

STRENGTH AND CONDITIONING PRACTICES OF NATIONAL BASKETBALL ASSOCIATION STRENGTH AND CONDITIONING COACHES

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ABSTRACT. Simenz, C.J., C.A. Dugan, and W.P. Ebben. Strength and Conditioning Practices of National Basketball Association Strength and Conditioning Coaches. *J. Strength Cond. Res.* 19(3):495–504. 2005.—This study describes the results of a survey of the practices of National Basketball Association strength and conditioning (NBA S&C) coaches. The response rate was 68.9% (20 of 29). This survey examines (a) background information, (b) physical testing, (c) flexibility development, (d) speed development, (e) plyometrics, (f) strength/power development, (g) unique aspects, and (h) comments from coaches providing additional information. Results indicate, in part, that coaches assess an average of 7.3 parameters of fitness, with body composition testing being the most common. All coaches used a variety of flexibility development strategies. Results reveal that 17 of 20 (85.0%) of NBA S&C coaches follow a periodization model. Nineteen of 20 coaches (95.0%) indicated that their athletes used Olympic-style lifts. All coaches employed plyometric exercises with their athletes. The squat and its variations, as well as the Olympic-style lifts and their variations, were the most frequently used exercises. The survey serves as a review and a source of applied information and new ideas.

KEY WORDS. periodization, speed, power, agility, flexibility, program design

INTRODUCTION

Basketball is a popular team sport throughout the U.S.A. and the world. The National Basketball Association (NBA) now boasts players from around the world, each bringing talents and skill sets unique to that athlete and the locale of his development. Not surprisingly, several articles have described the components of basketball conditioning programs (18, 25, 26) or scientifically evaluated aspects of physical conditioning (4, 8, 10, 14, 20, 24, 30, 31, 33, 34, 35) because it is thought that conditioning is important for success in professional basketball (18). With players entering the NBA from nearly every continent, it is likely that a variety of strength and conditioning practices and programs have been followed, some similar and some quite different from NBA practices. Also, with the recent trend toward drafting younger players, conditioning may play an even larger role in the development of the professional basketball player.

Surveys are an effective method of determining contemporary strength and conditioning practices. They have been used to examine strength and conditioning programs of college (2, 3, 5, 9, 16, 19, 23) and professional (6, 7, 27) athletes and coaches. Sutherland and Wiley (27) surveyed strength and conditioning services for professional athletes in four sports including basketball. That

survey did not focus on the specific strength and conditioning practices used by coaches in these sports, however.

The responsibilities of the NBA strength and conditioning (NBA S&C) coach are many, including program design, exercise technique, organization and administration, and testing and evaluation. Whereas investigators have examined the role of the strength and conditioning coach in other professional sports (6, 7), there has been no examination of NBA S&C coaches. The purpose of this survey was to examine a variety of strength and conditioning practices and the collective knowledge of NBA S&C Coaches and to describe the common and the unique strength and conditioning practices employed by these coaches.

METHODS

Experimental Approach to the Problem

Based on commonly used qualitative research methods, we administered the survey of strength and conditioning practices in an attempt to answer the guiding question of whether NBA S&C coaches used contemporary, scientifically based principles in the practice of their strength and conditioning programs and whether they would be willing to share their ideas with us. Based on interpretive methods, we avoided the use of a leading hypothesis because doing so can lead to biased interpretation of data. We attempted, however, to pose our guiding question in a format that addressed the standard empirical hypothesis format.

Survey

The survey, *Strength and Conditioning Practices of Professional Strength and Conditioning Coaches*, was adapted from that of Ebben and Blackard (6). The survey contained 8 sections: background information, physical testing, flexibility development, speed development, plyometrics, strength/power development, unique aspects of the coaches' program, and comments, and was based on the National Strength and Conditioning Association's 1988 Role Delineation Study (21).

Data Collection

An introductory letter describing the project was sent to all NBA S&C coaches. Within 1 month, a survey and cover letter were mailed. The purpose of the cover letter was to again explain the survey, the expected time commitment, and the confidentiality of information. All surveys were sent with a self-addressed, stamped envelope. A sec-

TABLE 1. NBA strength and conditioning coaches responses to survey.

Survey inquiry	Number of teams responding	Total response rate
First mailed survey	7	24%
Second mailed survey	8	52%
Third mailed survey	1	55%
Telephone interview	2	62%
E-mail response	2	69%
Unwilling to respond	1	

ond letter and copy of the survey were sent to NBA S&C coaches who did not respond to the first mailing. Additional attempts were made to contact NBA S&C coaches who did not respond to the mailed surveys. The NBA S&C coaches either returned the surveys, granted a telephone interview, completed the survey via email, refused to participate, or did not respond to the mailing or telephone messages. Data were collected from November 2002 to July 2003. After completion of data collection and analysis, a report of survey findings was mailed to all NBA S&C coaches participating in the survey. No coach or team name was associated with any responses.

Statistical Analyses

The survey contained fixed-response and open-ended questions. Answers to open-ended questions were content-analyzed according to methods (22) previously used in other surveys of professional sports strength and conditioning practices (6, 7). Investigators were trained and were experienced with qualitative methods of sports science research and content analysis. During data analysis, each investigator generated raw data and higher-order themes via independent, inductive content analysis and compared independently generated themes until consensus was reached at each level of analysis. At the point of development of higher-order themes, deductive analysis was used to confirm that all raw data themes were represented.

