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Current Periodization, Testing, and Monitoring Practices of Strength and Conditioning Coaches

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Purpose: This study investigated the periodization, testing, and monitoring practices of strength and conditioning practitioners across different levels of coaching experience and sports. ***Methods:*** An online survey was completed by 58 practitioners (25 sports/events) from 9 Southeast and East Asian countries. The survey focused on periodization models, programming frameworks, unloading strategies, fitness assessments, and pretraining readiness monitoring. Frequency analysis and chi-square tests were used to assess data distribution and differences. ***Results:*** Hybrid (multiple) periodization was favored over a single model for different training objectives (39%–45%), including *very* short-term training (≤4 wk). Emerging approaches including *flexible* programming were similarly adopted (43%). Program adjustment was primarily driven by athlete feedback (90%), self-observation (78%), and technical execution (74%). Major programming challenges identified were managing fatigue (72%), optimizing training stimuli (53%), specificity (50%), and adherence (47%). *Deloading* practices (95%) and *tapering* applications (91%) were common. Physical performance changes were primarily identified from testing (90%) but also from athlete/coach feedback (76%), monitoring (71%), training data (67%), and performance data/statistics (62%). Strength assessments were conducted 2 to 4 times yearly (67%) using 1 to 4 exercises (76%). Pretraining readiness was monitored via conversations (71%), wellness tools (46%), and performance devices (31%). Practitioners also utilized monitoring technology, force plates (21%), and velocity-tracking devices (23%). Training load was commonly quantified using volume load (81%) and session rating of perceived exertion (72%). None of the comparisons differed across experience levels and sport types ($P > .05$). ***Conclusion:*** Practitioners employed a range of periodization models, often integrating flexible approaches. Unloading strategies were commonly implemented alongside various assessment methods. Technologies were used for monitoring, but conversational/subjective methods remained more widespread.

Keywords*:* assessment, high performance, planning, resistance training, tapering, unloading training

Periodization and programming are integral within strength and conditioning (S&C) practice, aiming to optimize physical performance through structured training to peak for main competitions.[1–3] *Traditional*, *undulating*, and *block* models have been widely used in recent decades.[1,2,4] However, critics argue that they lack "flexibility" to adapt to athletes' changing needs (individualization) due to situational constraints (eg, stress, fatigue) and predefined fitness adaptations.[5]

Modern technologies now provide objective and subjective data on athletes' physical readiness and training demands to inform ongoing decision making around periodization.[6] Such data facilitate emerging "periodization concepts," such as *autoregulatory*, *flexible,* and *fluid* methods,[7,8] purportedly sensitive to individual day-to-day capability[9] or readiness.[7,8] Additional approaches include *tactical* or *wave* models, which align sport-specific tactical development with physical performance priorities within integrated training practices, such as small-sided games.[10,11] However, the effectiveness of these emerging approaches for long-term development remains unclear,[4,12] and the level of practices among practitioners is relatively unknown. At present, perspectives on periodization appear to be mixed and evolving, with differing views across theoretical foundations, beliefs, and emphasis in practices.

Periodization encompasses macromanagement of training through phase-based structuring, whereas programming focuses on the micromanagement, for example, exercise selection, volume, intensity, frequency, and density.[1,4] "Debates" continue regarding periodization concepts,[5,12,13] and terms such as *undulating* and *flexible* are also considered as forms of loading methodology.[1] Nevertheless, effective training load management through *deloading, tapering,* and *transition* phases remains essential for optimizing training cycles.[3,14] *Deloading* aids recovery and progression by temporarily reducing volume and intensity,[13] whereas *tapering* prior to a competition maximizes performance (peaking) by reducing fatigue and optimizing training adaptations.[1,15] *Transition*

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phases support recovery, maintain certain fitness levels, and prepare the athlete for the next training cycle.[3] Nevertheless, Ritchie et al[16] reported that *tapering* and peaking practices among coaches are complex and demonstrate considerable individual variation. Some S&C practitioners, therefore, employ programming strategies based on their philosophies and coaching experience,[17] which may offer practical insights (ie, a personalized approach), though these often lack empirical support. Conducting research that integrates these unloading strategies, particularly in athletic populations that have ongoing competition and testing schedules, remains challenging.[17] Accordingly, there is a need to understand the approaches currently applied by S&C practitioners.

Beyond periodization models and programming, pretraining monitoring provides an indication of physical readiness and can be used to track athletic development.[18] In high-performance settings, this monitoring increasingly incorporates advanced technologies and tools, such as wearable devices (eg, Global Positioning System), force plates, and biochemical markers, as well as subjective assessments (eg, psychophysiological questionnaires).[18–20] Force platforms, in particular, are widely used for lower-body assessments, which provides metrics on power output, neuromuscular function, and indicators of injury risk.[21] Furthermore, in resistance training contexts, although the one-repetition maximum test remains valid,[22] velocity-based training (eg, volume control, one-repetition maximum prediction/test) is growing in popularity.[23] Integrating objective data with subjective wellness data can enhance the impact of athlete monitoring by allowing programs to align with recovery needs and desired training outcomes.[18]

As the field of S&C develops and new technologies or training approaches emerge, there is a need to understand how applied practice changes. Perspectives from underexplored regions (eg, Southeast and East Asia) may provide novel insights as previous studies have largely focused on North America and Europe.[16,17,23] In this context, some differences in training prescription were observed (compared with common recommendations), likely due to coach preferences, trends at the time of the study, regional influences, or sport-specific demands and constraints.[17] It is noteworthy that the dominant sports in a region tend to differ, and this may be reflected in the S&C practices adopted. Furthermore, experience enhances competence, influencing the adoption of innovative practices, with more "expert" coaches (10+ y of experience) demonstrating superior skills and wisdom.[24,25] Therefore, the current survey-based study investigated how "Asian practitioners" implement periodization, programming, testing, monitoring, and technologies in S&C. In addition, we explored whether experienced practitioners adopt these methods differently from less experienced practitioners and whether training approaches differ between individual- and team-sports athletes. We hypothesized that experienced practitioners would use more established methods (ie, evidence informed and widely accepted) and technologies in training and monitoring and that this application would differ between sports types.

Methods

This study used a descriptive design (exploratory) to investigate periodization, testing, and monitoring practices in strength training and conditioning across practitioners of different experience levels and sports. The survey was conducted in English and required participants to have at least 1 year of experience as an S&C coach, be 18 years or older, and possess English literacy. The sample size was in accordance with prior research,[17] and considering the exploratory design of the study, a requisite sample size was not calculated a priori.[26] Data were collected via an online survey, Google Forms® (Google LLC), over 3 weeks in August 2024 (most entries received in the first week).

Participants

A total of 58 S&C practitioners (male 90%, female 10%) from 9 countries in Southeast and East Asia participated: Malaysia (45%), Singapore (16%), Philippines (12%), Hong Kong (7%), Indonesia (5%), Japan (5%), Thailand (5%), Vietnam (3%), and Brunei (2%). Respondents were predominantly aged younger than 40 years old (75%). They had a minimum education of a bachelor's degree (91%) and held relevant certifications (72%). The majority have worked with either international (33%), world-class (28%), or highly trained national-level athletes (28%), as reported based on the classification framework of McKay et al,[27] and were based in a sports institute (38%) or a professional sports club (17%). This cohort represented 25 sports, grouped as: outdoor team or ball sports (football, hockey etc [31%]); strength and power (sprints, jumps, weightlifting [21%]); court sports (basketball, volleyball [17%]); racquet sports (badminton, tennis [14%]); combat (boxing, karate [9%]); and aquatic (swimming, diving [5%]). Coaches were categorized into 2 strata based on years of experience, 1–9 years and 10 or more years,[24] and sport types (individual and team sports). No identifiable details of participants are presented. The study was endorsed by an institutional research committee.

