

Strength-training practices across seasonal phases: A cross-sectional survey of Spanish team-sport coaches

DAVID I. NOUR-FRÍAS¹, EDUARDO JOSÉ FERNÁNDEZ-OZCORTA², RAFAEL RAMOS-VÉLIZ^{3*}

¹ Movistar Estudiantes, Madrid, SPAIN

¹ CD Ilunion, Madrid, SPAIN

² Department of Integrated Didactics, Universidad de Huelva, Huelva, SPAIN

³ Faculty of Humanities, Education and Sport, University CEU Fernando III, CEU Universities, Bormujos, Sevilla, SPAIN

³ Centro de Estudios Universitarios Cardenal Spínola CEU, Área Departamental de Actividad Física y Deporte, Bormujos, Sevilla, SPAIN

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Abstract.

This cross-sectional study aimed to describe the self-reported strength-training practices of team-sport coaches in Spain across the pre-season, competitive season and transition phases. Strength training is widely recognized as an essential component of team-sport preparation, but evidence on how it is organized across the season in Spanish settings is limited. An online questionnaire (Google Forms) covered general information, planning and periodization, monitoring procedures, phase-specific programming and main challenges. It was distributed through professional networks, social media and email between 28 May and 30 June 2021, using convenience and snowball sampling. Thirty-four male coaches from seven team sports (~~football~~(soccer, basketball, water polo, handball, futsal, rugby and volleyball)) were included. Results are reported as counts and percentages with item-specific denominators, and paired frequency responses are described as counts. Thirty-three coaches (97.1%) reported planning strength training, and all 34 selected injury prevention as an objective. Twenty-two of 32 respondents (68.8%) monitored strength training, most often with rating of perceived exertion (~~20/22~~)(20/22, 90.9%). The modal response was three sessions per microcycle in pre-season (13/34, 38.2%) and two in the competitive season (13/31, 41.9%). Among the 31 coaches who answered both items, 10 reported fewer sessions in-season, 19 no change and two more (mean difference -0.32 sessions). Three sets per exercise were the modal response in every phase, and free weights were selected by more than 90% of respondents in pre-season and the competitive season. Open-text answers described equipment and resources, time, facilities, and club or staff support as the main challenges. In this small convenience sample, the modal frequency was lower in the competitive season than in pre-season, although most paired responses showed no change. These results describe reported practices and may serve as a reference for coaches to compare their own planning.

Keywords: Resistance exercise; Periodization; Microcycle; Load monitoring; Questionnaire

Introduction

Strength training is a well-established component of team-sport preparation, enhancing performance and reducing injury risk, with effects that vary with the dose prescribed (Lauersen et al., 2018; Suchomel et al., 2016; Swinton et al., 2024). A recent scoping review of randomized trials reached a similar conclusion for team-sport athletes, while noting that the studies were heterogeneous and concentrated in a few sports (Weerasinghe et al., 2026). Putting this evidence into daily practice is not simple. Fixture congestion, limited resources, and competing demands shape what coaches can do (Griffin et al., 2021; Loturco et al., 2022), and Strength and Conditioning Coaches (SCCs) have to adapt evidence-based recommendations to their local context.

A central part of that adaptation is how strength work is distributed across the season, which usually includes a pre-season, a competitive season, and a transition period. Periodization concepts for team sports describe how training can be organized across these phases (de Hoyo Lora & Arrones, 2022; Weldon, Duncan, Turner, Lockie, et al., 2022). The competitive season is where time is scarcest. In professional soccer, one weekly maintenance session during the first 12 weeks of the competitive season preserved the strength and sprint gains obtained in the preparatory period (Rønnestad et al., 2011), and a meta-analysis in well-trained populations found no clear differences in maximal strength development between training frequencies over 6-12 weeks (Cuthbert et al., 2021). Whether coaches in Spanish team sports reduce their frequency of strength training once competition starts is, to our knowledge, not well described.

