

REVIEW ARTICLE

Is “periodization programming” periodization or programming?

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Within the literature examining the periodization of resistance training, “periodization” and “programming” are often confused and used interchangeably. This has resulted in the drawing of inferences regarding the efficacy of periodization from training studies comparing different programming models over short periods of time. As this conflation has become an area of scientific discussion, what was once referred to as “periodization” is now often referred to as “periodization programming” or “periodized programming.” Presumably, the use of the term “periodization programming” acknowledges the short-term nature of a given research intervention. However, this term has never been explicitly defined in the scientific literature. Furthermore, it is unclear if “periodization programming” is actually a form of periodization.

Objectives: To define “periodization programming” and to discuss its use within the literature.

Design & Methods: Literature including the terms “periodization programming” and “periodized programming” were reviewed.

Results: Deliberate manipulations in the volume and training load over the short-term seem to be defining characteristics of “periodization programming.” The resistance training methods employed by “periodization programming” studies share common ground such that they are structured in a manner resembling one stage of a block periodization model and are carried out alongside other stressors.

Conclusions: “Periodization programming” studies are similar to previous studies employed to examine the concept of periodization and thus, may more accurately be investigating resistance training at the programming level. Without a formal definition, these studies may add to the confusion within the literature and further challenge the ability to draw inferences surrounding the efficacy of periodization.

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Key words: periodization ■ periodization programming ■ periodisation ■ resistance training

INTRODUCTION

Periodization has been defined as a “theoretical and practical construct that allows for the systematic, sequential, and integrative programming of training interventions into mutually dependent periods of time to induce specific physiological adaptations that underpin performance outcomes”.¹ The scientific staging for periodization stems from Hans Selye’s general adaptation syndrome² which, when extended to resistance exercise and sport, suggests that training for the sport will create competing stressors which may impair one’s ability to adapt to resistance exercise (and vice versa).³ As such, periodization attempts to manage the stress of exercise to reduce the likelihood of overtraining and bring performance to peak levels at a specific time.^{4,5} Given these expected outcomes, the majority of strength and conditioning coaches in both professional⁶⁻⁸ and collegiate⁹ sports follow a periodization model.

Various approaches to periodization have been investigated within the scientific literature, each offering a unique rationale and structure for the sub-division of a program into sequentially and specifically focused training periods.¹⁰⁻¹² Regardless of the model employed, periodization has been accepted as the “gold standard” training theory and deemed

superior to a non-periodized program for facilitating skeletal muscle adaptations.¹³⁻¹⁵ As the scientific investigation of periodization has advanced, the definition of periodization has not remained consistent and the experiments employed to investigate periodization have traditionally been short-term in nature.¹⁶ For example, most studies examining periodization compare one resistance training program that includes variation (referred to as periodization) to another that does not include variation (referred to as non-periodization) over limited time frames (i.e., 6-12 weeks).¹⁶ Such studies have been criticized not to represent periodization, but rather different programming strategies.¹³ Perhaps, as a result of this criticism, short-term studies that incorporate variation have begun to refer to this variation as “periodization programming” as opposed to “periodization” itself. Accordingly, this has created a new term within the literature that has not been explicitly defined. The purpose of this paper is to define “periodization programming” and to discuss its use within the literature.

Periodization – limited by study design?

Early observations from Stone et al.⁵ investigated skeletal muscle adaptations following 6-weeks of periodized and non-periodized resistance training programs. The periodized

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group performed 5 sets at a 10-repetition maximum (RM) for 3 weeks, followed by 1 week each of 5 sets at a 5RM, 3 sets at a 3RM, and finally 3 sets at a 2RM. Thus, over the 6-week period there was a progressive increase in exercise load and a gradual decrease in exercise volume. The non-periodized group performed 3 sets at a 6RM for the entire 6-weeks, hence there was no change in exercise load or volume over the 6-week period.⁵ In a similar manner, Rhea et al.¹⁰ compared strength adaptations between 12-weeks of daily alterations in repetition patterns (i.e., daily undulating periodization) and less frequent changes in training variables (every 4-weeks; i.e., linear periodization). Both Stone et al.⁵ and Rhea et al.¹⁰ observed that the protocol including more variation demonstrated more positive changes in outcome measures over time and have used this evidence to support the notion that a periodized resistance training program is superior to a non-periodized training program. Notwithstanding, Mattocks et al.¹⁷ suggested that various methodological factors (i.e., tools used to assess muscle growth, methods of evaluating strength/performance) may explain differences between such periodized and non-periodized programs. In consideration of maximal strength, Mattocks et al.¹⁷ suggested the differences between periodized and non-periodized training programs may merely be due to the principle of specificity. Meaning, a group performing a 2RM in the weeks before strength testing is training closer to the strength test (1RM) compared to a group performing a 6RM. Intriguingly, proponents of periodization typically attribute these greater strength increases to the variations in training stimuli as opposed to the specificity of the training program.¹³⁻¹⁵ For example, a recent meta-analysis published by Williams et al.¹⁴ concluded the seemingly favorable changes in strength (measured by 1RM) produced by periodized training plans to be the result greater training variation allowing for enhanced recovery and physical preparedness.