Survey Development

The survey questionnaire was initially developed by the lead investigator and subsequently refined (eg, content, clarity, structure, or relevance) by the core research team, comprising experienced researchers, sports scientists, and S&C practitioners, to ensure face validity. Content and construct validity were then qualitatively confirmed by another group within the research team with similar expertise, further supporting the appropriateness of the survey items. The members of the research team held either a master's degree or PhD in sports science-related fields and had extensive experience (>10 y) supporting elite and world-class athletes in different sports. Following this, 3 S&C coaches assisted with pilot testing and provided further feedback.[28] As this study was exploratory, the CROSS guidelines were adopted to guide the development and reporting of the survey where deemed applicable.[29] The sociodemographic section contained 9 questions, the planning and periodization section included 13 questions, and the testing and monitoring section contained 8 questions (30 questions in total). These questions were primarily multiple choice, with some optional open-text fields (see Supplementary Material [available online]).

Data Collection

Once the target audience was identified, the questionnaire was distributed through the authors' professional networks, with a focus on large organizations (sports institutes, clubs, and associations) within Asia to ensure appropriate representation. These organizations were given particular priority due to their established employment standards pertaining to S&C and their role in supporting top athletes in each country. Participants were informed of the study's purpose, objectives, estimated completion time, and confidentiality through an introductory section at the beginning of the online survey prior to providing consent.

Statistical Analysis

Data are reported as percentages, which were rounded to whole numbers (minor discrepancies may occur as a result) for overall responses and categorized by coach experience and sports. Chi-square test for independence was used to assess significance of the categorical variables based on residuals greater than 1.96 or less than −1.96, which was equivalent to $P \leq .05$. Qualitative terms were employed to describe the magnitude of observed frequencies:[25] "all" = 100% of respondents; "most" = 75% to 99%; "majority" = 53% to 74%; "approximately half" = 48% to 52%; "minority" = 26% to 47%; and "some" = 1% to 25%. When the overall distribution exceeded 25% (minority level), a proportion ratio of ≥2.0 (moderate difference) was highlighted to determine the magnitude of differences between experienced and less-experienced practitioners, as well as sport types (individual and team). The thresholds of proportion ratio were set at 1.11 (trivial), 1.43 (small), 2.0 (moderate), 3.3 (large), and 10 (very large) along with their reciprocals (0.9, 0.7, 0.5, 0.3, and 0.1).[30] Statistical analyses were performed using IBM SPSS Statistics for Windows (version 26.0, IBM Corp).

Results

There were no differences between more- and less-experienced practitioners or between sports types or individual and team sports (proportion ratio < 2.0, small or trivial) in any of the comparisons (Tables 1, 2, 3 and 4; Figures 1, 2 and 3).

All practitioners followed periodization, with the choice of models (*traditional, undulating, block*, *hybrid*) depending on training objectives (Table 1). However, the use of a single model, on average, was mostly <30%. *Hybrid* or multiple models were employed by more practitioners for *strength and power* (39% of practitioners), *strength endurance* (39%), and *sport-specific skills* (45%). For these objectives, the application of the traditional periodization model was the lowest (17%, 16%, and 14%, respectively). However, for *hypertrophy*, more practitioners used a *traditional* model (35%) than the other variants. For very short-term training (up to 4 wk), no "periodization model" was used predominantly by more than 40% of practitioners. The *undulating* model was used with the highest proportion (38%) for *strength endurance* development (Table 1).

Less than 30% of respondents perceived that emerging training methods (*autoregulatory*, *flexible*, *tactical*, *agile*, and *fluid*) were effective. Perceived effectiveness ranged from 29% in *autoregulatory* to 16% for *fluid* training methods (Table 1). Despite this, 43% of practitioners indicated "I regularly use" a *flexible* model, whereas the adoption rates for *autoregulatory* and *agile* models were < 25%.

Approximately half of the practitioners (48%) indicated that they "sometimes (when necessary)" worked within a multidisciplinary team in the planning of training (Table 2). Most practitioners indicated that they adjusted strength programs based on athlete feedback (90%), self-observation (78%), and technical execution (74%; Table 2). More practitioners considered adjustments of strength training on a monthly basis or "regularly" (38%), whereas the same percentage indicated making adjustments weekly or daily. A similar trend was observed for conditioning, with 37% reporting weekly or "frequently" modifications (26% "constantly" or daily; Table 3). The most challenging aspects of programming were fatigue management (72%), optimization of the training stimulus (53%), specificity (50%), and training adherence (47%; Table 2).

Half of the practitioners (50%) indicated that they "regularly" implemented *deloading* practices, whereas 45% said "only when necessary" (Table 2). Most practitioners used a taper (91%), with a *minority* having used a slow exponential taper (33%) or linear taper (26%) before competitions. During the *transition* phase, a majority indicated a "focus on technical aspects" (58%) or "other fitness components" (57%; Table 2). During *tapering* (Figure 1), practitioners opted for either high (>85%) or moderate (~60%–75%) loading intensities, especially for strength and power (44% and 38% each) and strength-dominant (50% and 38% each) sports. Moderate intensities were mostly applied in racquet (58%), ball (57%), and combat (46%) sports. Moderate and low intensities were commonplace within precision sports (both 48%), and a majority used low-load intensities (<50%) within endurance sports (63%).

More practitioners opted for "low volume" in strength and power (74%), strength-dominant (62%), ball (62%), combat (61%), and racquet (56%) sports (Figure 1). Both moderate and low volumes were applied within endurance (42% and 46% each) and precision sports (both 43%). For training frequency (Figure 1), in many sports during *tapering*, practitioners utilized moderate S&C training frequency (twice weekly). Practitioners in strength-dominant and precision sports considered both moderate and high frequency or >3 sessions per week (both 50%), whereas the majority (55%) in combat sports considered high-frequency training.

The effectiveness of S&C programs (Table 4) was mostly determined from testing results (90%), athlete/coach feedback (76%), monitoring (71%), training data (67%), and performance data/statistics (62%). Assessments of maximum strength were conducted twice (36%) or 4 times (31%) a year (Table 4), involving either 3 to 4 exercises (44%) or 1 to 2 exercises (32%; Table 4). The most common exercises used were bench press (88%), back squat (86%), deadlift (59%), and power clean (40%; Figure 4). Only 31% of practitioners considered using an athlete screening practice (eg, Functional Movement Screening; Table 4).

Approximately 71% of practitioners indicated that they "often or very often" monitored pretraining readiness using a conversational assessment, whereas 31% (often–very often) indicated using performance tests (Figure 2). In terms of the use of technology (Figure 2), *some* practitioners indicated that they "often/very often" used force plates (21%) or a velocity device (23%). The prevalence of subjective methods to monitor athlete status was 34% (Figure 2). Finally, volume load (81%) and session rating of perceived exertion (RPE) (72%) were the primary methods used to measure training load across all groups (Figure 3).

