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Weightlifting: Program Design

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summary

This is the second part of a 2-part discussion (the first, "Weightlifting: A Brief Overview," appeared 28(1):50–66, 2006) on weightlifting and will describe the best methods of designing a weightlifting program.

The authors have had considerable experience in coaching and training national-, international-, and Olympic-level weightlifters in the United States and Great Britain. These weightlifters have included men and women, as well as junior, senior, and master (veteran) weightlifters. Although there may be some differences in program design detail resulting from age, gender, or (occasionally) individual differences, the training program would follow the same basic characteristics for these groups.

For example, take an athlete who is a well-trained, moderately advanced (not elite) male weightlifter (94 kg, 300 kg total). A testing/monitoring program is put in place so that training progress can be tracked. Initial testing indicates that this athlete has talent enough to progress to international competitions, and his short-term goal is to compete in the Commonwealth Games. In conjunction with his coach, the athlete creates a long-term plan designed to produce a total (325 kg) that will qualify the athlete for the Commonwealth Games. A general outline of the long-term plan is shown in Figure 1.

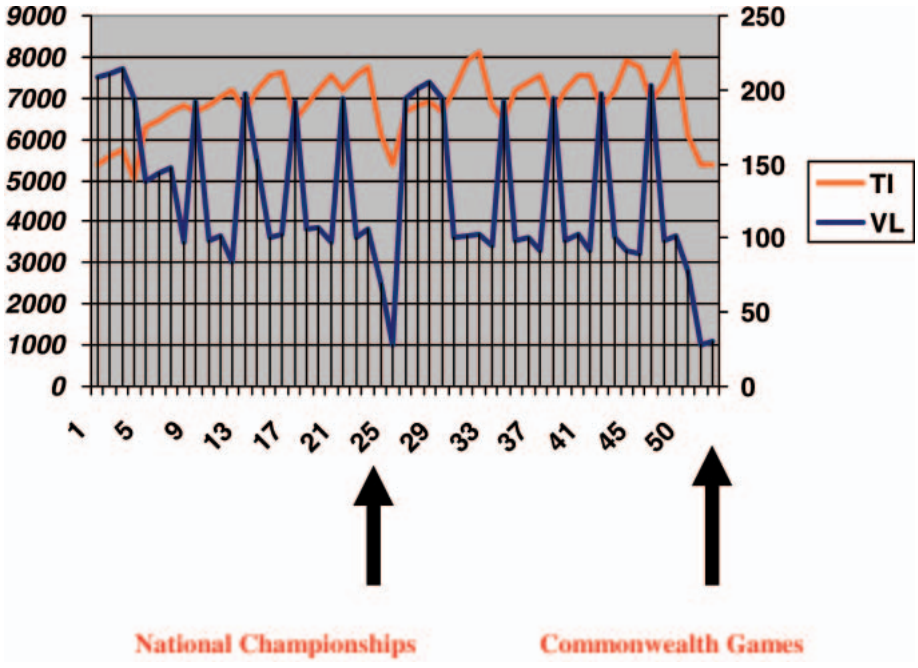

Figure 1. Long-term periodization model. VL = average volume load (total kg)/wk and includes all sets; TI = average training intensity (kg)/wk and includes only target loads. Monday = heavy day; Thursday = light day (15–20% less).

Table 1a
12-Week Preparation Phase Training Program for a Moderately Trained Weightlifter (94 Kg, Total = 300); First Mesocycle of the Training Year, General Concept of Sets and Repetitions

Block 1	Block 2	Block 3
Wk 1: 3×10	Wk 5: 3×5 (1×5)	Wk 9: 5×5 (1×5)
Wk 2: 3×10	Wk 6: 3×5 (1×5)	Wk 10: 3×3 (1×5)
Wk 3: 3×10	Wk 7: 3×3 (1×5)	Wk 11: 3×3 (1×5)
Wk 4: 3×10	Wk 8: 3×2 (1×5)	Wk 12: 3×2 (1×5)

Sets in parentheses are "down" sets performed with maximum effort at approximately 40–55% of 1 repetition maximum to optimize power output.