RESULTS

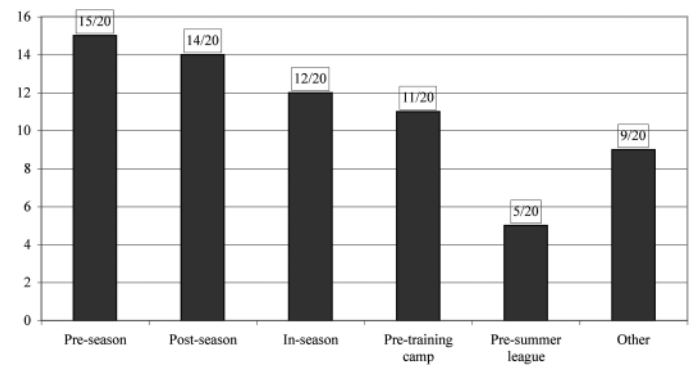
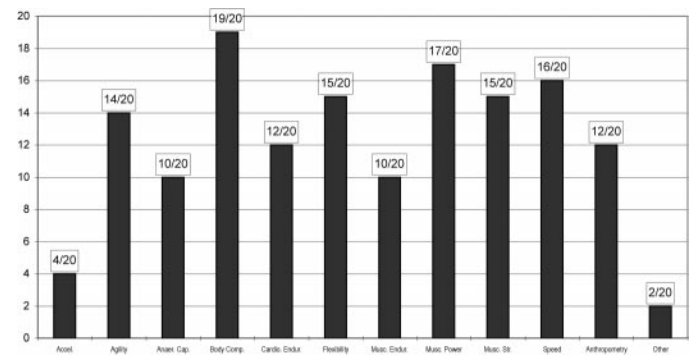
Background Information

Twenty of 29 (68.9%) NBA S&C coaches responded to the survey. One NBA S&C coach directly refused to participate. The remaining 8 NBA S&C coaches did not respond to the mailed surveys or telephone messages. Table 1 presents responses to the first mailing, the second mailing, telephone contact or third mailing, and email participation.

Twenty coaches reported their names and tenure in the NBA, resulting in a mean average of 9.55 years. Nine coaches reported having an assistant, 2 of whom were part-time assistants. One coach reported having 2 assistants, and 2 coaches reported having 1 or more interns.

Physical Testing

The second section of the survey assessed variables of physical testing. Coaches were asked how often and what times of the year variables of athlete fitness were tested (Figure 1), what parameters of fitness were tested (Figure 2), and what specific tests were used. Coaches reported testing an average of 7.3 parameters of fitness using 7.8 specific tests. Seven NBA S&C coaches who responded

**FIGURE 1.** Times when variables of athlete fitness are formally measured.**FIGURE 2.** Variables of athlete fitness tested by National Basketball Association strength and conditioning coaches.

“other” provided additional information about physical testing, including information that physical fitness testing occurred “weekly in season (weight and body fat),” “every other week through season (body fat),” “monthly (weight and body fat),” “every 6 weeks in season,” “dependent on the player,” “predraft,” and “possibly in the summer months in specific situations,” each of which was reported by 1 coach. Regarding which variables of physical fitness were measured and what specific tests were used, 15 NBA S&C coaches reported measuring muscular strength. Methods included the “bench press,” reported by 10 coaches; a “leg press,” reported by 5 coaches; a “squat test,” reported by 2 coaches; “pull-ups,” reported by 2 coaches; and 1 coach each reported testing the following: “Biodex, isokinetic lower body at 60°·s⁻¹”; “standing, 8-kg medicine ball throw”; “grip”; “5 repetition maximum (RM)”; and “185RM.”

Nineteen NBA S&C coaches reported measuring body composition. Ten coaches used “skin calipers” or “skin-folds”; 2 reported “% body-fat testing”; and 1 coach each reported using the following: “height and weight”; “CPU program after skinfolds”; and “skinfold, 5 sites and 3 formulas,” and “skinfold, 7 sites.”

Ten NBA S&C coaches reported testing for anaerobic capacity. Three coaches indicated testing anaerobic capacity using some form of a 17 width test. Variations included the “17 width × 3, 2-minute recovery”; “17 test”; and “4 × 17 court test.” One coach each reported using “300-yard dash,” “court-drill test,” “5 sets of 10 lengths (on court),” “standardized conditioning circuits,” and a “step test.”

Fourteen NBA S&C coaches stated that they measure

agility. Two coaches each reported using “t-test” and “box drill.” Other tests included a “National Basketball Strength and Conditioning Association protocol,” “20-yd drill,” an “in the paint (small t-test),” “lane box test,” “10-m shuttle,” “slides,” “lane agility,” and “court testing,” each reported by 1 coach.

Seventeen NBA S&C coaches reported measuring muscular power. Thirteen coaches reported using variations of the vertical jump (VJ). These variations included the “vertical jump and leap” and the “standing vertical jump,” each reported by 7 coaches; “running and approach vertical jump,” cited by 3 coaches; “1-step vertical jump,” used by 2 coaches; and “the countermovement vertical jump,” “repeat VJ,” and “3–5 step VJ,” each reported by 1 coach. Two coaches reported testing “horizontal and long jumps.” One coach each indicated that he used “Agaton thrust”; “seated, medical ball throw”; “snatch press”; “high pulls”; “power clean”; and “5RM.”

Fifteen NBA S&C coaches stated that they measure flexibility. Methods included a “sit-and-reach test,” reported by 9 coaches, as well as a “Gray and Cook’s movement screen (modified),” “a spread eagle,” “a variety of range of motion tests,” and “static and dynamic movements,” each reported by 1 coach.