Discussion

Our findings indicate that periodization application varied depending on training objectives, with more practitioners utilizing *hybrid* approaches (multiple models) for strength and power, strength endurance, and sport-specific skill development. Less than 30% of practitioners perceived emerging "periodization" models to be effective; however, 43% regularly used a *flexible* model. Key programming challenges included managing fatigue from other sessions, and 90% of practitioners relied on athlete feedback rather than objective biomarkers or training metrics to adjust training. *Deloading* was common, and tapering varied in intensity, volume, and frequency depending on sports classification (ie, strength dominant, endurance). During transition phases, the *majority*

Table 1 Descriptive Reporting of “Periodization” Approaches Used in Resistance-Training Prescription

	Traditional	Undulating	Block	Hybrid	Others
(a) Regular periodization					
Strength and power, %	17	20	24	39	0
<10 y, 10+ y, %	27 ¦ 7	19 ¦ 21	23 ¦ 25	31 ¦ 46	0 ¦ 0
Individual, team, %	19 ¦ 14	27 ¦ 14	27 ¦ 21	27 ¦ 50	0 ¦ 0
Strength endurance, %	16	22	18	39	4
<10 y, 10+ y, %	29 ¦ 4	20 ¦ 24	13 ¦ 24	29 ¦ 48	8 ¦ 0
Individual, team, %	25 ¦ 8	25 ¦ 20	17 ¦ 20	29 ¦ 48	4 ¦ 4
Hypertrophy, %	35	14	23	29	0
<10 y, 10+ y, %	50 ¦ 19	19 ¦ 8	27 ¦ 19	23 ¦ 35	0 ¦ 0
Individual, team, %	46 ¦ 25	17 ¦ 11	21 ¦ 25	17 ¦ 39	0 ¦ 0
Sport-specific skills, %	14	18	20	45	2
<10 y, 10+ y, %	23 ¦ 4	27 ¦ 9	19 ¦ 22	31 ¦ 61	0 ¦ 4
Individual, team, %	13 ¦ 15	22 ¦ 15	26 ¦ 15	35 ¦ 54	4 ¦ 0
(b) Very short-term periodization (≤4 wk)					
Strength and power, %	18	29	20	33	0
<10 y, 10+ y, %	30 ¦ 7	30 ¦ 29	15 ¦ 25	26 ¦ 39	0 ¦ 0
Individual, team, %	19 ¦ 18	33 ¦ 25	22 ¦ 18	26 ¦ 39	0 ¦ 0
Strength endurance, %	20	38	8	32	2
<10 y, 10+ y, %	32 ¦ 8	40 ¦ 36	4 ¦ 12	20 ¦ 44	4 ¦ 0
Individual, team, %	21 ¦ 19	46 ¦ 31	8 ¦ 8	21 ¦ 42	4 ¦ 0
Hypertrophy, %	28	26	22	22	2
<10 y, 10+ y, %	44 ¦ 12	20 ¦ 32	16 ¦ 28	16 ¦ 28	4 ¦ 0
Individual, team, %	35 ¦ 22	30 ¦ 22	22 ¦ 22	9 ¦ 33	4 ¦ 0
Sport-specific skills, %	22	26	14	36	2
<10 y, 10+ y, %	35 ¦ 8	27 ¦ 25	12 ¦ 17	27 ¦ 46	0 ¦ 4
Individual, team, %	25 ¦ 19	29 ¦ 23	13 ¦ 15	29 ¦ 42	4 ¦ 0
	Autoregulatory	**Flexible**	**Tactical**	**Agile**	**Fluid**
(c) Emerging models					
I don’t know, %	14	12	14	26	33
<10 y, 10+ y, %	14 ¦ 14	14 ¦ 10	17 ¦ 10	28 ¦ 24	31 ¦ 34
Individual, team, %	3 ¦ 24	7 ¦ 17	10 ¦ 17	21 ¦ 31	31 ¦ 34
I don’t use it, %	31	16	28	36	34
<10 y, 10+ y, %	17 ¦ 45	21 ¦ 10	24 ¦ 31	38 ¦ 34	34 ¦ 34
Individual, team, %	31 ¦ 31	21 ¦ 10	45 ¦ 10	34 ¦ 38	31 ¦ 38
I regularly use it, %	24	43	31	17	16
<10 y, 10+ y, %	31 ¦ 17	31 ¦ 55	38 ¦ 24	14 ¦ 21	21 ¦ 10
Individual, team, %	28 ¦ 21	45 ¦ 41	24 ¦ 38	21 ¦ 14	10 ¦ 21
It’s effective, %	29	28	28	19	16
<10 y, 10+ y, %	38 ¦ 21	34 ¦ 21	21 ¦ 34	21 ¦ 17	14 ¦ 17
Individual, team, %	34 ¦ 24	24 ¦ 31	21 ¦ 34	21 ¦ 17	24 ¦ 7
It’s not effective, %	0	0	0	0	0
<10 y, 10+ y, %	0 ¦ 0	0 ¦ 0	0 ¦ 0	0 ¦ 0	0 ¦ 0
Individual, team, %	0 ¦ 0	0 ¦ 0	0 ¦ 0	0 ¦ 0	0 ¦ 0
It’s a misconception, %	2	2	0	2	2
<10 y, 10+ y, %	0 ¦ 3	0 ¦ 3	0 ¦ 0	0 ¦ 3	0 ¦ 3
Individual, team, %	3 ¦ 0	3 ¦ 0	0 ¦ 0	3 ¦ 0	3 ¦ 0

Note: Questions (a) Which periodization approach do you primarily use in resistance training to achieve the following objectives? (b) If you have limited time (up to 4 wk only), which periodization approach do you consider for the following objectives? (c) What best represents your perspective on the following emerging programming methods for strength training? No statistical difference was found in any of the comparative variables (experience level and sport type). Data are displayed by level of experience (<10 y = left number; 10+ y = right number) and individual (left number, line below) or team sport (right number, line below).

Table 2 Programming Challenges, Practices, and Unloading Strategies of Practitioners for the Total Cohort and by Experience