An example of a 12-week mesocycle, indicative of the preparation phase, is shown in Tables 1a and 1b. In this general model, the first block (4 weeks) is devoted to high volume strength-endurance training produced by higher repetitions per set (10 per set). Although volumes/repetitions this high are not typically performed often by weightlifters, we believe this high-volume phase is important for a number of reasons:

- Compared to lower repetitions per set (or a lower volume of work), repetitions in this range have been associated with greater alterations in body composition, particularly decreased body fat (9, 10).
- Beneficial metabolic alterations are more likely to occur with higher volumes and higher repetitions per set (4, 6, 7, 13).
- Strength-endurance and power-endurance parameters are better trained than with lower volume training (3).
- Although endocrine responses to resistance exercise appear to have relatively minor effects on hypertrophy and performance, higher repetitions per set can increase substantially the testosterone and growth hormone concentrations postexercise (4) and can be greater than the responses resulting from lower repetitions per set (2).
- The concentrated strength-endurance loading (CSEL) afforded by this phase of training may result in an increased resting testosterone-cortisol ratio (or a rebound effect 2–5 weeks after the CSEL) (8).
- Most importantly, this phase—provided exercises selection is appropriate—lays the physiological and structural foundation for further training that will emphasize other aspects of performance (i.e., maximum strength, and power) (5, 11, 12).
- In our experience, weightlifters completing this type of preparation perform better during the subsequent higher intensity training periods and generally have fewer injuries.

As a 4-week block, this strength-endurance concentrated loading phase would be repeated 2–3 times per year, depending upon the background and level of athlete. For moderate level and advanced athletes, this phase should occur approximately 12–16 weeks before major competitions. In addition, occasional brief (1 week) periods of high repetition strength-endurance training can be performed at the beginning of an 8–12 week mesocycle in order to reestablish and reinforce the beneficial physiological and structural adaptations afforded by this type of training.

After the initial high volume block (4 weeks), training is returned to more normal volumes. The volume load across each block follows a repeated overreaching model. Weight training is performed 4 days per week (Monday, Wednesday, Thursday, Saturday); heavy lifting days (based on volume load) are preceded by recovery days (only midsection work). Note that whereas the general scheme may call for 3 × 5 repetitions or 3 × 3 repetitions, not all lifts are performed in this traditional manner. Often clusters are used for major lifts, particularly the snatch and the clean and jerk (C&J). For example, a 1-set cluster for the C&J is used during block 3. Note also that the cluster often is undulated; for example, a set of 5 with a 30-second recovery between repetitions may involve single lifts at 100 kg, 110 kg, 115 kg, 110 kg, and 100 kg. We have adopted this method due to 2 observations. First, clusters reduce the fatigue associated with a typical set, and thus higher force and power outputs can be maintained, enhancing the quality of the set (1). However, the short rest periods (15–30 seconds) are such that the lifter is forced to perform against a background of fatigue not unlike that encountered in competition, particularly during the warm-up for competition. Second, after reaching the target load for the cluster, it is often difficult for the lifter to continue at the heaviest loads, perhaps due to a physical or mental let-down; by reducing the load, quality work can continue. Thus, undulating the load further enhances force, velocity, and power maintenance.

The exercises for this preparation phase are shown in Table 1b. During block 1, considerable emphasis is placed on comprehensive muscle/structural strengthening. We feel this comprehensive process is important for 2 reasons. First, although it can be argued that some muscles are not directly involved in a weightlifting movement or are involved only to a minor extent, we would suggest that no one has perfect technique, nor can anyone produce exactly the same technique for every lift. When a lift (snatch or C&J) is not

