



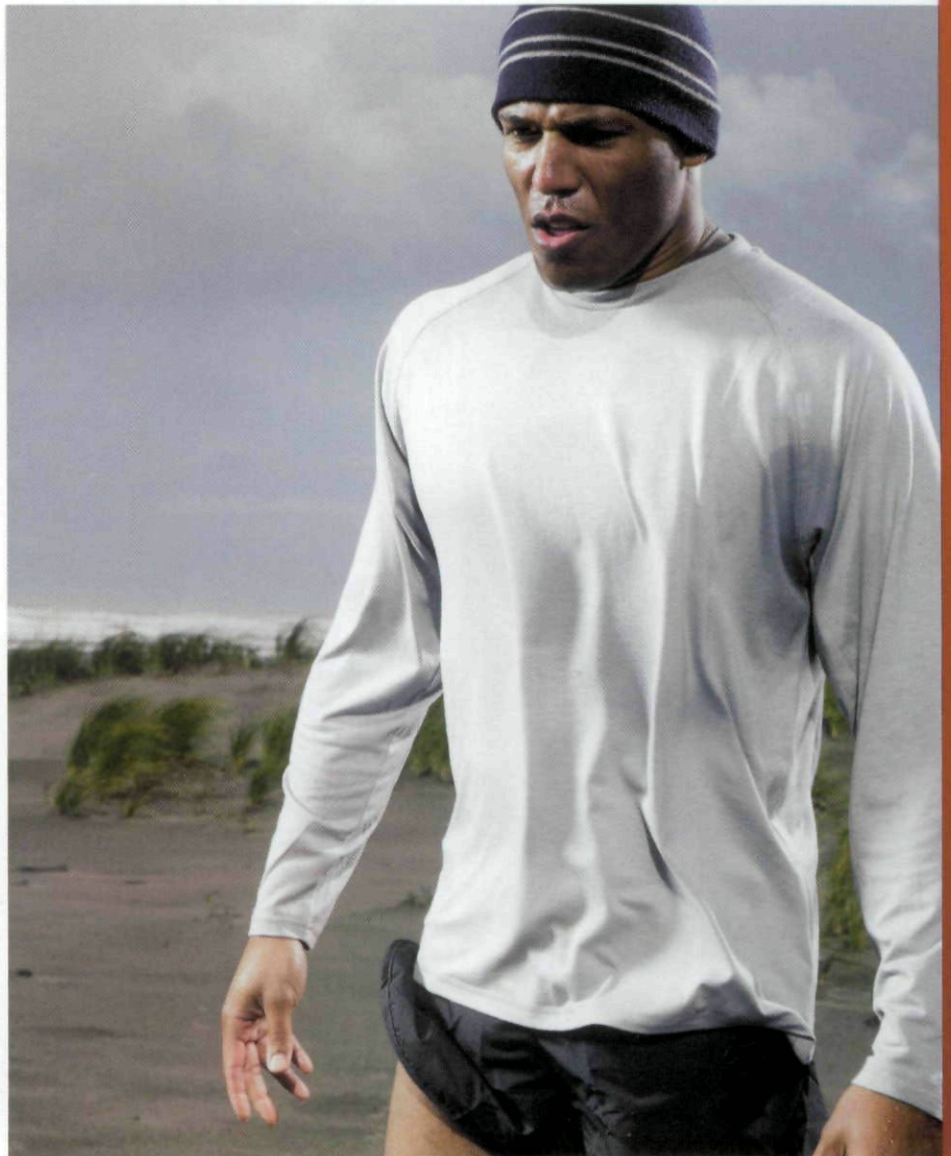
Is There a *Best* Periodization Model?

A comparison of three different models.

Buford, T.W., et al. 2007. A comparison of periodization models during nine weeks with equated volume and intensity for strength. Journal of Strength and Conditioning Research, 21 (4), 1245–50.

Personal trainers and group fitness instructors are habitually seeking effective and optimal programs to maximize training adaptations in clients and students. Although muscular-strength researchers have not determined which type of strength training program is most advantageous, the present thought is that some form of periodization is central to the design (Buford et al. 2007). **Periodization** refers to an organized plan of exercise where acute training variables—such as number of repetitions, number of sets, intensity, recovery between sets, type of exercise (fixed form and/or freeform), repetition tempo, type of contraction (concentric, eccentric, isometric) and training frequency—are systematically manipulated.