	Total, %	<10 y, %; 10+ y, %	Individual, %; team, %
(a) What is/are the most challenging aspect(s) of strength training programming?[a]			
Specificity	50	52 ¦ 48	48 ¦ 52
Individualization	43	52 ¦ 34	38 ¦ 48
Fatigue considerations	72	79 ¦ 66	76 ¦ 69
Optimization of training stimulus	53	55 ¦ 52	55 ¦ 52
Specific prescription challenges	34	34 ¦ 34	38 ¦ 31
Training adherence	47	34 ¦ 59	52 ¦ 41
Programming freedom	22	21 ¦ 24	21 ¦ 24
Other	3	0 ¦ 7	3 ¦ 3
(b) Do you work within a multidisciplinary team (eg, physiologist, nutritionist, biomechanist, physiotherapist) in the planning of strength training?			
Yes, very often	38	31 ¦ 45	45 ¦ 31
Yes, sometimes (when necessary)	48	52 ¦ 45	52 ¦ 45
No	14	17 ¦ 10	3 ¦ 24
(c) What is (are) the measurement(s) or indicator(s) you commonly use for adjusting the strength training program (contents)?[a]			
Neuromuscular	59	66 ¦ 52	59 ¦ 59
Technical execution	74	76 ¦ 72	76 ¦ 72
Athlete feedback	90	86 ¦ 93	90 ¦ 90
Self-observation	78	79 ¦ 76	79 ¦ 76
Movement speed	52	55 ¦ 48	41 ¦ 62
(d) Do you employ *deloading* phases in your training cycles? (eg, one easy week after 3 regular training weeks)?			
Yes, regularly	50	59 ¦ 41	48 ¦ 52
Only when necessary	45	41 ¦ 48	45 ¦ 45
No	3	0 ¦ 7	7 ¦ 0
Unsure	2	3 ¦ 1	0 ¦ 3
(e) What is your regular approach to *tapering* for strength training?			
Linear taper	26	31 ¦ 21	31 ¦ 21
Slow exponential taper	33	28 ¦ 38	28 ¦ 38
Fast exponential taper	10	7 ¦ 14	14 ¦ 7
Step taper	10	17 ¦ 3	10 ¦ 10
Multiple-step tapers (2 or 3 adjustments)	12	7 ¦ 17	7 ¦ 17
Do not use taper	9	10 ¦ 7	10 ¦ 7
(f) What is (are) your primary approach(es) to strength maintenance during a transition phase?[a]			
Focus on technical aspects	58	62 ¦ 56	54 ¦ 63
Focus on other fitness components	57	58 ¦ 56	54 ¦ 59
Minimal strength training during the transition	45	42 ¦ 48	50 ¦ 41
Other	4	0 ¦ 7	4 ¦ 4

Note: (a) Specificity (aligning training with sport-specific demands), individualization (individualizing based on the athlete's technical mastery), fatigue considerations (eg, from the sport-specific training sessions), optimization of training stimulus (across different athletes, eg, volume and intensity), specific prescription challenges (eg, needs to incorporate "corrective" exercises), training adherence (eg, athlete modifies programs as they wish), programming freedom (eg, deliver preferred program without head-/skill-coach modifications). (c) Neuromuscular (eg, vertical jump), technical execution (eg, visual appraisal of strength exercises), athlete feedback (eg, fatigue level, soreness, sleep quality), self-observation (eg, of athlete appearance, mood, etc), movement speed (eg, bar velocity).
[a]Participants were allowed to choose more than 1 option. No significant difference was found in any of the comparative variables (experience level and sport type).

of practitioners focused on technical aspects and other fitness components. Almost all practitioners used strength tests, primarily bench press, back squat, and deadlift, to track progress, and *some* also utilized screening tools. In addition, 71% utilized a conversational assessment to monitor pretraining readiness, and *some* used technology (<25%), such as force plate and velocity devices. Practitioners preferred simple methods (volume load and session RPE) to quantify training load. In contrast to our hypotheses, no differences were found with respect to coaching experience or sports types.

Table 3 Adjustment Frequency of Strength and Conditioning Programs by Total Cohort, Coaching Experience, and Sport Type

	Rarely	Occasionally	Regularly	Frequently	Constantly
(a) Strength training	2	22	38	28	10
<10 y, 10+ y, %	3 ¦ 0	24 ¦ 21	41 ¦ 35	24 ¦ 31	7 ¦ 14
Individual, team, %	0 ¦ 3	24 ¦ 21	35 ¦ 41	31 ¦ 24	10 ¦ 10
(b) Conditioning session	2	2	20	37	26
<10 y, 10+ y, %	4 ¦ 0	4 ¦ 0	22 ¦ 17	30 ¦ 46	33 ¦ 17
Individual, team, %	0 ¦ 4	0 ¦ 4	29 ¦ 11	33 ¦ 41	25 ¦ 26

Note: Question (a/b) “How often do you adjust or modify your strength and conditioning training program (contents)?” Rarely (once a year), occasionally (every few months), regularly (monthly), frequently (weekly), constantly (every session). No significant was difference found in all comparative variables (experience level and sport type).

Table 4 Testing and Monitoring Practices by Total Cohort, Experience, and Sport Type

	Total, %	<10 y, %; 10+ y, %	Individual, %; team, %
How do you assess the effectiveness of your strength and conditioning prescription?[a]			
Testing results	90	86 ¦ 93	93 ¦ 86
Regular monitoring	71	76 ¦ 66	72 ¦ 69
Training data	67	62 ¦ 72	76 ¦ 59
Athlete/coach feedback	76	76 ¦ 76	76 ¦ 76
Performance data	62	55 ¦ 69	48 ¦ 76
Other	2	0 ¦ 3	0 ¦ 3
How frequently do you assess athlete(s’) maximum strength?			
Weekly	2	3 ¦ 0	3 ¦ 0
Monthly	16	28 ¦ 3	17 ¦ 14
4 times a year	31	21 ¦ 41	28 ¦ 35
2 times a year	36	31 ¦ 41	38 ¦ 35
I don’t assess max strength at all	7	10 ¦ 3	7 ¦ 7
Other	9	7 ¦ 10	7 ¦ 10
Across how many exercises do you assess maximum strength?			
1–2 tests	32	38 ¦ 25	38 ¦ 25
3–4 tests	44	35 ¦ 54	41 ¦ 46
5–6 tests	21	21 ¦ 21	14 ¦ 29
7–8 tests	0	0 ¦ 0	0 ¦ 0
Others	4	7 ¦ 0	7 ¦ 0
Do you apply any athlete screening method(s)?			
I don’t use any screening method	29	31 ¦ 28	38 ¦ 21
I rarely use it	29	31 ¦ 28	34 ¦ 24
I use it regularly	31	31 ¦ 31	21 ¦ 41
I have found it not useful	14	14 ¦ 14	10 ¦ 17
Other	2	0 ¦ 3	3 ¦ 0

Note: Testing results (eg, strength, power, sprinting assessments), regular monitoring results (eg, weekly or monthly vertical jumps), training data (eg, performance during training [kg], bar speed), and performance data (results, statistics).
[a]Participants were allowed to choose more than 1 option. No significant difference was found in all comparative variables (experience level and sport type).

