exercise Medicine research? European Journal of Sport Science, 14(8), 847-851. https://doi.org/10.1080/17461391.2014.911354

Day, M. L., McGuigan, M. R., Brice, G., & Foster, C. (2004). Monitoring exercise intensity during resistance training using the session RPE scale. Journal of Strength and Conditioning Research, 18(2), 353-358.

Foster, C. (1998). Monitoring training in athletes with reference to overtraining syndrome. Medicine and Science in Sports and Exercise, 30(7), 1164-1168. https://doi.org/10.1097/00005768-199807000-00023

Foster, C., Florhaug, J. A., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., Doleshal, P., & Dodge, C. (2001). A New Approach to Monitoring Exercise Training. Journal of Strength and Conditioning Research, 15(1), 109-115.

Foster, C., Rodriguez-Marroyo, J. A., & De Koning, J. J. (2017). Monitoring training loads: The past, the present, and the future. International Journal of Sports Physiology and Performance, 12(s2), 2-8. https://doi.org/10.1123/IJSPP.2016-0388

Franciotti, R., De Gracia, P., Zakovska, A., Haddad, M., Stylianides, G., Djaoui, L., Dellal, A., & Chamari, K. (2017). Session-RPE Method for Training Load Monitoring: Validity, Ecological Usefulness, and Influencing Factors. Frontiers in Neuroscience, 11, 612. https://doi.org/10.3389/fnins.2017.00612

Halson, S. L. (2014). Monitoring Training Load to Understand Fatigue in Athletes. In Sports Medicine (Vol. 44, Issue Suppl 2, pp. 139-147). Springer International Publishing. https://doi.org/10.1007/s40279-014-0253-z

Hartmann, H., Wirth, K., Keiner, M., Mickel, C., Sander, A., & Szilvas, E. (2015). Short-term Periodization Models: Effects on Strength and Speed-strength Performance. Sports Medicine (Auckland, N.Z.), 45(10), 1373-1386. https://doi.org/10.1007/s40279-015-0355-2

Issurin, V. B. (2010). New horizons for the methodology and physiology of training periodization. In Sports Medicine (Vol. 40, Issue 3, pp. 189-206). Sports Med. https://doi.org/10.2165/11319770-000000000-00000

Kyriazis, T. A., Terzis, G., Boudolos, K., & Georgiadis, G. (2009). Muscular Power, Neuromuscular Activation, and Performance in Shot Put Athletes At Preseason and at Competition Period. Journal of Strength and Conditioning Research, 23(6), 1773-1779. https://doi.org/10.1519/JSC.0b013e3181b3f91e

Lee, E. C., Fragala, M. S., Kavouras, S. A., Queen, R. M., Pryor, J. L., & Casa, D. J. (2017). Biomarkers in sports and exercise: Tracking health, performance, and recovery in athletes. In Journal of Strength and Conditioning Research (Vol. 31, Issue 10, pp. 2920-2937). NSCA National Strength and Conditioning Association. https://doi.org/10.1519/JSC.0000000000002122

Malone, J. J., Jaspers, A., Helsen, W., Merks, B., Frencken, W. G. P., & Brink, M. S. (2018). Seasonal training load and wellness monitoring in a professional soccer goalkeeper. International Journal of Sports Physiology and Performance, 13(5), 672-675. https://doi.org/10.1123/ijspp.2017-0472

McGuigan, M. R., Egan, A. D., & Foster, C. (2004). Salivary cortisol responses and perceived exertion during high intensity and low intensity bouts of resistance exercise. Journal of Sports Science and Medicine, 3(1), 8-15.

McLean, B. D., Coutts, A. J., Kelly, V., McGuigan, M. R., & Cormack, S. J. (2010). Neuromuscular, endocrine, and perceptual fatigue responses during different length between-match microcycles in professional rugby league players. International Journal of Sports Physiology and Performance, 5(3), 367-383. https://doi.org/10.1123/ijspp.5.3.367

Mujika, I. (2009). Tapering and peaking for optimal performance. Human Kinetics Publishers Inc. https://doi.org/10.5040/9781492595960

Mujika, I. (2010). Intense training: The key to optimal performance before and during the taper. In Scandinavian Journal of Medicine and Science in Sports (Vol. 20, Issue SUPPL. 2, pp. 24-31). https://doi.org/10.1111/j.1600-0838.2010.01189.x

Mujika, I., & Padilla, S. (2003). Scientific bases for precompetition tapering strategies. Medicine and Science in Sports and Exercise, 35(7), 1182-1187. https://doi.org/10.1249/01.MSS.0000074448.73931.11

Oliveto, N. (2004). Establishing Volume Load Parameters: A Different Look in Designing a Strength Training Periodization for Throwing Events. Strength and Conditioning Journal, 26(5), 52-55.