The roots of periodization program design date back to the 1950s and early 1960s, when European sports scientists and coaches were training some of the best athletes of that period. The human body has a tremendous capacity for muscular-fitness adaptation, and a primary goal of periodization is to progressively and systematically overload the body so that it attains its muscular-fitness potential. While there are many schemes of periodization, the three very popular models in the pres-



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ent investigation are linear periodization, daily undulating periodization and weekly undulating periodization.

Subjects

Ten women and 18 men (average age = 22 years), all untrained in resistance exercise, volunteered for this 9-week study. Subjects completed a 4-week familiarization program (three sessions per week) to learn proper resistance training technique and execution before being randomly assigned to one of the three periodization models. Subjects were required to attend at least 90% of the training sessions in order to remain qualified as participants.

Testing

Subjects were tested at the beginning, middle and end of the 9-week periodization study. Tests included skinfold body composition assessment (consisting of triceps, midaxillary, abdominal, suprailiac, subscapular, thigh and pectoral skinfold sites), chest and thigh circumference measurements, and one-repetition maximum of the bench press and leg press. All testing sessions took place at the same time of day and were conducted by the same researcher.

Periodization Training Models

As noted, the three training models were linear periodization (five men, four women), daily undulating periodization (seven men, three women) and weekly undulating periodization (six men, three women) (see Figures 1, 2 and 3 for the program design of these models). Groups trained 3 days per week with 48 hours between sessions. All groups performed the exact same exercises on each day of the week (see Table 1).

Table 1.
Daily Exercises Performed by Groups

Monday	Wednesday	Friday
bench press	bench press	bench press
leg press	leg press	leg press
seated row	lat pull	upright row
lunge	leg extension	leg curl
preacher curl	standing calf raise	triceps extension
incline sit-up	back extension	knee raise

All subject training was supervised by the same individuals, and the subjects self-assessed their training intensity for every exercise set with a Borg 10-point rating of perceived exertion (RPE) scale (see Table 2). Subjects were encouraged to achieve an RPE of 8 or 9 on the final repetition of each set.

Table 2.
Borg 10-Point Rating of Perceived Exertion Scale

RPE	Description
0	complete rest
1	very, very easy
2	easy
3	moderate
4	somewhat hard
5	hard
6	
7	very hard
8	
9	
10	extremely hard (almost maximal)
—	exhaustion

Source: Adapted from Borg, G., Hassmén, P., & Lagerström, M. 1987. Perceived exertion related to heart rate and blood lactate during arm and leg exercise. *European Journal of Applied Physiology*, 56 (6), 679–85.

Each group performed exactly the same number of abdominal and low-back exercises throughout the 9-week study. Groups completed 3 sets each day, with no additional resistance other than body weight. Repetitions ranged from 15 to 12 to 10 and varied according to each group's program design.

Study Results

Although improvements were seen in all variables, no periodization model was shown to be statistically superior to the other models. Table 3 summarizes the percent changes observed in this 9-week investigation.

Discussion

The comparison of these three periodization models distinguishes this study as a particularly novel investigation. The incorporation of untrained men and women is also entirely original—and useful for personal trainers who regularly initiate exercise programs with untrained clients.

In particular, the 32% increase (bench press) and 108% increase (leg press) in strength for women (with all groups

Table 3.
Percent Changes in Physiological Variables Tested

Variable	Percent Change After 9 Weeks of Training
body fat	LP = 5% decrease DUP = 7% decrease WUP = 4% decrease
chest circumference	LP = 2% increase DUP = 1% increase WUP = 1% increase
thigh circumference	LP = 7% increase DUP = 4% increase WUP = 7% increase
<i>Note:</i> Since no significant differences were seen in the periodization models, authors chose to present <i>combined</i> bench press and leg press strength data by gender to better understand group adaptations.	
bench press (women)	all groups—average: 32% increase
bench press (men)	all groups—average: 19% increase
leg press (women)	all groups—average: 108% increase
leg press (men)	all groups—average: 80% increase

LP = linear periodization; DUP = daily undulating periodization; WUP = weekly undulating periodization

combined) should be highlighted (see Table 3). Although muscle fiber characteristics (slow twitch and fast twitch) have been observed to be quite similar in men and women, these findings are impressive (and without scientific explanation from the authors). One hypothesis for why periodization training is so effective is that it provides a systematic and satisfactory overload to specific muscle fiber types while other muscle fibers are getting

There was no difference in the RPE ratings of subjects in the different groups. This suggests that (1) all subjects trained at relatively similar intensities and (2) no model of periodization training elicited any overtraining symptoms, such as muscular fatigue, impaired strength performance, aching joints, pain or decreased efficiency of movement.