Periodization Models

This study found that practitioners often employ *hybrid* or multiple periodization approaches (39%–45%) to target specific objectives (ie, strength and power, strength endurance, or sport-specific skills) rather than adhering to a single model. *Hybrid* approaches combine 2 or more models across a season to target dominant motor qualities of a sport (eg, strength and power). For example, a *block* model might be used early in the season, followed by an *undulating* model during the competition period. Coaching philosophy, athlete level, and competition type (team vs individual) all likely influence periodization choice.[3,17] Single-model use, such as *traditional, undulating*, or *block* periodization models, was observed in < 25% of practitioners, except when hypertrophy was the targeted training

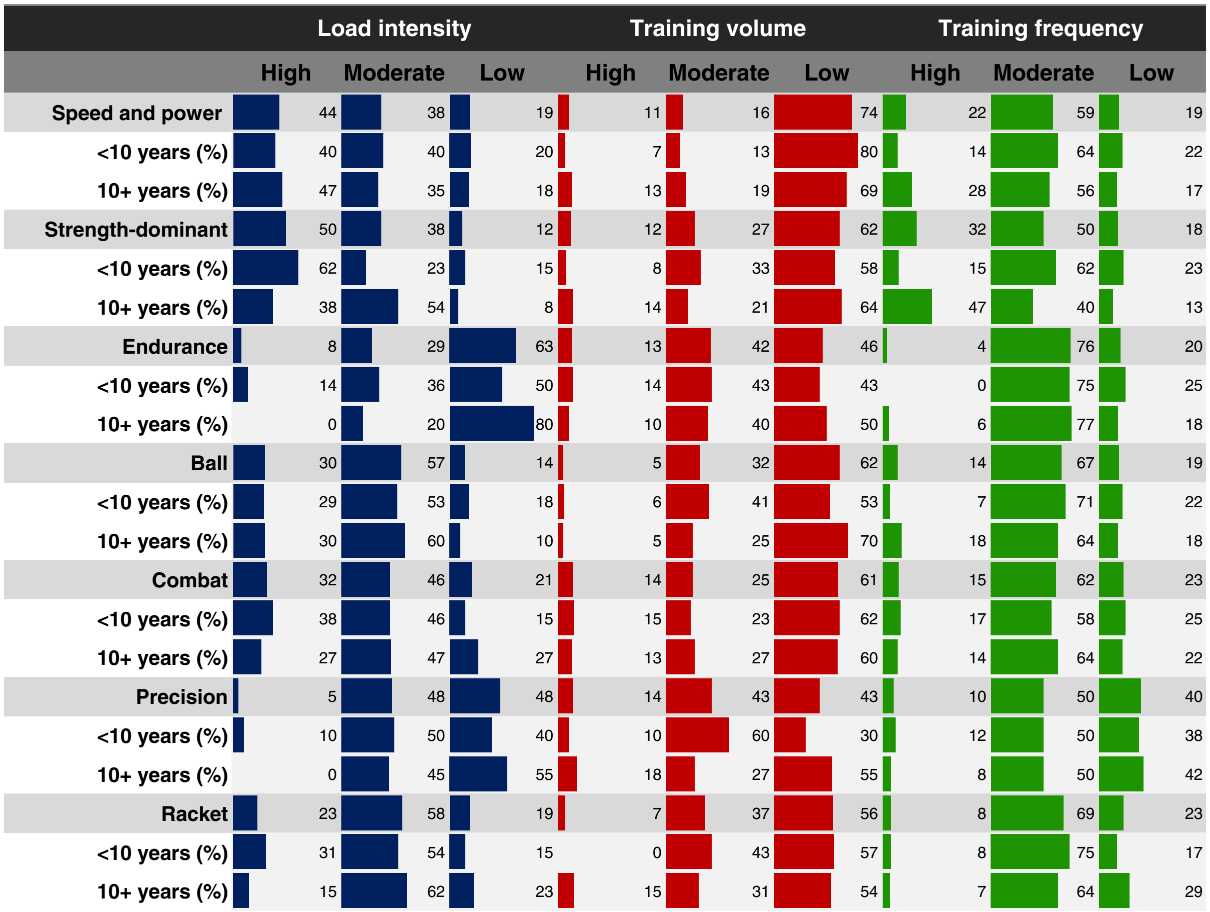

Figure 1 — Tapering strategies for load intensity, training volume, and training frequency by sport classification and coaching experience. *Note:* Speed and power sports (sprint running, skating, cycling, etc), strength-dominant sports (weightlifting, strongman, shot put, etc), endurance sports (long-distance events, triathlon, etc), ball sports (rugby, football, hockey, etc), combat sports (boxing, karate, etc), precision sports (bowling, shooting, etc), racket sports (squash, badminton, etc). *Intensity:* High load intensity (>85%), moderate load intensity (~60%–75%), and low load intensity (<50%). *Frequency:* High frequency (≥3 sessions per week), moderate frequency (2 sessions per week), and low frequency (1 session per week). No significant difference was found in any of the comparative variables (experience level).

outcome (35%). *Block* periodization as a single model, although underutilized, has previously been reported to be effective.[4] Likewise, *undulating* models have shown strength benefits over *linear* (traditional) models, particularly in trained athletes,[2] yet hypertrophy outcomes appear similar across periodization models when the training volume is equalized.[31] The study's findings reflect the current state of literature, where most existing studies on "periodization" models are considered "short-term," that is, <9 months,[2,13,32] and do not account for the broader process (managing overtraining risk, long-term effects, etc) within extended time frames.[13]

For "very" short-term "periodization" (up to 4 wk), similarly, no single model was used by more than 40% of practitioners. Short preparation periods are common in athletic training,[33,34] with different models applied depending on training objectives. *Undulating* model was favored by 38% of respondents for strength endurance, allowing practitioners to split the repetition range in a short time frame.[1,33] For example, one session might use 15 repetitions, whereas another increases volume to 25 repetitions to enhance fatigue resistance. In a *block* model aimed at power optimization,[4] training may be structured based on the strength–power continuum—basic/max strength emphasis, followed by speed/power emphasis and tapering —though its effectiveness over a short period remains uncertain.

Regardless of models, very short-term resistance training can enhance muscle force through neural adaptations[35] and increased peak force (~10%) and muscle cross-sectional area (~5%),[36] including in professional rugby players.[33] Enhanced performance outcomes in very short-term training programs depend on the efficacy of programming strategies.[13] These findings demonstrate a need to select programming models that align with specific training needs within short time frames that are common in sporting environments.

Among the "emerging periodization," the *flexible* model showed the highest use (43%) and perceived effectiveness (28%). This usage likely reflects the ability of this approach to adjust training to meet individual needs (eg, swapping heavy and light days based on readiness).[37] *Fluid* and *agile* (iterative, continuous training adjustment based on changing needs)[38] models displayed less utility, with 33% and 26% respectively. *Autoregulatory* training, which permits strength increase/progression at one's own pace based on daily and weekly variations in performance,[9] was seen as "effective" by 29% and "regularly used" by 24%, indicating some integration within current practice.[9] Conversely, the *fluid* model, which emphasizes daily adjustment to volume and intensity based upon prior physiological monitoring (before each training session),[7] had low perceived effectiveness (16%) and use (16%), potentially due to challenges of application within daily practice. These