Twelve NBA S&C coaches said they measured cardiovascular endurance. Methods used included “ $\dot{V}O_2$ max” and “300-yd shuttle,” each used by 2 coaches, and “2-mi. treadmill run,” “submax treadmill,” and “the treadmill test,” reported by 1 coach each.

Sixteen NBA S&C coaches tested for athlete speed. Seven coaches used the three-quarter court sprint, examples of which included “baseline to far free throw line (three-quarter court),” “25-yd (three-quarter court) sprint,” and “three-quarter court sprint.” Two coaches reported using “court sprints,” and 1 coach each said he tested the “40-yd dash,” “full-court sprint,” “basketball situational speed,” “the 20-m sprint,” and “court testing.”

Two NBA S&C coaches reported measuring other variables of physical fitness, including “5 down-and-backs in 65 seconds” and “medical, submax $\dot{V}O_2$.”

Twelve NBA S&C coaches reported taking anthropometric measurements on their athletes. Five coaches indicated measuring “wingspan.” Four coaches reported measuring “height”; 3 coaches each measured “weight” and “reach.” Two coaches reported measuring “hand size,” and 1 coach each indicated measuring “girth,” “skinfold and calipers,” “during rookie camp,” “body composition,” “tape measure,” and using an “athletic trainer.”

Ten NBA S&C coaches reported measuring muscular endurance. Methods of measuring muscular endurance included a “bench press to fatigue at 185 lbs,” used by 4 coaches; “1 minute crunch and sit-up test,” used by 2 coaches; and “push-ups,” “dips,” “pull-ups,” and “Biodex (low body) at $300^\circ \cdot s^{-1}$,” each used by 1 coach.

Four NBA S&C coaches tested acceleration using tests such as a “full-court sprint (shuttle sprint),” “20-m sprint,” and “court testing,” each reported by 1 coach.

Flexibility Development

The 20 NBA S&C coaches all reported that their teams performed some type of flexibility training. Every NBA S&C coach indicated that their teams performed static flexibility exercises. Eighteen, 15, and 5 coaches reported that they employed dynamic, proprioceptive neuromus-

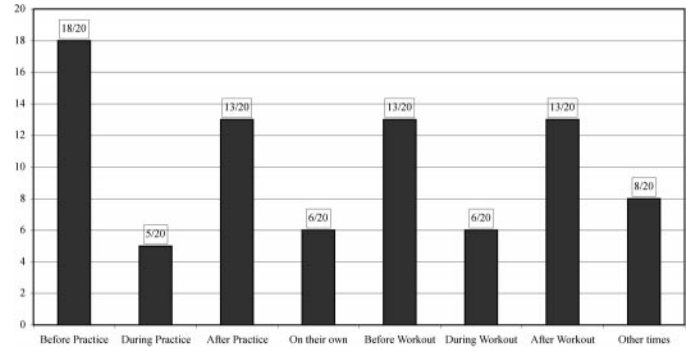


FIGURE 3. Times when National Basketball Association athletes are encouraged or required to perform flexibility exercises.

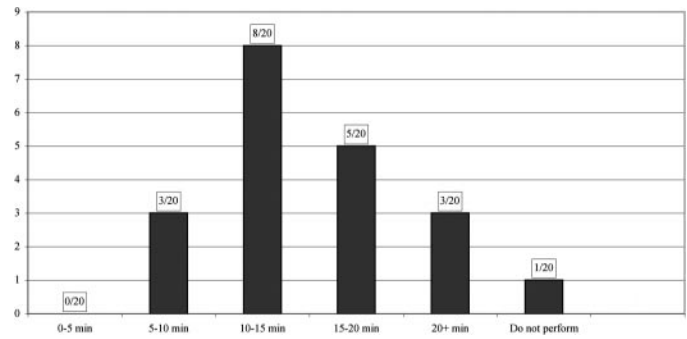


FIGURE 4. Length (in minutes) of National Basketball Association strength and conditioning coaches' normal prepractice flexibility session.

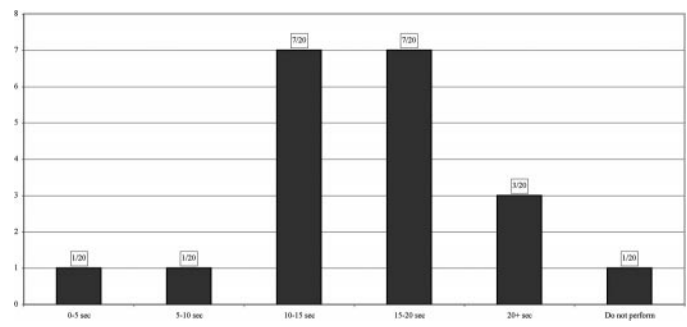


FIGURE 5. Amount of time (in seconds) that National Basketball Association strength and conditioning coaches encourage their athletes to hold a static stretch.

cular facilitation, and ballistic exercises, respectively. Additional comments included “active isolated.”

Coaches were asked to indicate when athletes were encouraged or required to perform flexibility exercises, the duration of the normal prepractice flexibility session, and the duration that athletes were encouraged to hold a static stretch (Figures 3–5). Additional comments indicated that athletes were encouraged to stretch at other times such as “all of the above,” “at home (2),” “as often as possible (2),” “pregame according to specific needs,” “preseason,” “we encourage all the time,” and “stretch machine (MedX).”