Table 1b
Exercises

Block 1	Block 2	Block 3
*Monday and Thursday** (AM) 1. Squats *Monday and Thursday* (PM) 2. Step press 3. Incline dumbbell press 4. Bent over lateral raises (dumbbells)	*Monday and Thursday** (AM) 1. Squats *Monday and Thursday* (PM) 2. Front squats Rest 10–15 min 3. Push jerk (front squat first rep)—one set at target	*Monday and Thursday** (AM) 1. Squats *Monday and Thursday* (PM) 1. Push jerk (front squat first rep) 2. Split lockouts (from power rack) 3. Bent-over lateral raises (dumbbells)
Wednesday (AM) 1. Clean grip shoulder shrugs (first rep from floor) 2. Clean grip pulls from floor 3. Clean grip pulls from knee (blocks) *Wednesday* (PM) 4. Clean grip shoulder shrugs (first rep from floor) 5. Clean grip pulls from mid-thigh (blocks) 6. Hyperextensions from glute-ham bench	*Wednesday* (AM) 1. Clean grip shoulder shrugs (first rep from floor) 2. Clean grip pulls from floor (clean first rep of warm-up sets) *Wednesday* (PM) 3. Clean grip shoulder shrugs (first rep from floor) 4. Clean grip pulls from mid-thigh (blocks) 5. Hyperextensions from glute-ham bench	*Wednesday* (AM) 1. Clean grip shoulder shrugs (first rep from floor) 2. Clean grip pulls from floor *Wednesday* (PM) 3. Clean grip shoulder shrugs (first rep from floor) 4. Clean grip pulls from mid-thigh (blocks) 5. Stiff legged deadlift (160–170° knee angle)
Saturday 1. Snatch grip shoulder shrugs (first rep from floor) 2. Snatch grip pulls from mid-thigh (blocks) Rest 15 min 3. Snatch 10 × 1 as a cluster (30 s between reps) 4. Hyperextensions from a glute-ham bench 5. Snatch grip upright row Stretch after training session	*Saturday* 1. Snatch grip shoulder shrugs (first rep from floor) 2. Snatch grip pulls from mid-thigh (blocks) Rest 15 min 3. Snatch 5 × 1 as an undulating cluster (30 s between reps) 4. Hyperextensions from a glute-ham bench 5. Snatch grip upright row 6. Pull-ups Stretch after training session	*Saturday* 1. Snatch grip shoulder shrugs (first rep from floor) 2. Snatch 5 × 1 as an undulating cluster (30 s between reps) Rest 15 min 3. Clean grip shoulder shrugs (first rep from floor) 4. Clean and jerk 5 × 1 as an undulating cluster (30 s between reps) 5. Stiff legged deadlift (160–170° knee angle) Stretch after training session
Thursday Light day: 20% lower	*Thursday* Light day: 15–20% lower	*Thursday* Light day: 15–20% lower
Tuesday and Friday Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws	*Tuesday and Friday* Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws	*Tuesday and Friday* Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws
Sunday Rest	*Sunday* Rest	*Sunday* Rest
*Thursday is a light day, 15–20% lower.		

technically perfect, it is possible that many of the normally less-involved muscles become more involved, thus a stronger assist of the musculature can enhance the potential of success even though technique is not exact. However, too much assistance work may not be advantageous for athletes needing to make weight, because the additional hypertrophy may make this difficult. Furthermore, it should be noted that these exercises are indeed assistance exercises and are not designed to replace the more important large muscle mass–multi-joint exercises that have a much larger impact

on performance. Thus, the effects of these exercises must be very carefully monitored and their placement in the overall program must be carefully considered. Second, many muscles stabilize during a lift—we would argue that stronger stabilization might reduce injury. However, we also would argue that large muscle mass exercises, which have a high degree of mechanically specificity, are more likely to enhance stability then are smaller isolated or single joint exercises. This results from the observation that during multi-joint large muscle mass exercises, the anatomical/functional role (i.e., agonist, antagonist, stabilizer) of a specific muscle or groups of muscles is not clear cut (14); and that the role of muscles can change with slight alterations of the movement and with changes in velocity. Thus, most of the exercises programmed are specific in nature (i.e., large muscle mass, multi-joint exercises). Indeed, an important area of study, which has not been researched well, deals with the degree to which small muscle mass exercises influence performance in large muscle mass exercises or can be used to prevent injury.