	I don't use	Rarely	Occasionally	Often	Very often
How often do you identify "pre-training readiness" among athletes (i.e. before commencing warm-ups)?					
Wellness questionnaires (%)	26	9	19	22	24
<10 years (%)	28	10	24	17	21
10+ years (%)	24	7	14	28	28
Individual (%)	28	10	21	21	21
Team (%)	24	7	17	24	28
Performance tests (%)	14	14	41	22	9
<10 years (%)	7	14	48	17	14
10+ years (%)	21	14	34	28	3
Individual (%)	14	10	41	28	7
Team (%)	14	17	41	17	10
Sleep assessment	29	10	17	21	22
<10 years (%)	21	21	17	14	28
10+ years (%)	38	0	17	28	17
Individual (%)	21	10	24	24	21
Team (%)	38	10	10	17	24
Hydration status	45	9	22	12	12
<10 years (%)	45	10	21	17	7
10+ years (%)	45	7	24	7	17
Individual (%)	55	14	17	7	7
Team (%)	35	3	28	17	17
Physiological biomarkers	69	14	12	3	2
<10 years (%)	59	21	14	3	3
10+ years (%)	79	7	10	3	0
Individual (%)	72	7	14	3	3
Team (%)	66	21	10	3	0
Conversational assessment	5	3	21	26	45
<10 years (%)	10	7	24	21	38
10+ years (%)	0	0	17	31	52
Individual (%)	7	7	10	31	45
Team (%)	3	0	31	21	45
Other	69	5	16	7	3
<10 years (%)	69	10	10	10	0
10+ years (%)	69	0	21	3	7
Individual (%)	62	7	10	14	7
Team (%)	76	3	21	0	0
How often are the following technologies and other methods used for monitoring athlete status?					
Force plate	32	9	39	14	7
<10 years (%)	29	7	39	11	14
10+ years (%)	34	10	38	17	0
Individual (%)	11	11	43	25	11
Team (%)	52	7	34	3	3
Velocity device	28	14	36	16	7
<10 years (%)	21	21	41	7	10
10+ years (%)	34	7	31	24	3
Individual (%)	14	14	38	24	10
Team (%)	41	14	34	7	3
Salivary biomarkers	83	9	5	3	0
<10 years (%)	83	10	3	3	0
10+ years (%)	83	7	7	3	0
Individual (%)	79	10	3	7	0
Team (%)	86	7	7	0	0
HRV monitor	50	7	21	10	12
<10 years (%)	48	10	21	14	7
10+ years (%)	52	3	21	7	17
Individual (%)	55	0	21	14	10
Team (%)	45	14	21	7	14
Subjective methods	17	10	34	17	21
<10 years (%)	14	21	34	10	21
10+ years (%)	21	0	34	24	21
Individual (%)	21	14	31	21	14
Team (%)	14	7	38	14	28

Figure 2 — Athlete-monitoring tools and methods used among practitioners by total cohort, experience, and sport type. No significant difference was found in any of the comparative variables (experience level and sport type).

	Total	<10 years	10+ years	Individual	Team
I don't measure training load	14%	17%	10%	17%	10%
Volume load	81%	90%	72%	76%	86%
Session RPE	72%	72%	72%	62%	83%
Duration alone	12%	14%	10%	14%	10%
Distance	22%	28%	17%	21%	24%
Training impulse or TRIMP	10%	14%	7%	7%	14%
Anaerobic load (lactate)	5%	3%	7%	3%	7%
Global Positioning System	22%	14%	31%	10%	34%
Inertial Sensing System	3%	3%	3%	0%	7%
Monitoring software	9%	14%	3%	14%	3%
Management System	17%	14%	21%	17%	17%
Training diaries	17%	17%	17%	14%	21%
Other	0%	0%	0%	0%	0%

Figure 3 — Measurements of training load in strength and conditioning by total cohort, experience, and sport type. *Note:* Question "How do you measure training load in strength and conditioning?" No significant difference was found in any of the comparative variables (experience level and sport type). Color coding shows the prevalence of training load measures, with red for high use (eg, volume load), yellow for moderate, and light yellow for low usage. See online article for color version of the figure.

emerging models, though subtly distinct, seemingly reflect "overlapping concepts" that collectively emphasize a need for "flexibility" in training prescription so it is tailored to the athlete's condition. Although additional empirical support may be necessary, these emerging models are often seen as programming strategies implemented within broader planning of periodization for athletes.[4,12] In this context, "autoregulation" ("flexibility") in periodization seems essential for guiding programming strategies.[1,4,5,12] Our current data demonstrate that S&C coaches across Asia have an awareness of these concepts and utilize them within applied practice, although this number was modest.

Programming Framework and Training

Approximately half of practitioners (48%) reported that they "sometimes collaborated" with a multidisciplinary team, enabling input integration with coaching expertise to enhance programming.[18] Athlete performance is multidimensional (eg, physical, mental, and social), which must be contemplated integrally in multidisciplinary periodization solutions[3,39] in addition to integrated sports science applications (eg, recovery, nutrition, psychology) to enhance periodization and influence training theory and practice.[3]

We found that most practitioners used subjective measures (athlete feedback) and observation (including technical execution) to inform training adjustments. These methods are more straightforward and practical for understanding and enhancing training.[40,41] There was also a high prevalence of objective measures, such as neuromuscular data (59%) and movement speed (52%), which are important to prescribe training that closely matches individual capacity and tolerance on any given day.[41] Likely related to programming "flexibility" in training, S&C practitioners reported that strength training programs were typically adjusted either monthly (38%) or weekly/daily (38%), whereas conditioning was modified more frequently, often weekly (37%) or daily (26%; Table 3). Furthermore, the greatest programming challenges were predominantly aligned with "fatigue from previous training," and approximately half of the respondents identified challenges around optimizing the training stimulus, specificity, and adherence. Adjustment of daily routines based on athlete needs and contemporary capability seems vital[42] to avoid overreaching, injury, and illness.[43] For example, younger and older athletes, as well as those with higher and lower performance capacities, muscle typology, and training age, may recover at different rates.[44,45] In addition, fatigued athletes may lack motivation to carry out noncompetitive, maximal-effort tasks.[46] Thus, among elite athletes, optimal stimulus in strength development (for example) would require appropriate training (eg, low-volume, high-intensity sessions with long rest periods) along with additional motivation and encouragement.[42] These findings signify that a degree of athlete individualization and appropriate program adjustment is necessary to achieve optimal programming and training outcomes.

Unloading Strategies

During the *transition* phase, coaches primarily emphasized technical aspects and other fitness components. This period typically involves maintenance of training (reduced training, cross-training) as well as recovery.[3] Interestingly, almost all practitioners considered a *deloading* strategy, either consistently (50%) or when necessary (45%). This period usually occurs in training where *wavelike* increases in volume loads are implemented[4]; for example,