The mean average duration of an NBA prepractice flexibility session was 13.5 ± 4.0 minutes. The mean av-

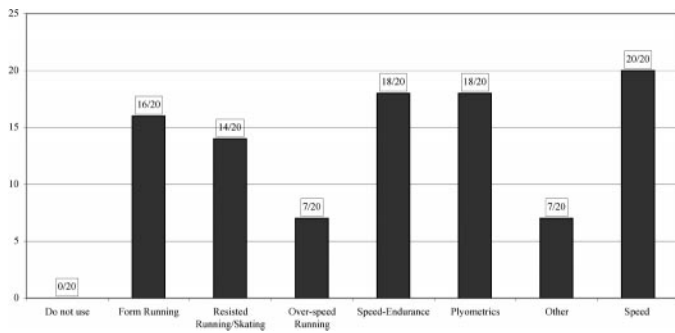


FIGURE 6. Types of speed-development exercises used by National Basketball Association strength and conditioning coaches.

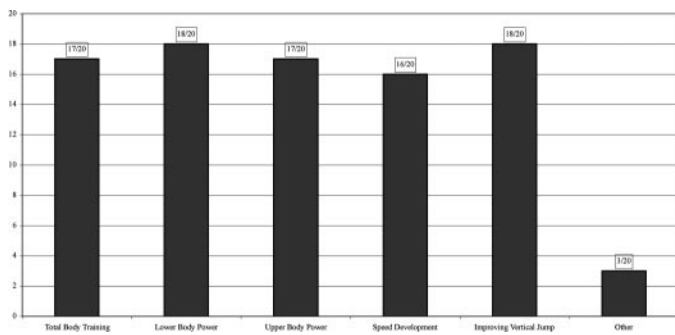


FIGURE 7. Reported uses of plyometric training by National Basketball Association strength and conditioning coaches.

erage duration an NBA athlete was encouraged or required to hold a static stretch was 14.5 ± 3.9 seconds.

Speed Development

Twenty of 20 coaches who responded to the survey reported incorporating some type of a speed development exercise into their program (Figure 6). Eighteen coaches used plyometrics for developing speed. Eighteen coaches indicated they used speed and endurance training. Sixteen coaches reported using form running, 14 stated they used resisted running, and 8 reported using overspeed training. Comments to this question included “preseason only,” “ABC’s run mech.,” “low volume,” and “weight suits or man made hill.”

Six coaches responded to the “other” section indicating that they used “sand and hill running,” “pool running,” “lots of deceleration work,” “speed rope,” and “complex training.”

Plyometrics

All of the 20 responding NBA S&C coaches reported using plyometrics. For those who included plyometric exercises in training their athletes, 18 reported using plyometric training for both improving vertical jump and for lower-body power. Seventeen coaches used plyometric training for both total-body training and upper-body power, and 16 reported they used plyometric training for speed development. Three coaches reported using “other” methods, including “lateral speed and agility”; “balancing, body control, and coordination”; “synchronization of motor unit function”; and “core conditioning” (Figure 7).

In response to the question about when coaches used plyometric training with their athletes, 9 coaches said

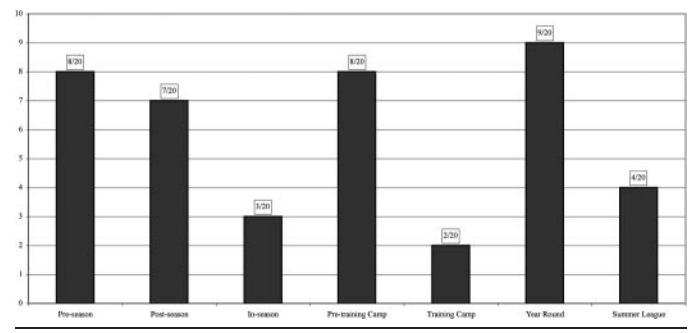


FIGURE 8. The stage, cycle, and phase of training in which National Basketball Association strength and conditioning coaches incorporate plyometric training.

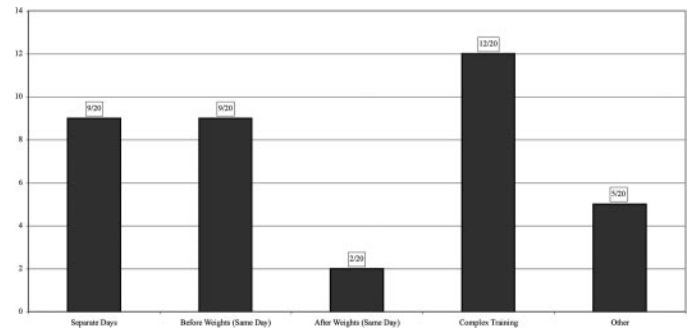


FIGURE 9. Method of integration for plyometric training and weight training.

they incorporated plyometric training year-round, 8 stated that they incorporated plyometric training during the preseason and pretraining camp, and 7 incorporated plyometric training during the postseason. Four coaches stated that they incorporated plyometric training during the summer league. Three coaches reported using plyometric training in-season, and 2 coaches cited using plyometric training during training camp. Comments made by NBA S&C coaches concerning the stage, cycle, and phase of plyometric training incorporation included: “significant emphasis in off-season and player-specific in-season,” “year-round for the young player,” “different intensities at different times of the year,” “volume drops during season,” and “hard to pull in players for in-season” (Figure 8).