Survey studies are widely used to map what SCCs actually do in different sports and countries (Loturco & Bishop, 2025). They have described considerable variability in the frequency, structure and content of strength

sessions in professional cricket (Weldon, Duncan, Turner, Christie, et al., 2021), soccer (McQuilliam et al., 2024; Weldon, Duncan, Turner, Sampaio, et al., 2021; Weldon, Wong, et al., 2022), volleyball (Weldon, Mak, et al., 2021), North American professional leagues (Ebben et al., 2004, 2005) and samples from several sports (Weldon, Duncan, Turner, LaPlaca, et al., 2022). Periodization, testing and monitoring practices have also been surveyed (Washif et al., 2025). Although theoretical frameworks emphasize systematic planning, individualization, and periodization (Weldon, Duncan, Turner, Lockie, et al., 2022), their translation into applied settings is far from uniform. Organizational culture, time and resource constraints, and the need to balance strength development with technical-tactical preparation contribute to this heterogeneity (Thompson et al., 2023; Weldon, Duncan, Turner, Lockie, et al., 2022).

Evidence from Spain is limited. Earlier work described the resistance-training practices of elite Spanish club teams (Reverter-Masía et al., 2009). More recent studies have surveyed or interviewed coaches in professional Spanish soccer (Cañadas-García et al., 2026) and in futsal (Albalad-Aiguabella et al., 2025; Spyrou et al., 2024), and multi-country work has examined physical-fitness assessment and monitoring among coaches in Portugal, Spain and Romania (Wen et al., 2024). Qualitative work with professional soccer trainers is also available (Barrera-Díaz et al., 2023). Our own narrative review, which drew on earlier coach surveys and did not collect new data from coaches, summarized the strength-training practices reported in team sports (Nour-Frías et al., 2024). The present study adds a smaller, multi-sport Spanish sample collected in 2021. Its value lies in a transparent description of coaches' answers across seasonal phases, not in a claim to be the first survey.

This study describes the self-reported strength-training practices of a convenience sample of team-sport coaches working in Spain in 2021. Specifically, we aimed to describe planning and session characteristics across pre-season, competitive season and transition. Because some respondents answered for more than one phase, we also describe the paired frequency responses. The coding of open-text answers on implementation challenges was exploratory.

Materials and Methods

This study adopted a descriptive cross-sectional research design to systematically characterize the current strength-training practices of Strength and Conditioning Coaches (SCCs) in Spanish team sports. All participants were active SCCs working exclusively in team sports across different competitive levels within Spain. The primary objective was to describe how coaches apply strength-training programming strategies in real-world contexts, with particular attention to prevailing trends and methodological approaches across different competitive environments.

Setting

The survey was administered online using Google Forms from 28 May to 30 June 2021 and distributed through professional networks, social media, and email. This was a convenience and snowball sample; neither a sampling frame nor a response rate is available.

The survey was administered in 2021. Before responding, participants were informed of the study objectives and of the anonymous and confidential handling of their data, and all 34 recorded affirmative consent. The ethics committee of CEU Cardenal Spínola reviewed and approved the completed study on 7 July 2025 (reference CS-10-070725), after data collection; it was not prospective approval of the 2021 survey.

Participants

Participants were 34 coaches working in team sports in Spain; all identified as male. A national federation-coaching license was not required, and six of the 34 selected "No" on the license item. Each person is counted once in each independent breakdown in Table 1; responses naming several levels or both team genders remain in separate categories.

Table 1. Respondents by sport, competitive level and team gender (n = 34).

Dimension and category	Coaches, n (%)
Sport	
Soccer	18 (52.9%)
Basketball	5 (14.7%)
Water polo	5 (14.7%)
Handball	2 (5.9%)
Futsal	2 (5.9%)
Rugby	1 (2.9%)
Volleyball	1 (2.9%)
Subtotal	34 (100.0%)
Competition level	
Named division/league	13 (38.2%)
Other named competition	10 (29.4%)
Youth/development	5 (14.7%)
Not specified	3 (8.8%)
Multiple levels	2 (5.9%)
National team	1 (2.9%)
Subtotal	34 (100.0%)

Dimension and category	Coaches, n (%)
Team gender	
Men	16 (47.1%)
Women	8 (23.5%)
Not specified	6 (17.6%)
Both men and women	4 (11.8%)
Subtotal	34 (100.0%)

Note. Each breakdown counts each person once and sums to 34. Sport names were normalized from free text. "Multiple levels" comprises "third division and Segunda B" and "first and second division"; levels not specified comprise "Spain", "training/development (formación)" and one blank. "Both men and women" comprises four coaches reporting both team genders; six did not specify team gender. Named divisions/leagues and other named competitions are grouped from the reported wording. Original answers were in Spanish and are translated here.