A criticism of Mattocks et al.'s¹⁷ suggestion that a periodized resistance training program is not superior to a non-periodized training program for muscle size and strength adaptations is the suggestion that authors conflated the concepts of periodization and programming.^{13,18} Namely, Cunanan et al.¹³ pointed out that issues arise when drawing conclusions based on training studies that include variation (inaccurately referred to as periodization) rather than those examining the overall concept of periodization (i.e., the long-term, overarching plan that accounts for competing stressors). If true, this conflation between periodization and programming is not limited to a few isolated studies, but rather an issue with a large majority of the scientific literature studying periodization. Kataoka et al.¹⁶ examined the definitions of periodization and corresponding study designs which have been employed to examine the concept of periodization. The authors noted that the majority of the definitions of periodization reference stress management, phase potentiation, and an attempt to peak performance. After reviewing 80 separate definitions on periodization the authors suggested that:

“Periodization is an organizational approach to training that considers the competing stressors within an

athlete’s life and creates “periods” of time dedicated to specific outcomes (i.e., strength, hypertrophy or power). These designated periods are intended to manage the stress associated with exercise, while also creating potentiation in the subsequent training phases. Through proper stress management and program design this approach may also attempt to peak various performance measures at a specific time relevant to competition.”

Kataoka et al.¹⁶ also observed that, despite the definitions proposed for periodization, the majority of experimental interventions designed to examine periodization follow participants for a 4-18 week time frame and are designed in a manner that does not align with the concepts proposed in the definitions of periodization.¹⁶ For example, within a 6-12 week time frame, it is difficult to design multiple training phases to examine the potentiation of various training adaptations. Moreover, it is unlikely that performing the same repetition scheme over short durations would put an individual at risk of overtraining. Therefore, a variation in volume or training load (often referred to inappropriately as “intensity”¹⁹) cannot be justified for the purposes of managing the stress of exercise and/or peaking performance. All things considered, Kataoka et al.¹⁶ suggested that the efficacy of periodization would be more appropriately studied over longer durations and in a sport-context while considering the competing stressors within an athlete’s life.

“Periodization Programming”

The majority of experimental interventions employed to investigate periodization do not adequately address the main tenants proposed in its definition, particularly for the long-term development of fitness characteristics and the attempt to peak performance.^{13,16} As such, studies comparing different periodization models in the literature are more accurately making comparisons at the programming level. To illustrate, the previously mentioned work of Stone et al.⁵ is commonly acknowledged as a “periodization” study; however, given the researchers compared resistance training using variation versus a constant repetition scheme, it might more appropriately be considered a “programming” study.¹³ Recently, “periodization programming” and “periodized programming” have gained popularity as terms used to describe training studies including variation in programming over short time periods (i.e., 6-12 weeks).²⁰⁻²² This language appears to stem from the work of Painter and colleagues²⁰ who compared two different periodization programming models in track and field athletes. Broadly, the block form of periodization programming used a three-phase progression model whereby volume load (i.e., sets x repetitions x load) and training “intensity” (i.e., volume load/total repetitions) were manipulated within and across weeks. In contrast, the daily undulating periodization programming model incorporated aspects of all three training phases within each week using session-by-session alterations in repetition maximum ranges. It is worth noting that similar resistance training programs have been employed in previous

research, albeit the terminology used across these studies lacks consistency. For example, the literature has referred to alterations in repetition patterns within the week as daily undulating periodization^{10,23,24} and more recently, daily undulating programming;²⁵ however, such variation was coined “daily undulating periodization programming” by Painter et al.²⁰ Likewise, one can find resistance training programs comparable to the abovementioned “block form of programming for periodization” termed block periodization models, among other nomenclature within the literature.^{12,26,27} Notwithstanding these discrepancies, Painter et al.²⁰ suggested these methods to be limited in duration, yet structurally similar to various periodization models, namely, the phase potentiation methods described by Stone et al.,²⁷ the conjugated successive methods of Verkhoshansky,²⁸ and the block periodization described by Issurin.²⁹ Furthermore, the authors concluded the block protocol to be the superior method based on it requiring less total work (estimated by volume load) to achieve statistically similar gains in performance.²⁰ For this reason, it seems that the block form of programming has garnered acceptance as an effective strategy for developing strength and power within limited time frames, evidenced by recent “periodization programming” studies utilizing similar training protocols.^{21,22,30}