Perret, C. (2017). Elite-adapted wheelchair sports performance: a systematic review. In Disability and Rehabilitation (Vol. 39, Issue 2, pp. 164-172). Taylor and Francis Ltd. https://doi.org/10.3109/09638288.2015.1095951

Schofield, M., Cronin, J. B., Macadam, P., & Hébert-Losier, K. (2019). Rotational shot put: a phase analysis of current kinematic knowledge. Sports Biomechanics, 1-19. https://doi.org/10.1080/14763141.2019.1636130

Schwellnus, M., Soligard, T., Alonso, J. M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T. J., Gleeson, M., Hägglund, M., Hutchinson, M. R., Van Rensburg, C. J., Meeusen, R., Orchard, J. W., Pluim, B. M., Raftery, M., Budgett, R., & Engebretsen, L. (2016). How much is too much? (Part 2) International Olympic Committee consensus statement on load in sport and risk of illness. British Journal of Sports Medicine, 50(17), 1043-1052. https://doi.org/10.1136/bjsports-2016-096572

Simim, M. A. M., De Mello, M. T., Silva, B. V. C., Rodrigues, D. F., Rosa, J. P. P., Couto, B. P., & Da Silva, A. (2017). Load monitoring variables in training and competition situations: A systematic review applied to wheelchair sports. In Adapted Physical Activity Quarterly (Vol. 34, Issue 4, pp. 466-483). Human Kinetics Publishers Inc. https://doi.org/10.1123/apaq.2016-0149

Singh, F., Foster, C., Tod, D., & McGuigan, M. R. (2007). Monitoring different types of resistance training using session rating of perceived exertion. International Journal of Sports Physiology and Performance, 2(1), 34-45. https://doi.org/10.1123/ijspp.2.1.34

Stone, M. H., Sanborn, K., O'Bryant, H. S., Hartman, M., Stone, M. E., Proulx, C., Ward, B., & Hruby, J. (2003). Maximum strength-power-performance relationships in collegiate throwers. Journal of Strength and Conditioning Research, 17(4), 739-745.

Sweet, T. W., Foster, C., McGuigan, M. R., & Brice, G. (2004). Quantitation of resistance training using the session rating of perceived exertion method. Journal of Strength and Conditioning Research, 18(4), 796-802.

Terzis, G., Stratakos, G., Manta, P., & Georgiadis, G. (2008). Throwing performance after resistance training and detraining. Journal of Strength and Conditioning Research, 22(4), 1198-1204. https://doi.org/10.1519/JSC.0b013e31816d5c97

Tibana, R. A., Frade De Sousa, N. M., Cunha, G. V., Prestes, J., Fett, C., Gabbett, T. J., & Azevedo Voltarelli, F. (2018). Validity of Session Rating Perceived Exertion Method for Quantifying Internal Training Load during High-Intensity Functional Training. Sports, 68(6). https://doi.org/10.3390/sports6030068

Travis, S. K., Mujika, I., Gentles, J. A., Stone, M. H., & Bazyler, C. D. (2020). Tapering and Peaking Maximal Strength for Powerlifting Performance: A Review. Sports, 8(9), 125. https://doi.org/10.3390/sports8090125

Wallace, L. K., Slattery, K. M., & Coutts, A. J. (2009). The ecological validity and application of the session-rpe method for quantifying training loads in swimming. Journal of Strength and Conditioning Research, 23(1), 33-38. https://doi.org/10.1519/JSC.0b013e3181874512

Zaras, N. D., Stasinaki, A.-N. E., Krase, A. A., Methenitis, S. K., Karampatsos, G. P., Georgiadis, G. V, Spengos, K. M., & Terzis, G. D. (2014). Effects of tapering with light vs. heavy loads on track and field throwing performance. Journal of Strength and Conditioning Research, 28(12), 3484-3495. https://doi.org/10.1519/JSC.0000000000000566