Strength-Training Practices Survey

Data were collected using a structured online questionnaire, specifically developed and administered for this research via Google Forms™. The research team developed the instrument on the basis of a review of previous studies on strength and conditioning practices in team sports (e.g., Ebben et al., 2004, 2005; Reverter-Masía et al., 2009), as described in the following paragraphs. It was tailored to explore strength-training practices across seasonal phases in depth among strength and conditioning coaches in the Spanish context. This self-report approach was selected for its efficiency and accessibility, enabling the recruitment of participants across a range of clubs and locations, despite its known potential for response bias.

The initial construction of the questionnaire was a collaborative effort among three researchers, who formulated key domains and specific items based on a critical appraisal of the scientific literature relevant to strength and conditioning. To support content validity and conceptual clarity, the questionnaire underwent a review by three independent academic experts, each internationally recognized for their scientific output in this area (as indexed by ExpertScape, with at least three recent publications on the subject). Their suggestions, particularly those regarding the contextualization of practical scenarios, were considered, resulting in the reorganization and refinement of the instrument.

Subsequently, the revised version of the questionnaire was evaluated by three expert coaches, each holding at least a level II coaching license and with an academic background in sport sciences. Their input was used to improve the practical relevance of the items.

After integrating all recommendations, the final version of the questionnaire was once again reviewed and approved by the original academic experts before administration. The survey was implemented digitally using Google Forms™, which facilitated wide dissemination and systematic data collection.

The source questionnaire comprises 62 substantive numbered questions across seven sections: 11 general, 14 planning and periodization, 3 monitoring, 11 pre-season, 11 competitive-season, 11 transition, and 1 main-challenges question. Of these, 20 questions allowed respondents to select all applicable options, 31 required a single response from predefined options (including three rating scales), and 11 allowed free-text responses. A consent item preceded the numbered questions and is not included in the 62. The three seasonal blocks repeat the same 11 question stems for distinct phases. Conditional skips follow a No response to planning (to monitoring), testing (to monitoring), and monitoring (to pre-season), while respondents not covering transition are directed to the final challenges section. Free-text "Other" fields within structured questions do not add new numbered questions.

Data Analysis

We report counts and percentages using the number of valid (nonblank) responses to each item as the denominator. For multiple-selection items, percentages are the proportion of respondents selecting each option and do not sum to 100%. For training frequency, we describe the pre-season and competitive-season responses paired by respondent as the number of coaches reporting fewer, the same or more sessions, together with the mean paired difference. No inferential test was applied. Open-text answers on challenges were coded by one researcher into five descriptive categories (equipment/resources, time/scheduling, facilities/space, club or staff support, and other challenges); multiple codes per answer were allowed. Data processing and statistical analyses were performed using R software, version 4.5.1. Percentages for monitoring tools use as the denominator the respondents who reported monitoring strength training, not everyone who answered the tools item.

Results

Background information

Thirty-four coaches completed the survey between 28 May and 30 June 2021; all were male. Missing responses to particular items were handled using item-specific denominators.

All 34 respondents reported their highest academic qualification: 21 reported a master's degree (61.8%), eight a bachelor's degree (23.5%), and five a doctorate (14.7%). On the national-federation coaching-license item (n = 34), 10 reported Level III (29.4%), nine Level II (26.5%), seven Level I (20.6%), six no license (17.6%), and two reported a higher-level coaching qualification without a numbered level (5.9%). Only five respondents completed the separate international strength-certification item; among these five, three mentioned

NSCA, two EXOS/Exos Academy, one CFSC, and one a specialist certification in women's soccer. Multiple credentials could be named in one answer, so these counts overlap and are not proportions of all 34 coaches. A blank certification response was not coded as "none".