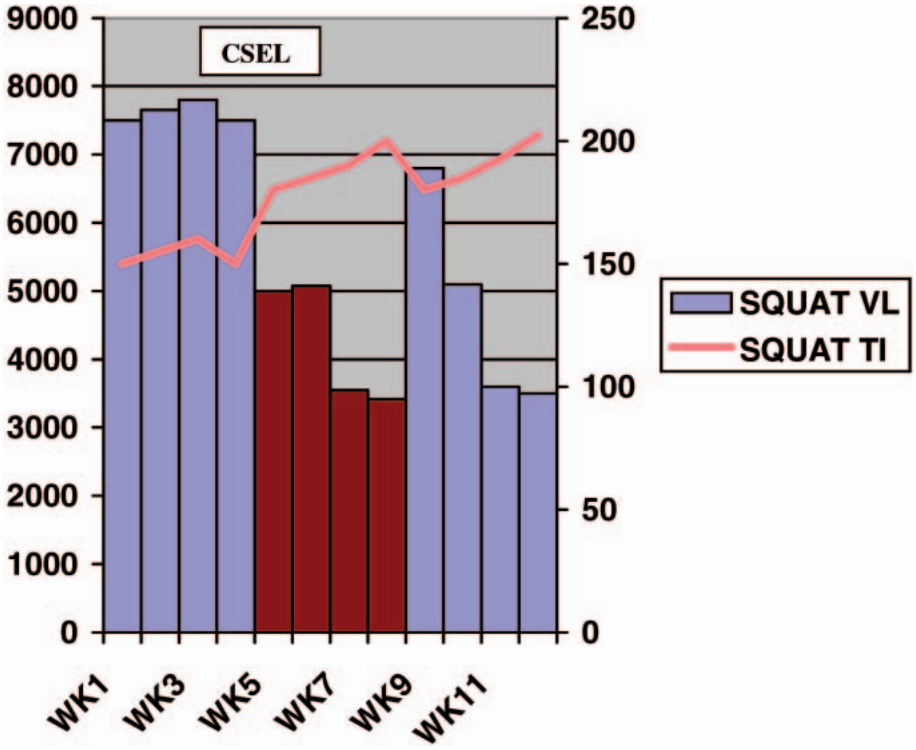

Figure 2. Average volume load and intensity for each week during the preparation phase for a moderately advanced lifter (94 kg, 300 kg total). VL = average volume load (total kg)/wk and includes all sets; TI = average training intensity (kg)/wk and includes only target loads; CSEL = concentrated strength endurance load.

Table 2
Example Training Loads over 12 weeks (Mesocycle 1)

WK	MONDAY	(% initial 1RM)	VL	THURSDAY	(% initial 1RM)	VL
1	150	66	4,500	125	55	3,750
2	155	69	4,650	130	58	3,900
3	160	71	4,800	135	60	4,050
4	155	69	4,650	130	58	3,900
5	180	80	2,700	155	68	2,325
6	190	84	2,850	160	71	2,400
7	195	87	1,755	160	71	1,440
8	200	89	1,200	165	73	990
9	180	80	4,500	150	67	3,750
10	192.5	86	1,732.5	155	68	1,395
11	202.5	90	1,822.5	160	71	1,440
12	207.5	92	1,245	165	73	990

VL (volume load) = repetitions × mass lifted at target loads.
Athlete level = moderate, 94 kg, 300 kg total; best snatch = 132.5; best clean and jerk = 167.5; best squat = 225.

Table 3
Exercise Schedule for 12-Week Mesocycle Leading to a Major Competition

Block 1—4 Weeks	Block 2—4 Weeks	Block 3—4 Weeks
*Monday and Thursday** (AM) 1. Squats *Monday and Thursday* (PM) 2. Front ¼ squats (jerk drives) 3. Press from split	*Monday and Thursday** (AM) 1. Squats 2. Clean and push press 3. Split lockouts (recovery last rep/set)	*Monday and Thursday** (AM) 1. Squats 2. Clean and push jerk 3. Split lockouts
Wednesday (AM) 1. Clean grip shoulder shrugs 2. Pulls from thigh (blocks) *Wednesday* (PM) 3. Clean grip shoulder shrugs 4. Pulls from knee (blocks) 5. Hyperextensions	*Wednesday* (AM) 1. Clean grip shoulder shrugs 2. Pulls from thigh (blocks) *Wednesday* (PM) 3. Clean grip shoulder shrugs 4. Pulls from floor 5. Stiff legged deadlift	*Wednesday* (AM) 1. Clean grip shoulder shrugs 2. Pulls from thigh (blocks) *Wednesday* (PM) 3. Clean grip shoulder shrugs 4. Pulls from knee (blocks)
Saturday 1. Snatch grip shoulder shrugs 2. Power snatch 1 set as a cluster Rest 15 min 3. Clean grip shoulder shrugs 4. C & J 1 set as a cluster Stretch after training session	*Saturday* 1. Snatch grip shoulder shrugs 2. Snatch 1 set as a cluster Rest 15 min 3. Clean grip shoulder shrugs 4. C & J 1 set as a cluster Stretch after training session	*Saturday* 1. Snatch grip shoulder shrugs 2. Snatch 1 set as an undulating cluster: Wk 9—125 kg Wk 10—127.5 kg Wk 11—130 kg (starting attempt) Wk 12—Meet Rest 15 min 3. Clean grip shoulder shrugs 4. C & J 1 set as an undulating cluster: Wk 9 —160 kg Wk 10—165 kg (starting attempt) Wk 11—155 kg Wk 12—Meet Stretch after training session
Thursday Light day: 15–20% lower	*Thursday* Light day: 15–20% lower	*Thursday* Light day: 15–20% lower
Tuesday and Friday Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws	*Tuesday and Friday* Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws	*Tuesday and Friday* Mid-section work: walking twists, basket hangs, candle-sticks, etc. Occasional easy sprints and ball throws
Sunday Rest	*Sunday* Rest	*Sunday* Rest