Coaches were asked how they integrated plyometric training into the weight-training program (Figure 9). Twelve coaches used complex training with plyometric training and weight training combined in the same workout. Nine coaches responded that they conducted plyometric training and weight-training workouts on separate days, and 9 responded that they performed plyometric training before the weight training on the same day. Two coaches had athletes perform plyometric training after weight training on the same day. Five coaches endorsed “other” methods of combining plyometric and weight training. These responses included coaches who stated, “it depends on the phase but usually complex,” “2 times a week,” “don’t limit plyometrics to any single method,” “lower-body before or after upper-body workouts on same day or off days,” and 1 who indicated that it “depends on the player and his goals.”

The fifth question in this section asked the coaches to

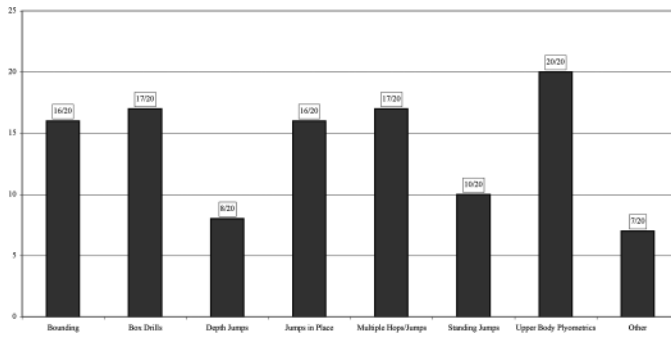


FIGURE 10. Plyometric exercises regularly employed by National Basketball Association strength and conditioning coaches.

identify the types of plyometric exercises regularly used in their program (Figure 10). Twenty coaches reported using upper-body plyometrics. Seventeen coaches each indicated that they use box drills and multiple hops or jumps. Sixteen coaches each used jumps in place and bounding, and 10 employed standing jumps. Eight coaches reported using depth jumps. Seven coaches endorsed the “other” category, reporting they use “core and board stuff with medicine balls,” “a plyometric power machine,” “vertimax,” “lightly weighted squat jumps,” “obstacles and water plyometrics,” and “many others.” Two other coaches listed general examples such as, “you name it, we use it, depending on the time of year,” and “depends on who and specific needs.”

Coaches who used plyometric training were asked to estimate the annual number of injuries as a result of plyometric training. Seventeen reported no plyometric training injuries, and 3 reported injuries with responses such as “a few minor events per year,” “very few,” and “very few, focus on technique.”

Strength/Power Development

The first question in this section was asked to determine the number of days per week that athletes participated in an off-season strength/power development program. Fourteen coaches responded 4 days a week. Ten coaches indicated 3 days a week, 5 coaches responded 5 days a week, and 1 coach responded 2 days a week.

The second question in the strength/power development section of the survey asked the NBA S&C coaches to determine the average length of their off-season resistance-training workouts (Figure 11). Eight coaches each reported workouts were 45–60 minutes long or 60+ minutes long, 4 reported that workouts lasted 30–45 minutes, and 1 reported workouts were 15–30 minutes long.

The third question in this section asked NBA S&C coaches how many days of the week their athletes participated in in-season strength/power development activities. Responses ranged from 2 to 5+ days per week, with the most common answer being 2 days a week, endorsed by 14 coaches. Thirteen coaches reported 3 days a week. Four coaches reported 4 days a week, and 2 coaches reported 5+ days a week.

The fifth question in the strength/power section of the survey asked NBA S&C coaches if they used Olympic-style (weightlifting) exercises or their variations; 19 of 20 indicated they did. Additional comments include “high pulls” and “yes, but not with all players.” Only 1 coach

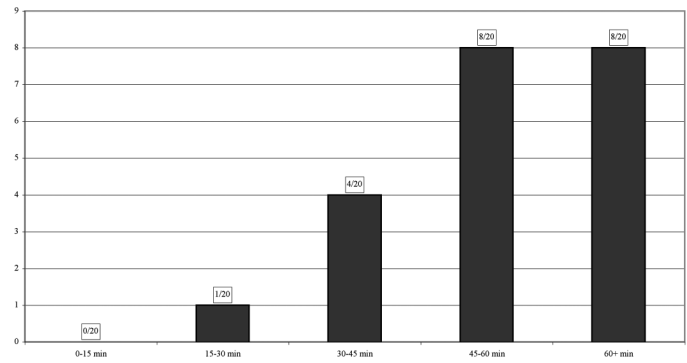


FIGURE 11. Average length of National Basketball Association strength and conditioning coaches' off-season weightlifting workouts.

reported that he did not use Olympic-style exercises with his athletes.

Question six in the strength/power section of the survey determined whether coaches use machines to train athletes and the manufacturer and brands commonly used. Fourteen coaches reported limited or no use of machines. Typical responses included “only in limited situations” and “limited usage.” The most commonly used machines included Cybex, Hammer Strength, BodyMasters used by 9, 9, and 7 coaches, respectively. Four coaches reported using Samson equipment, 3 coaches listed York, and Nautilus, Agaton, and Bear were reported by 2 coaches each. One coach each reported the use of a variety of other machines representing 9 other manufacturers.

The seventh question in the strength/power development asked NBA S&C coaches to identify, in order of importance, the 5 resistance-training exercises that were most important in their program. Nine coaches reported that the squat or its variations were the most important exercises; examples included single-leg squats, dumbbell-sumo squats, and dumbbell squats. Five coaches reported that Olympic lifts or variations of the clean were most important; examples included the power clean, hang snatch, and hang clean. Two coaches reported core exercises as most important. Two coaches reported other exercises were most important.