A provisional definition of “periodization programming” is offered in a recent training study by Moquin et al.²¹ whom stated, “*Certain resistance training programs, particularly those using periodization programming, alter several factors over time including volume and intensity.*” Presumably, this definition suggests that any manipulation of volume and/or training load during training would be indicative of “periodization programming;” whereas no variation in programming variables would make the protocols “non-periodized programming.” Additionally, the inclusion of the word “programming” distinguishes a more short-term intervention from the larger concept of periodization. Taken together, the contemporary “periodization programming” (i.e., “periodized programming”) appears to be a blanket term for designing resistance training programs that resemble larger periodization models over limited durations. For example, Ishida et al.³⁰ speculated that block periodization provides superior fitness adaptations compared to other approaches within a time frame ranging from 8-12 weeks. With regard to this, the authors investigated if “short-term periodized programming” could improve strength, jump, and sprint performance in male soccer players.³⁰ The strength training program employed was structurally similar to a block periodization design, albeit compressed into a 7-week time period. In short, training consisted of 3 weeks of performing 3 sets of 10 repetitions, followed by 1 week of 5 sets of 5 repetitions, 2 weeks of 3 sets of 5 repetitions, and a final week of 3 sets of 3 repetitions (reduced training volume week).³⁰ Additionally, alterations in training loads [i.e., percentage 1RM; (referred to by the authors³⁰ as “daily relative intensities”)] were incorporated on a daily and weekly basis to aid in fatigue management. Ergo, variation was accomplished by manipulating volume load within and across the 7-weeks.³⁰ Following a similar study

design, Moquin et al.²¹ monitored changes in lean body mass and cross-sectional area across 11-weeks of resistance training using block periodized programming. The training regime was programmed such that fluctuations in volume and training loads occurred within each week and phase of training.²¹ Thus, over the 11-weeks, the training program resembled, what might be, one stage of a larger block periodization model.²¹ Another study by Wetmore et al.³¹ assessed the effects of training status on adaptations to 11-weeks of block periodization training. Citing the works of Painter et al.^{20,22} and previous “periodization” literature,⁴ the authors³¹ made the case that block periodization was effective for developing maximum strength and power and went on to employ a study design akin to that previously mentioned.²¹ Interestingly, however, Wetmore et al.³¹ did not use the contemporary language to describe these protocols. Although identical strategies were used to achieve variation within training, they did not appear to consider these tactics to be “periodization programming.” Instead, the authors³¹ referred to these protocols as “block periodization training.”

Altogether, these “periodization programming” studies may more closely resemble the larger concept of periodization compared to earlier work (i.e., Stone et al.⁵); however, they also have similar limitations in that conclusions are being drawn based on programming strategies employed over a short time period (i.e., 6-12 weeks). Furthermore, despite employing study designs nearly identical to each other^{21,31} and previous research,^{20,27,32} these studies lack consistency in their terminology. Accordingly, this new language seemingly adds to the confusion within the literature and further challenges the ability to draw inferences surrounding the efficacy of periodization for resistance training adaptations.^{13,16}

Can periodization include non-periodized programming?

Proponents of periodization commonly agree that variations in volume and loading parameters allow for better fatigue management and recovery, which may not be experienced with non-periodized training.¹³⁻¹⁵ The majority of the abovementioned studies^{20-22,30} used a heavy and light day system, which incorporated fluctuations in volume and/or training loads at the microcycle level (i.e., several days to 2 weeks). Such alterations are typically employed to produce greater variations in training stimuli, which is believed to better manage fatigue and optimize performance during long-term training.¹³⁻¹⁵ However, whether these tactics are necessary over 6-12 weeks and/or if they lead to superior adaptations in muscle size and strength do not appear to be supported by sufficient empirical evidence.¹⁷ Regarding maximal strength, Dankel et al.³³ showed that performing up to 5 heavy single repetitions during training (3x/week) over the course of 6-weeks resulted in similar increases in maximal strength compared to a traditional resistance training program (4 sets at an 8-12RM to volitional failure). Furthermore, the authors observed muscle growth only in the traditional exercise group suggesting that the changes in strength were driven largely through adaptations underlying the principle of specificity.³³