Importance, Main Objectives, and Planning of Resistance Training

On a 1–10 importance scale ($n = 34$ for each item), respondents rated the importance of strength training to their sport at a mean of 9.00 (sample $SD \pm 1.13$), their club's perceived importance at 6.47 ($SD \pm 2.72$), and players' perceived importance at 6.74 ($SD \pm 1.50$). The objectives item allowed multiple selections ($n = 34$): injury prevention 34/34 (100.0%), competitive performance 31/34 (91.2%), force–velocity-profile optimization 21/34 (61.8%), power 18/34 (52.9%), eccentric strength 8/34 (23.5%), and maximal dynamic strength 7/34 (20.6%). Four additional free-text objectives were each named once; these counts are respondent selections, not mutually exclusive aims.

Thirty-three of 34 respondents selected "Yes" to planning strength training (97.1%). The separate multiple-selection item on periods considered in planning was answered by 33: the competitive season was selected by 33/33 (100.0%), pre-season 31/33 (93.9%), and transition 20/33 (60.6%). Two additional free-text mentions concerned post-season/vacations and the competition calendar (one each); period counts overlap and do not imply that a coach planned one period exclusively.

Load progression was queried with a multiple-selection item answered by 29 respondents. Changes in external-load intensity were selected 20/29 (69.0%), changes in volume 19/29 (65.5%), proximity/orientation to competition 17/29 (58.6%), changes in between-set or block recovery 16/29 (55.2%), execution-velocity prescription 13/29 (44.8%), and effort level 13/29 (44.8%). One respondent also named time under tension and another added a caveat about when velocity data could be used. Each percentage is out of the 29 respondents; selected options can overlap.

Monitoring. Of the 32 respondents who answered the monitoring screening item, 22/32 (68.8%) reported monitoring strength training. Among these 22, the tools selected were rating of perceived exertion 20/22 (90.9%), player observation 15/22 (68.2%), mobile applications 10/22 (45.5%), linear encoders 9/22 (40.9%), video-analysis software 6/22 (27.3%) and training diary 5/22 (22.7%); three further answers used other labels or free text and are not broken down. Multiple options could be selected, so percentages do not sum to 100% and are out of 22.

Strength-training practices across seasonal phases

This section describes phase-specific responses, with valid item denominators shown alongside the counts. Seasonal differences in item response rates should be considered when interpreting these descriptions (Figure 1).

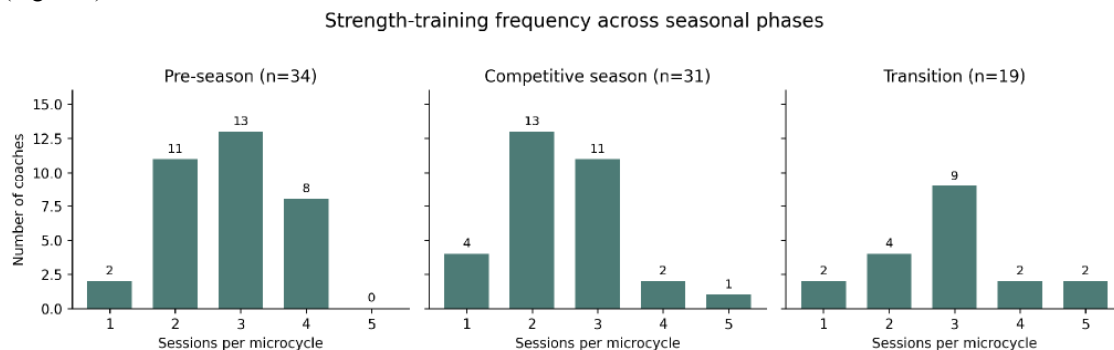


Figure 1. Self-reported strength-training sessions per microcycle by phase (pre-season $n = 34$; competitive season $n = 31$; transition $n = 19$).