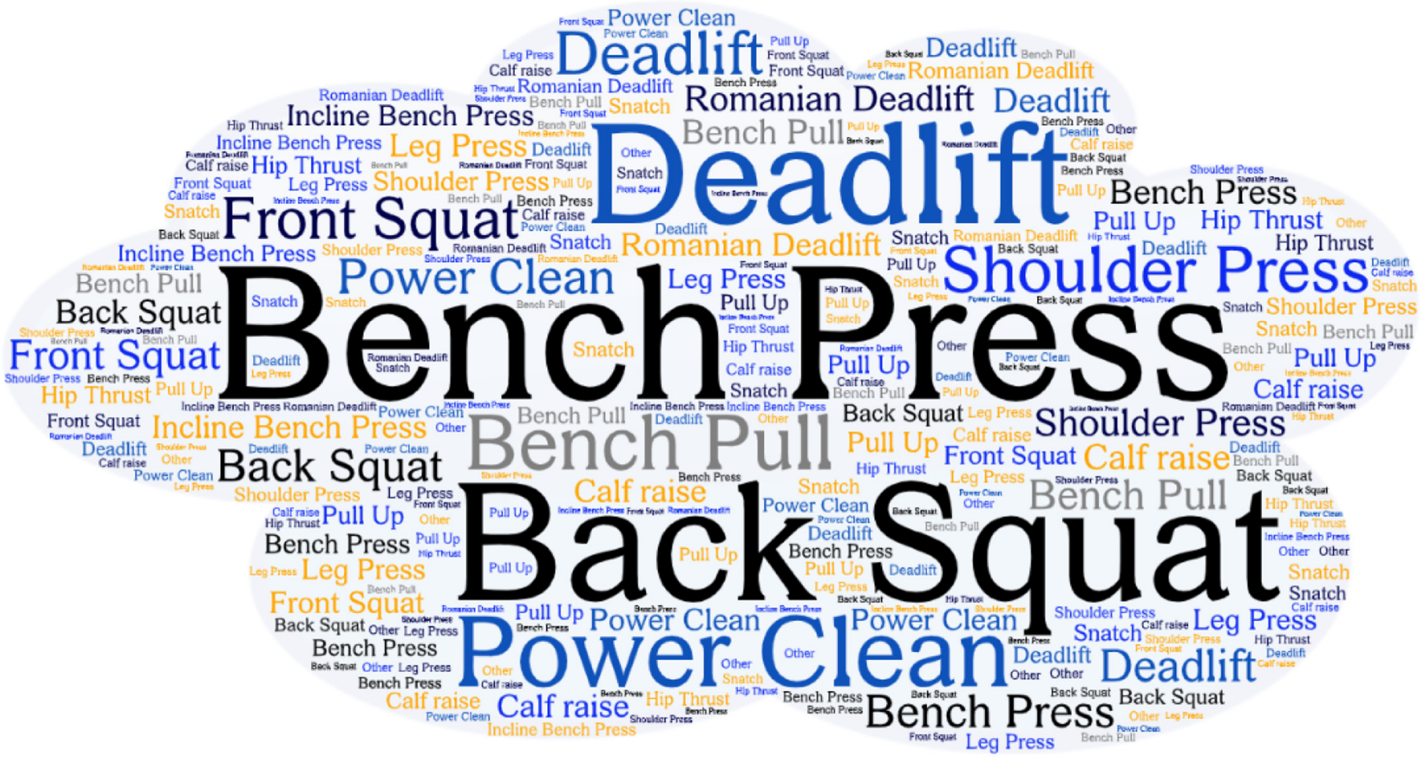

Figure 4 — Commonly prescribed maximum strength assessments. *Note:* Question "What are the exercises commonly used in your maximum strength assessment?" (*Participants were allowed to choose more than 1 option*). The percentage distribution is represented by font size, with the bench press (88% of 58 S&C coaches), back squat (86%), deadlift (59%), power clean (40%), bench pull (31%), and shoulder press (26%) being the 6 most frequently utilized exercises. Utilization of leg press (17%), hip thrust (14%), front squat (12%), and snatch (10%) was lower, and the adoption rates of other exercises (eg, Romanian deadlift, pull-up/chin-up, incline bench press, calf raise) were <10% (out of 58 S&C coaches). The figure was created using WordArt (https://wordart.com/).

volume loads with 3 weeks on (increases) and 1 week off in a cyclic manner. Such an approach is designed to reduce fatigue, avoid the deleterious effects of prolonged high training demand, and facilitate the realization of meaningful physiological adaptations.[13]

Most practitioners (91%) used a taper strategy. This application was predominantly a slow exponential taper (33%) or linear taper (26%). Depending on sports, practitioners either utilized *moderate* to high *intensity* (speed and power 44%; strength dominant 50%), moderate *intensity* (racquet 58%; ball 57%; combat 46%), or low *intensity* (endurance 63%). During taper phases, practitioners considered low *volume* for most strength-focused sports (56%–74%) as well as using moderate *frequency* overall (twice per week), with high *frequency* preferred in combat (55%) and strength-dominant sports (50%). The manner of adjustment (tapering strategy) in intensity, volume, and frequency varied, primarily based on sports classification (ie, strength and power, endurance, racquet). This observation is consistent with Mujika and Padilla,[15] who reported diverse tapering strategies across different sports (eg, endurance and power based). Other studies focused more on the systematic reduction of training load as a universal tapering approach.[47]

Testing and Monitoring

Testing appeared to be common to assess athlete development (90%). Approximately two thirds of practitioners conducted strength testing up to 4 times a year, with 76% assessing up to 4 exercises—most commonly the bench-press (88%) and back-squat (86%) exercises. Most previous studies reported a similarly high rate of physical testing utilization (92%–100%) among practitioners, primarily from the United States and European countries.[48] Weldon et al[48] reported that a range of tests (strength, power, speed, agility, etc) were utilized in different sports, and the most common were body composition (86%), strength (75%), and power (70%). However, due to intensive playing schedules, (eg, in Major League Baseball), fewer assessments were conducted for strength (33%), power (33%), speed (19%), and acceleration (5%).[49] However, use of simpler, nonphysically demanding tests (ie, body composition) was unanimous (ie, 100%).[48] Interestingly, the current study also highlights a broader range of strategies to evaluate the effectiveness of S&C programs, including feedback from athletes or coaches (76%), monitoring (71%) and training data (67%), and even utilizing performance data or statistics about athletes (62%).

Assessments can be embedded within training sessions using alternative approaches, for example, one-repetition maximum predictions.[48] It is important to note that the extensive demands of a long season and intensive playing schedules (eg, team sports) may limit the time available for testing.[48] Within team sports where cardiovascular fitness is a large performance-determining factor, practitioners may also "test" by monitoring physiological responses such as heart rate during submaximal training activities (eg, matched intensity training drills).[50] "Invisible monitoring" (eg, using built-in instruments to seamlessly stream data) also enables load evaluation while minimizing athlete and practitioner burden,[51] all ensuring nondisruptive testing and monitoring within the available time for training.[47] In this context, Asimakidis et al[52] highlighted that testing results (visualization) were typically produced using Microsoft Excel (79%) and, to a lesser extent, Microsoft Power BI (32%). Furthermore, athletes generally received intuitive, individualized reports highlighting performance and areas for improvement, whereas coaches were provided with more comprehensive analyses and comparisons.[52]

To identify pretraining readiness, a *majority* of practitioners (71%) favored a conversational approach, whereas the use physiological biomarkers was limited (Figure 2). Biomarkers (eg, hormones) may be altered following intensified training but do not always directly reflect changes in exercise performance.[43] Therefore, usage of blood lactate (range 2%–45%) and saliva monitoring (24%), as well as heart rate indices (1%–98%) and heart rate variability, in high-level football (35%) remains varied.[20] Given the complex relationships between physiological responses, training load, injury, and performance, practitioners should ideally incorporate subjective and objective readiness measures (training and competition).[18,19] Monitoring internal and external training demands is necessary for understanding an athlete's load.[53] Subjective well-being may generally decline with acute increases in training load and during chronic training but improves with acute load reductions.[54] Nevertheless, only 31% of practitioners reported "often–very often" monitoring of daily fatigue or recovery using performance tests. Athlete monitoring systems appear to have greater impact (including acceptance) when accompanied by an education program.[19]