In agreement with this, similar results have been observed over longer durations and with less frequent practice/exposure to the 1RM test in both trained³⁴ and untrained populations.³⁵ Of note, while this type of training may not consistently increase maximal strength or be feasible for extended periods of time, it was chosen as an example to illustrate the point that deliberate manipulations in training variables are not necessary for adaptation. Accordingly, whilst variation may be important in an over-arching periodization strategy, it seems reasonable to suggest that when targeting one specific fitness characteristic over short time frames (i.e., maximum strength, 8-12 weeks), an approach to training that does not include variation can be employed. In theory, a training block could utilize non-periodized programming, yet exist within the larger periodization paradigm. Despite not being explicitly designed for such a purpose, this notion might be better understood using the study design of Buckner et al.³⁴ Buckner et al.³⁴ investigated if changes in muscle size enhance strength adaptation. Briefly, the training study was 12-weeks in duration and included two experiments. The first experiment was 8-weeks in duration and required the traditional training condition to perform 4 sets of an 8-12RM twice per week (i.e., hypertrophy phase).³⁴ In the subsequent 4-weeks, training was altered whereby a single maximal strength repetition was performed followed by 2 sets at an 8-12RM on two days per week (i.e., 1RM training phase).³⁴ In contrast, the 1RM training condition performed bi-weekly maximal strength repetitions for the entire 12-weeks.³⁴ Considering there were no manipulations in training variables over the course of 12-weeks, we recognize that the 1RM training condition would be deemed a non-periodized program. In a similar manner, the traditional training program did not incorporate variation during each respective experiment (i.e., phase of training). Thus, we presume both training phases would be acknowledged as non-periodized programs by themselves; however, over the course of 12-weeks, variation was indeed present. To this, we question at what point variation within the resistance training literature becomes periodization and which terminology would be the most appropriate to use when referencing the 12-week training program employed by Buckner et al.³⁴: “periodization;” “programming;” or perhaps, “periodization programming?”

CONCLUSION

In the previous years, there have been many discussions within the literature about the efficacy of periodization for resistance training adaptations.^{3,13,15} Many thought-provoking points have been raised, though various controversies still exist. For example, some authors have suggested that a periodized resistance training program is not superior to a non-periodized training program for muscle size and strength adaptations,^{17,36} while others believe a periodized approach to be superior.¹³⁻¹⁵ These differences appear driven by the current state of the literature, specifically, inconsistencies in the definition of periodization and lack of study designs adequately addressing the main tenants proposed in these definitions.^{13,16} From a conceptual perspective, this has resulted in

authors confusing periodization and programming, hence drawing inferences regarding the efficacy of periodization from training studies comparing different programming models (inaccurately referred to as periodization).^{13,18}

Recently, the phrases “periodization programming” and “periodized programming” have appeared in training studies employing resistance training programs that include variation over short time periods (i.e., 6-12 weeks).²⁰⁻²² The primary purpose of the present manuscript was to define “periodization programming” and to discuss its use within the literature. Whilst we are not aware of any formal definition, deliberate manipulations in the volume and training loads within a resistance exercise program seem to be defining characteristics. Moreover, the resistance training programs employed by “periodization programming” studies share common ground in that they are structured in a manner resembling one phase or stage of the block periodization model and are often carried out alongside other “stressors” (i.e., sport-specific training^{20,22,30}; bi-weekly sprint training²¹). In this light, these protocols are certainly more periodized, per se, than previous research¹⁶; however, they are limited in duration. As such, they do not adequately address the long-term development of fitness characteristics and may more accurately be investigating resistance training at the programming level.^{13,16}

Given the lack of sufficient empirical evidence supporting the need for purposeful variation within short-term resistance training programs, it is worth discussing the practicality of including a block of training with no variation into a larger periodized program. Presumably, this training block would employ non-periodized programming; however, in the larger periodization paradigm, manipulations in volume and training loads could occur. In support of this contention, we question if it would be appropriate to refer to this variation as “periodization;” “programming;” or perhaps, “periodization programming?”

CONFLICTS OF INTEREST

The authors report no relationships that could be construed as a conflict of interest.

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