For the second most important exercise, 6 coaches identified variations of the squat; examples included the squat and leg press and the single-leg squat. Three coaches indicated lunges were most important. Two coaches each reported that variations of the Olympic lifts and bench press were the most important, citing “dumbbell snatches,” “power shrugs,” and “bench and chest presses.” Coaches indicated a variety of other exercises as the second most important in their programs. Examples included leg curls, rows, leg presses, functional and dynamic balance and body displacement, and dead lifts, with 1 coach identifying each of these exercises.

Five coaches indicated that variations of the Olympic lifts were the third most important exercise in their programs; examples included the cleans, hang cleans, and snatch. Two coaches each indicated that the push press, lunge, and the bench press were the third most important exercises. Other examples, endorsed by 1 coach each included the squat, ham and glute, core, hip extension, and external rotation.

The fourth most important exercise according to the coaches included variations of the squat, as indicated by

TABLE 2. Conceptualization of training.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Physiological adaptations	4	Anatomical adaptation very early off-season (3 wks). Hypertrophy off-season (4 wks). Strength off-season (4 wks). Power off-season (3–4 wks). Competition in-season (8–9 mos. Manipulated throughout). Active rest following season (2 wks).
Seasonal	4	Typical 4-phase off-season macrocycle with peak at training camp. In-season is player specific.
Seasonal adaptations	2	Hypertrophy (4 wks), strength (4 wks), strength/power (4 wks), in-season (all season, 3–4 wk. variations).
Miscellaneous	3	Repetitions and sets changed throughout year. However, it is difficult to follow a periodized model with the number of games, travel, etc.
No reply	6	

TABLE 3. Determination of training loads.

Higher-order themes	Number of responses	Select raw data representing responses to this question
% Repetition maximum (RM)	6	We test with % of RM, then determine maximum accordingly (repetitions with weight).
RM	3	3RM
Estimated 1RM	2	Estimated maximum.
Repetition scheme	2	We use a repetition scheme to determine weight. Phase 1–20 reps, phase 2–15, 12, 10, phase 3–8, 6, 4, phase 4 4–6 repetitions.
Miscellaneous	5	Experience with player and what he demonstrates in loads handled in daily workouts.
No reply	2	

TABLE 4. Sets and repetitions used during off-season program.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Phase and cycle	9	Baseline trial 2–3 sets, 12–20 reps; hypertrophy 3 sets, 10 reps; basic strength 4 sets, 8 reps; strength/power 4–5 sets, 6 reps.
Sets and repetition range	7	3–5 sets of 2–10 reps.
Miscellaneous	4	12, 10, 8, 6 @ 65, 70, 75, 80% RM.

4 coaches; bench press and Olympic variations, identified by 2 coaches each; and step-ups and lat-pull variations, each identified by 2 coaches. Examples of other responses reported by 1 coach each included adductor training, core, and hill runs.

The fifth most important exercise according to the coaches included Olympic lift variations such as the snatch-and-hang clean, as indicated by 3 coaches. Two coaches endorsed both the stiff-leg dead lift and the scapular retraction. Examples of other responses included standing military, push-ups, and leg curls.

The eighth question in this section assessed the NBA S&C coaches' conceptualization of training, specifically inquiring about the use of a periodization model, training phases, and cycles. Responses were content analyzed into 2 categories, including a periodization model (PM) and a nonperiodization model (NPM). Seventeen of 19 NBA S&C coaches reported conceptualizing training according to a PM, whereas 2 responded that they did not. One coach did not respond to the conceptualization of training question. Table 2 presents higher-order themes, number of responses, and select raw data representing responses to this question. For those coaches whose answers were part of the higher-order theme of PM, answers were further content analyzed into second-order themes including: (a) specific physiological adaptation phases, (b) com-

bined seasonal and physiological adaptation, (c) seasonal periodization, and (d) miscellaneous. All coaches described the length of training cycles as being between 1 and 8 weeks long.

Question nine in this section inquired how coaches determined training loads. Responses were content analyzed into 6 categories: (a) percent RM, (b) repetition maximum, (c) estimated 1RM (d) repetition scheme, (e) miscellaneous, and (f) no reply. Table 3 depicts these higher-order themes, the total number of coaches whose responses made up the themes, and select raw data within each higher-order theme.

The tenth question in the strength/power development section of the survey inquired about the number of sets and repetitions used during the NBA S&C coaches' off-season programs. Content analysis resulted in formation of 3 higher-order themes, organized from most common to least common response: (a) phase and cycle, (b) range of sets and reps, and (c) miscellaneous. Table 4 depicts higher-order themes, the total number of coaches' responses comprising each theme, and select raw data that are representative of responses to this question.

The eleventh question in the strength/power development section of the survey inquired about the number of sets and repetitions used during the NBA S&C coaches' in-season programs. Content analysis resulted in the forma-

TABLE 5. Sets and repetitions used during in-season program.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Sets and repetition range	9	12–15 reps in 1–3 sets, 6–10 reps in 2–3 sets, 2–5 reps in 1–3 sets.
Sets and repetitions with qualifiers	4	Depends on what athlete's needs are. Some get higher volume, some lower volume. Example 2×6 vs. 3×15 .
Miscellaneous	6	Moderate volumes and intensities. Again, the athlete's peculiarities dictate appropriate load, volumes, and exercise selection.
No reply	1	