Our data demonstrate that *some* practitioners in this cohort consistently use technology such as force plates (21%) and velocity devices (23%) to monitor performance and physical status, and there are almost comparable considerations of subjective methods (34%). In a study involving practitioners from 17 countries, technology-based equipment was widely used (65%); the use of "other assessment devices" (55% vs 14% in force plate) was highest, followed by bar velocity trackers (41%) and speed gates (23%).[48] This observation reflects the growing trend toward more advanced tools for accurate and objective measurements[6,20] to inform better decision-making processes.[19] Nevertheless, usage of salivary biomarkers (8%) for monitoring athlete status was very low, although 22% (often–very often) reported heart rate variability use (Figure 2). Practitioners have quantified training loads primarily through volume load (81%—strength training) and session RPE (72%) methods, which are simple and practical, especially when monitoring a large number of athletes.[46,55] Quantifying training load is important for informed decision making and appropriate load prescription for athletes.[51] Session RPE, in particular, can be advantageous for practitioners as it is an affordable, time-efficient, and holistic measure of training load.[53,55] It also negates the divergent responses often observed from internal and external load monitoring approaches, which measure different aspects of training.[53] Our data indicate that S&C is adopting data-driven approaches, with testing and monitoring as integral aspects of athlete development programs. We are also aware that certain technologies carry inherent and recurring costs (eg, software updates, cloud services), which could influence the extent to which such tools are adopted. However, the increasing availability of valid and reliable mobile-based solutions may support broader and more cost-effective adoption.[56]

We acknowledge that the study relies on self-reported data, which may introduce recall bias and limit the ability to independently verify responses. Our sample primarily consists of practitioners working with large sports institutes and clubs, which may introduce a bias toward broader S&C practices across Southeast and East Asia. Female participation was limited, which likely reflects a wider sex imbalance of S&C practitioners within the profession.[57] Furthermore, the survey was administered only in English, which may have limited accessibility and reduced the potential sample size. However, this approach was considered satisfactory given the exploratory nature of the study. The authors are fully aware of the "debates" surrounding periodization terminologies and conceptualization, including model classification, for example, block versus sequential. However, as an exploratory and descriptive study, our focus is on capturing current S&C practices (in an underreported population) through a balanced, comprehensible, and inclusive approach. We investigated "emerging training models," some of which have subtle distinctions, with similar implications for affecting practice. This may have confused some practitioners, despite the availability of a relevant option (eg, "I don't know"). Peaking strategies are context specific to athletes and sports, although we presented data based on groups of similar sports. Future research could enhance these insights by incorporating qualitative approaches, such as interviews, to explore the underlying reasons behind certain practices in greater depth. Finally, replication of survey-based studies is recommended to observe longitudinal developments in generic and sport-specific practices (including specific topics, eg, peaking, tapering, invisible monitoring) as the S&C field continues to evolve.

Practical Applications

See Figure 5 for an infographic illustrating this list.

- Coaches appear to use *hybrid* periodization (multiple models) and incorporate "flexible programming" based on athlete readiness (condition or contemporary capability) to meet specific training objectives (eg, strength, power).
- Coaches can apply sport-specific *deloading* and *tapering* strategies to manage fatigue and recovery and adapt intensity, volume, and frequency based on sports and competition needs.
- Athlete feedback should remain prominent in informing programming adjustments, particularly where resources limit access to objective biomarkers.
- In time-limited situations, strength tests (eg, bench press and back squat) can be embedded into training to track progress and minimize training disruption.
- Efficacy of S&C programs can be appraised via testing as well as coach/athlete feedback, monitoring, and/or training and performance data/statistics.
- Where possible, technology (eg, force plates and velocity devices) may supplement subjective methods to inform and enhance decision making.
- Coaches can use simple methods to quantify training load, such as volume load (weight × set × repetition) and session RPE (sRPE and duration).

Conclusion

This study highlights a diverse range of periodization practices among S&C practitioners. This reflects an adaptive approach that balances training objectives, sport-specific demands, and challenges (athlete needs and load management). The use of *hybrid*

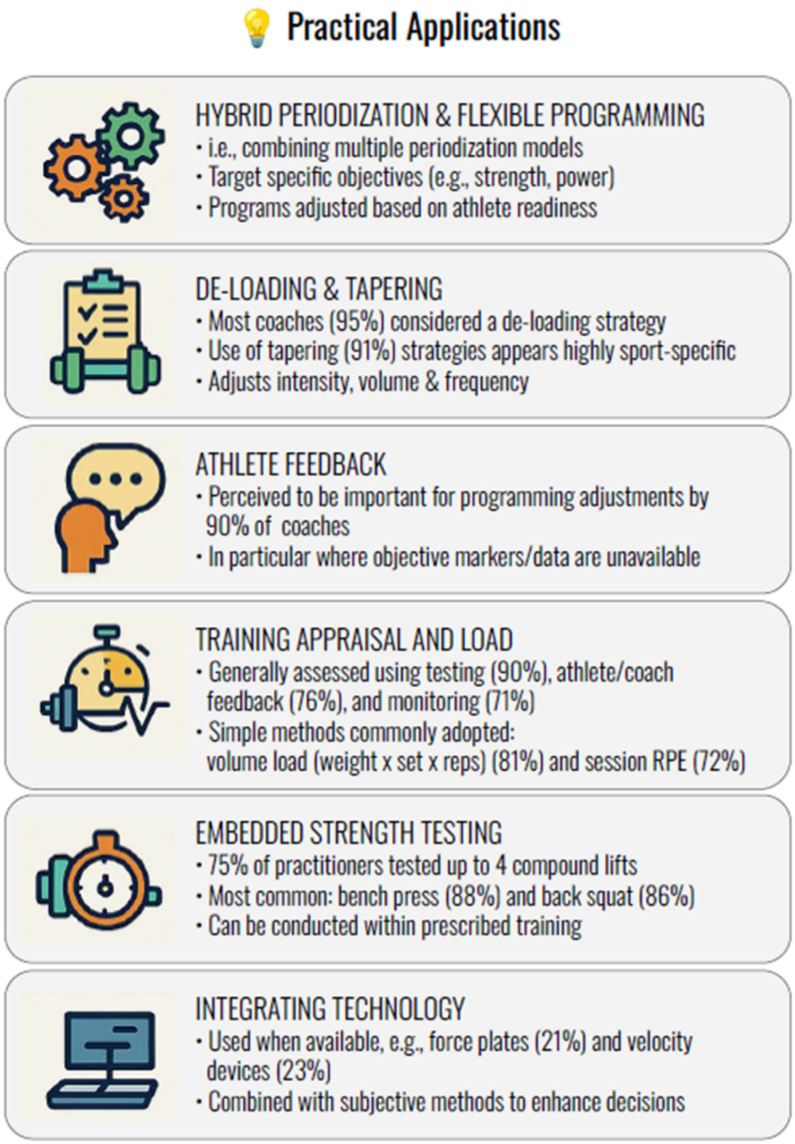

Figure 5 — Main take-home messages on current periodization, testing, and monitoring practices of strength and conditioning coaches.

periodization models was prevalent, particularly to address multiple objectives such as strength and power, strength endurance, and sport-specific skills. Emerging programming methods were modestly applied to accommodate individual athlete responses. The application of *deloading* and *tapering* was widespread and varied across sports. For many practitioners, a simple conversation with athletes appears to remain central to identify training readiness, with a subjective approach to guide training prescription and adjustment. Besides, *most* practitioners utilize traditional strength assessments, although some also incorporate advanced technologies for monitoring. Finally, training loads were primarily quantified using volume load and session RPE methods.

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