Note that in general, moving from block 1 to block 3, exercise mechanical specificity progresses from less specific to more specific. For example, progression for jerk development moves from pressing movements (block 1 = step press and dumbbell presses) to push jerks (block 2) to split lockouts and actual C&Js during block 3.

Volume and intensity considerations for the preparation phase are shown in Figure 2. Although many coaches base volume and intensity variation on percentages of the most recent snatch and C&J (competitive maximum) or a training maximum, we have not found that this method is always useful or advantageous. Rather, intensity is generally based upon approximate repetition maximum (RM) values and a progressive increase in weight. Thus, overload would follow a relatively steady progression. For some large muscle mass exercises, heavy and light days are used. This method not only reduces the overtraining potential, but also allows some exercise each week at higher velocities and power outputs. The loading should be carefully planned so that all sets and repetitions can be completed, overtraining potential is minimized, and reasonable progression can be accomplished. Using the squat as an example, week-to-week

target loads (heaviest planned loading for the exercise/day) would progress as shown in Table 2 (moderate level, 94 kg, 300 kg total; best snatch = 132.5; best C&J = 167.5, best squat = 225):

Similar progressions can be made for pulling movements—less variation (i.e., heavy and light days) can be appropriate for the pulling movements using this program, because of the preceding rest days (Tuesday and Friday), which reduces overtraining potential. Based on past experience and record keeping with a variety of athletes expected improvement in the squat would be approximately 2.5–5%.

Table 3 shows the exercises for a mesocycle following the initial preparatory phase; this mesocycle could lead to a major meet. A typical mesocycle leading to a competition peak would last 12–16 weeks and would follow a repeated overreaching design (5) (see Figure 3). In brief, overreaching is believed to be an early stage of overtraining (8). Overreaching typically occurs if the volume of training is markedly increased for a short period. The sharp increase in volume can result in increased fatigue and in performance decrements. However, several observations of weightlifters have shown that if an overreaching phase (approximately 1 week) is followed by a sharp return to normal training, then an increase in performance above baseline can occur. Adding a taper to normal training can result in addi-