TABLE 6. Unique aspect of each NBA strength and conditioning program.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Balance and stability	5	I incorporate Olympic movements with balance and strength. We do not use machines for lower body or core.
Core stability	3	Focus on core. Real exercise and movement technique.
Specific exercises listed	3	Variety of exercises—core stability work, medicine ball work, proprioception work.
Injury prevention and prehabilitation	3	My prehabilitation exercises train a combination of systems at once (i.e., strength, muscular endurance, hand–eye coordination, proprioception, agility, reaction time).
Variety of exercise	3	Off-season training includes pool plyometrics, yoga, martial arts, tai bo, form running just to name a few.
Evaluation and testing	2	Evaluation most extensive I've seen.
Olympic lifts	2	Most aggressive use of squats, pulls, and Olympic movements as core of program.
Program organization	2	Phase training is unique.
Specificity	2	All conditioning is done specifically for basketball, using our schemes of offense + defense to make up the movement patterns and basis of our drills.
Miscellaneous	9	Running our man-made hill is the only thing that might be unique.
No reply	3	

TABLE 7. How NBA strength and conditioning coaches would change their programs.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Change exercises	3	Personally, I would like to incorporate more Olympic movements into our training.
Contact time	3	I wish we had more time for weight training in-season.
No changes	3	I don't think I would change anything.
Space, equipment, and budget	3	Have access to greater floor space, which would increase variety.
Specificity	2	Always get input from coaching staff, try new things if it is sport-specific.
Miscellaneous	7	Always looking for ways to improve consistency and quality of effort from athletes.
No reply	5	

tion of 3 higher-order themes, listed from most common to least common response: (a) range of sets and reps, (b) sets and reps with qualifiers, and (c) miscellaneous. Table 5 depicts higher-order themes, total number of coaches whose responses make up the themes, and select, representative raw data supporting each higher-order theme.

Unique Aspects of the Program

Content analysis revealed 10 higher-order themes generated from the coaches' responses to the question regarding what they thought was unique about their program. Responses were analyzed into themes such as (a) balance and stability, (b) core stability, (c) specific exercises listed, (d) injury prevention and prehabilitation, (e) variety of exercises, (f) evaluation and testing, (g) Olympic lifts, (h) program organization, (i) specificity, and (j)

miscellaneous. Table 6 lists these higher-order themes, the total number of coaches whose responses make up each theme, and select representative raw data supporting each higher-order theme.

The second question of this section inquired what coaches would like to do differently with their strength and conditioning programs. Responses were content analyzed and resulted in the creation of 6 higher-order themes: (a) change exercises; (b) contact time; (c) no changes; (d) space, equipment, and budget concerns; (e) specificity; and (f) miscellaneous. Table 7 lists the higher-order themes, the total number of coaches whose responses make up each theme, and representative raw data within each higher-order theme.

The third question in this section assessed coaches' predictions regarding future trends in strength and con-

TABLE 8. Predictions regarding future trends in strength and conditioning in the NBA.

Higher-order themes	Number of responses	Select raw data representing responses to this question
Change in training focus	4	With data, training will grow more specific to hoops.
Functional training	4	There seems to be a trend toward more functional training.
Progress of profession	4	See profession continue to progress in its perception among coaches, medical staff, administration and ownership.
Specificity	3	It must become more specific to the sport for today's athlete to embrace it.
Miscellaneous	2	Technology will enable our profession to make gains toward training on an even higher level.
No reply	6	

ditioning in the NBA. Fourteen of 20 coaches responded to this item. Content analysis of responses resulted in the development of 5 higher-order themes: (a) change in training focus, (b) functional training, (c) progress of profession, (d) specificity, and (e) miscellaneous. Table 8 lists the higher-order themes, the total number of coaches whose responses make up each theme, and representative raw data within each higher-order theme.

Comments

The final section of the survey allowed NBA S&C coaches the opportunity to provide additional data or make specific comments regarding the survey. The responses of the 8 coaches who filled out this section were content analyzed into 6 higher-order themes: (a) interest in results, (b) thanks and appreciation, (c) individualization, (d) regret for delayed response, (e) goal setting, and (f) miscellaneous.

The higher-order theme "interest in results" consisted of comments such as "I look forward to seeing your results." The theme of "thanks and appreciation" was represented by comments such as, "if you need any more help, let me know. Best wishes." The theme of "individualization" was typified by comments such as "I believe a well-designed conditioning program must not only be sport-specific but also individual-specific." The theme "regret delayed response" was represented by comments such as "sorry this has taken me so long to get completed." The theme of "goal setting" included comments such as "goal setting is vital." Finally, the theme "miscellaneous" included comments such as "work on maintaining and rehabilitation."

DISCUSSION

The survey response rate (20 of 29) suggests most NBA S&C coaches, like their National Football League (NFL) and National Hockey League (NHL) counterparts (6, 7) are willing to share information regarding their programs and beliefs. It is also likely that multiple mailings and telephone contacts resulted in a greater response rate than typical for surveys (22). Although the response rate was slightly lower than similar surveys of professional football (87%) and hockey (77%) strength and conditioning coaches (6, 7), the rate exceeded the response rates of 42.7% (5), 48% (29), 59% (19), and 61.97% (3) of many strength and conditioning surveys. With the exception of 1 coach who declined to participate, the reasons for non-participation among the remaining coaches are unknown.

The NBA S&C coaches responding to the survey averaged 9.55 years of experience, which is longer than the average experience of S&C coaches in the NFL (6.52 years) or the NHL (6.28 years) (6, 7). These data suggest

that there is a lower turnover rate for S&C coaches in the NBA than in the other professional sports investigated, perhaps, in part, because of the favorable coach-to-athlete ratio present in the NBA. As a result of this continuity, the data appears a bit more stable than that of the NFL or NHL. Unlike the NFL, only 9 NBA S&C coaches had assistants, compared with the 19 NFL S&C coaches. That number was greater, however, than the 3 NHL S&C coaches who had assistants. Possible reasons for the disparity in number of assistants are team size (NFL) and funding (NHL). However, if these data are examined taking the coach-to-athlete ratio into account, these numbers appear to again support the increased tenure of the NBA S&C coach.