Results of this study show very positive and similar improvements with

Figure 1.
Linear Periodization Training Design for Exercises*



*Does not apply to exercises for the low back and abdominals.

needed recovery time. It is quite interesting to observe that the leg press strength increases for both the men and women were dramatically greater than the bench press improvements. This indicates that with untrained men and women, in a 9-week training program, lower-body adaptations are more prominent.

linear, daily undulating and weekly undulating periodization. The results suggest that rotating all of these models into a training program may be advantageous. Since personal trainers and other fitness professionals approach training sessions and group classes as a lifetime approach to health and fitness for their clients, this

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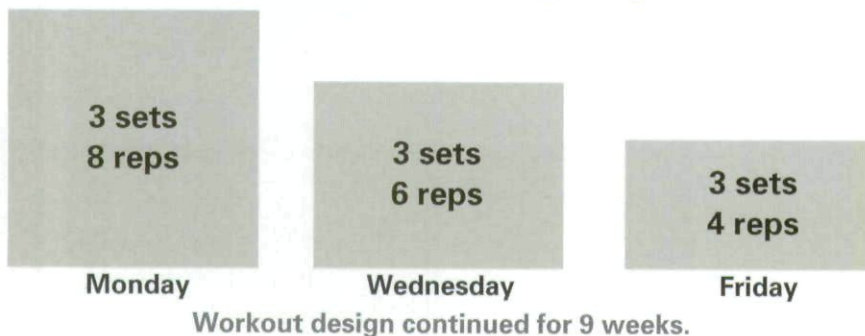
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Figure 2.
Daily Undulating Periodization Training Design for Exercises*



*Does not apply to exercises for the low back and abdominals.

Figure 3.
Weekly Undulating Periodization Training Design for Exercises*



*Does not apply to exercises for the low back and abdominals.

rotating approach is very feasible—and may also help prevent stagnation and boredom. That said, with regular assessment of physiological parameters (body composition, muscular strength, muscular endurance, balance, etc.), a personal trainer may determine that a client adapts more readily to one of the models, and the trainer might eventually select that model as a primary tool to use with the client in question. ■

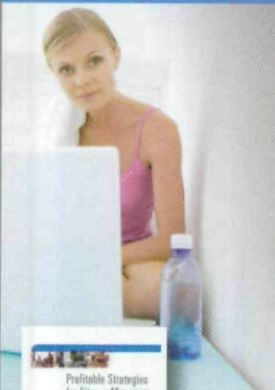
Len Kravitz, PhD, is the program coordinator of exercise science and a researcher at the University of New Mexico (UNM), where he recently won the Outstanding Teacher of the Year award. In 2006 he was honored as the Can-Fit-Pro Specialty Presenter of the Year and as the ACE Fitness Educator of the Year.

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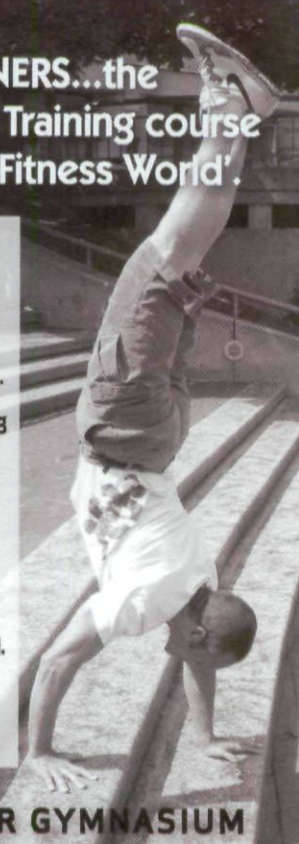
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