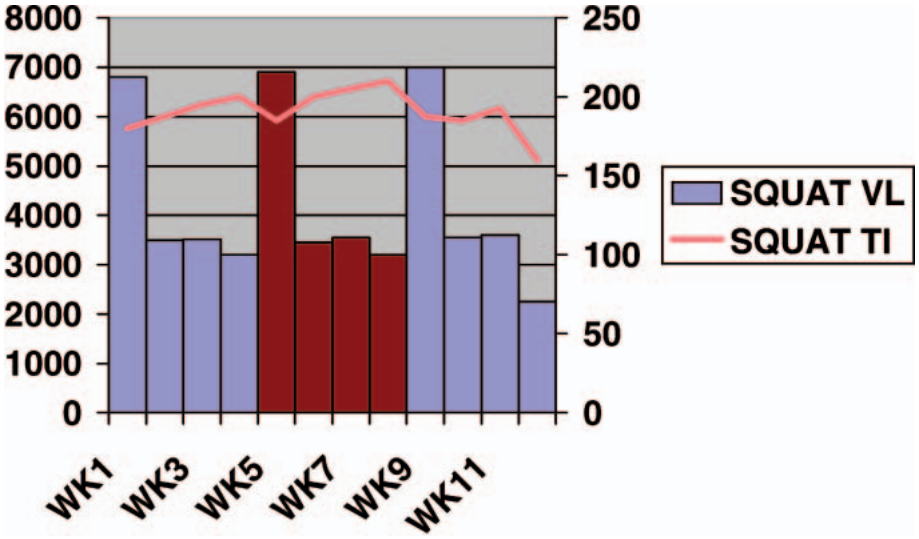

Figure 3. Volume and intensity for a 12-week mesocycle leading to a major meet (moderately advanced lifter: 94 kg, 300 kg total). The first week of each block represents an overreaching week. VL = average volume load (total kg)/wk and includes all sets; TI = average training intensity (kg)/wk and includes only target loads. Monday = heavy day; Thursday = light day (15–20% less).

Table 4
Example Training Loads over 12 weeks (Mesocycle 2)

WK	MONDAY	(% initial 1RM)	VL	THURSDAY	(% initial 1RM)	VL
1	180	80	4,500	152.5	68	3,812.5
2	187.5	83	2,812.5	160	71	2,400
3	195	86	2,925	165	73	2,475
4	200	89	1,200	170	76	1,050
5	185	82	4,625	157.5	70	3,937.5
6	200	89	3,000	170	76	2,550
7	205	91	1,845	175	78	1,050
8	210	93	1,260	177.5	79	1,065
9	187.5	83	4,687.5	160	71	4,000
10	185	82	2,775	157.5	70	2,362.5
11	192.5	85	1,732.5	165	73	990
12	160	71	960	no squats		

VL (volume load) = repetitions × mass lifted at target loads.
Athlete level = moderate, 94 kg, 300 kg total; best snatch = 132.5; best clean and jerk = 167.5; best squat = 225.

tional performance increases (8). Thus, planning an overreaching phase can be advantageous potentially in terms of performance improvement. In this example, each block begins with an overreaching week (5 × 5 at target load) followed by:

- Block 1: 2 weeks of normal training (3 × 5 at target load) and one week of reduced volume load (3 × 2 at target load).
- Blocks 2 and 3: 1 week of normal training (3 × 5 at target load), 1 week at 3 × 3 (target load) and 1 week at 3 × 2 (target load).

Again, using the squat as an example, week-to-week target loads (heaviest planned loading for the exercise/day) would progress as shown in Table 4 (moderate level, 94 kg, 300 kg total; best snatch = 132.5; best C&J = 167.5; best squat = 225):

Figure 1 describes a 1-year (macrocyle) plan with 3 planned peaks. The final peak would correspond to the Commonwealth Games. The volume load and training intensity are based on the general characteristics for the squat and pulling movements.

Additional Avenues for Research

"Weightlifting: A Brief Overview," in *Strength and Conditioning Journal* 28(1), and this article have provided the reader with theoretical and applied background material dealing with the sport of weightlifting. However, several aspects of weightlifting need to be better studied. Women's weightlifting is a relatively new sport—the first women's world championships were held in 1987. Areas for study concerning women's weightlifting deal with the effect of the menstrual cycle on performance and potential upper versus lower body strength/power limitations. Pulling movements can be broken down into 3 basic parts: first pull, transition, and second pull. It is possible that poor mechanics or lack of strength during any part could limit the entire pull and therefore be a limiting factor in completing a snatch or C&J. Using U.S. national-level weightlifters, force-time curve data collected by the authors from isometric and dynamic pulls suggest that lack of strength and speed during the second pull could be a limiting factor during a complete lift. Studies relating force-time curve data from pulls at different heights (e.g., floor, knee, midthigh) to weightlifting performance could provide insight into superior exercise selection during training. One of the most important types of studies dealing with weightlifting would be investigation(s) of the actual effectiveness of various types of training programs. These types of studies would not only affect weightlifting, but would have considerable carryover to other sports. For example, to the authors' knowledge, there are no published English-language studies comparing the efficacy of different types of weightlifting programs that actually have used weightlifters. These comparative programs could investigate (a) the type of program that most effectively teaches beginning lifters proper technique, (b) the types of programs that produce the best performance over a reasonable period of time (year), (c) the ways in which alterations in volume and intensity relate to changes in performance, and (d) whether training should differ with respect to physiological age and gender differences. ♦

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