All NBA S&C coaches reported testing athletes, a practice that is supported by research showing the utility of testing in identifying team and individual needs and goal setting (11). NBA S&C coaches tested an average of 7.3 parameters of fitness using 7.8 specific tests, which is similar to the NFL S&C coaches, who tested an average of 7.2 parameters of fitness with 10.0 tests, and the NHL S&C coaches, who used an average of 7.4 parameters and 9.8 tests.

The majority of NBA S&C coaches (16 of 20) train athletes specifically for speed development, unlike their NHL (7 of 23) and NFL (9 of 26) counterparts. Similarly, more NBA S&C coaches trained athletes for agility (14 of 20) than NHL (7 of 23) and NFL (9 of 26) S&C coaches. Surprisingly, despite testing speed and agility, very few NBA S&C coaches tested athletes for acceleration (4 of 20), which is less than that of the NHL (8 coaches) or NFL (6 coaches). In fact, acceleration was the variable of athlete fitness least tested by NBA S&C coaches. Conversely, body composition was the variable of athlete fitness most tested by NBA S&C coaches (19 coaches, 95%) and is similar to the practices of the NHL (20 coaches, 87%) (7) and the NFL (20 coaches, 77%) (6), despite research showing little utility in body composition as a predictor of athletic performance (1, 17, 32).

More NBA S&C coaches tested aerobic energy systems than anaerobic energy systems, despite the large anaerobic component of professional basketball (12, 26, 28) and literature suggesting that training for basketball, specifically in-season training, should be primarily anaerobic (28). This is similar to the practices of NFL S&C coaches but is dissimilar to NHL S&C coaches, who more frequently tested anaerobic systems, consistent with the anaerobic nature of ice hockey. Interestingly, 15 of 20 NBA S&C coaches reported testing for strength, a response rate that is similar to NHL S&C coaches (23 of 23) but unlike NFL S&C coaches (13 of 26). Similarly, 17 of 20 NBA S&C coaches tested for power, much like the NHL

(19 of 23) and, again, unlike the NFL (9 of 26). Tests employed to measure power, primarily the vertical jump in the case of NBA S&C coaches, have been shown to be effective measures of power specific to basketball players (13). Also, their use suggests awareness on the part of NBA S&C coaches to the need for movement specificity in testing elite athletes as evidenced by literature (15, 17).

The respondents used a variety of speed development strategies, with results similar to previous surveys of NHL and NFL athletes. A greater percentage (100%) of NBA S&C coaches used plyometrics with their athletes, compared with 91.3% of NHL S&C coaches (7), 90% of Division I coaches (5), and 73% of NFL coaches (6). One method of integrating plyometrics, complex training, was used by 60% of NBA S&C coaches. The result is similar to the response rate of 56.5% of NHL S&C coaches (7) but far greater than NFL S&C coaches (26.9%) (6).

Regarding program design, most NBA off-season programs are 4 days per week, and in-season programs are 2 days per week, consistent with results from surveys of NFL, NHL, and Division I strength coaches (5, 6, 7). A number of coaches commented that they had little contact time with players during the off-season or during the season while on the road. It was suggested by coaches that hectic travel schedules, lack of access to equipment on road trips, and the increasing use of personal trainers by athletes in the off-season were impediments to success in training athletes.

Most NBA S&C coaches used Olympic-style lifts (95%), which is greater than that reported of NHL S&C coaches (91.3%) (7), and college division I S&C coaches (85%) (5). The use of Olympic-style lifts is again consistent with existing literature relating to the large anaerobic and power components needed for basketball performance (13, 28). In fact, variations of Olympic lifts and squats remain the most commonly used exercises, consistent with what has been previously reported in surveys of professional athletes (6, 7). Most (90%) of the NBA S&C coaches reported periodizing their programs. These data are more similar to the practices of NHL S&C coaches (91.3%) (7), than those of the NFL (69.2%) (6). Like NHL S&C coaches (7), no NBA S&C coaches defined their programs as "high-intensity training," whereas survey results of NFL strength and conditioning practices revealed that 19.2% who did not periodize their programs indicated using "high-intensity training" concepts (6).

The practices of NBA S&C coaches are similar in many respects to those of NHL S&C coaches (7). Commonalities include periodization, speed training, use of plyometrics and Olympic lifts, conceptualization of training, and testing. Differences between NBA and NHL practices include less testing of anaerobic capacity by NBA S&C coaches and substantially more training for agility by NBA S&C coaches.

NBA S&C coaches are quite different from NFL S&C coaches in a number of ways. First, far fewer NBA S&C coaches use nonperiodized programming, and none claimed to use "high-intensity training" methodologies. Second, NBA S&C coaches use Olympic-style lifts and plyometrics more often than do NFL S&C coaches. Finally, NBA S&C coaches have significantly longer tenures than either NFL or NHL coaches.

PRACTICAL APPLICATIONS

This article describes the practices of NBA S&C coaches. Strength and conditioning coaches now have a source of data describing basketball strength and conditioning practices as they occur at the sport's highest talent level, the NBA, as well as a comparison to practices in other elite sports. The timely nature of this data suggests that basketball strength and conditioning coaches can use it as a review of strength and conditioning practices and a possible source of new ideas to diversify and improve their practices. The data should also prove useful to future investigators and practitioners as a source for comparison.

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