Location and timing. Strength training was scheduled before technical-tactical work by 32/34 (94.1%) in pre-season, 30/32 (93.8%) in-season, and 15/18 (83.3%) in transition. The gym was selected by 23/34 (67.6%), 22/33 (66.7%), and 13/19 (68.4%), respectively; this location question allowed multiple selections.

Session frequency and duration. In pre-season, 13/34 (38.2%) reported three strength sessions per microcycle, the most common response. During the competitive season, 13/31 (41.9%) reported two sessions, the most common response. In transition, 9/19 (47.4%) reported three sessions.

Among the 31 coaches who supplied both pre-season and competitive-season responses, 10/31 (32.3%) reported fewer sessions, 19/31 (61.3%) the same number, and 2/31 (6.5%) more (mean paired difference -0.32). Sessions of 31–45 minutes were reported by 13/34 (38.2%) in pre-season, 13/31 (41.9%) in-season and 7/18 (38.9%) in transition.

Exercises, sets, and repetitions. Four to six exercises was the modal category in pre-season (15/34, 44.1%), competitive season (17/30, 56.7%) and transition (9/19, 47.4%). Three sets were modal in each phase: 21/34 (61.8%), 21/31 (67.7%), and 13/19 (68.4%). Repetitions per set are summarized in Table 2; the 6–8 range was the most frequent category in each phase (14/34, 41.2%; 15/31, 48.4%; and 6/19, 31.6%).

Table 2. Repetitions per set by phase (n (%) of respondents).

Phase	n N	1-5	6-8	9-10	11-15	Other answers
Pre-season	34	5 (14.7%)	14 (41.2%)	8 (23.5%)	4 (11.8%)	3 (8.8%)
Competitive season	31	7 (22.6%)	15 (48.4%)	6 (19.4%)	3 (9.7%)	0 (0.0%)
Transition	19	3 (15.8%)	6 (31.6%)	5 (26.3%)	5 (26.3%)	0 (0.0%)

Note. Individual numeric answers were grouped into ranges. Other answers in pre-season: "depends" (n = 2) and "very variable 6-20" (n = 1), not assigned to a range. 0 indicates that no respondent selected the option.

Recovery intervals between strength training and technical-tactical training, and between strength training and competition, are shown in Table 3. Respondents could select more than one interval, so counts do not sum to the number of respondents. Strength training was placed on the same day as technical-tactical work by 30/34 coaches (88.2%) in pre-season, 30/33 (90.9%) in the competitive season, and 14/18 (77.8%) in transition.

Table 3. Recovery intervals reported by phase (n (%) of respondents; multiple selections allowed).

Phase and interval type	n N	Same day	24 h	36 h	48 h	> 48 h
Pre-season						
Strength to technical-tactical	34	30 (88.2%)	8 (23.5%)	2 (5.9%)	0 (0.0%)	0 (0.0%)
Strength to competition	33	2 (6.1%)	10 (30.3%)	8 (24.2%)	13 (39.4%)	6 (18.2%)
Competitive						
Strength to technical-tactical	33	30 (90.9%)	6 (18.2%)	2 (6.1%)	1 (3.0%)	0 (0.0%)
Strength to competition	32	2 (6.3%)	9 (28.1%)	6 (18.8%)	13 (40.6%)	7 (21.9%)
Transition						
Strength to technical-tactical	18	14 (77.8%)	5 (27.8%)	3 (16.7%)	1 (5.6%)	0 (0.0%)
Strength to competition	17	4 (23.5%)	5 (29.4%)	4 (23.5%)	4 (23.5%)	2 (11.8%)

Note. 0 indicates that no respondent selected the option.

Equipment reported across seasonal phases

Equipment use in pre-season. Jump/agility equipment was selected by 32/34 (94.1%) of respondents to that phase-specific item, free weights by 31/34 (91.2%), and resistance bands by 27/34 (79.4%). Percentages refer to coaches selecting each item; multiple selections were allowed (Figure 2).

During the competitive season, jump/agility equipment and free weights were each selected by 28/31 of respondents (90.3%); resistance bands were selected by 26/31 (83.9%).

During transition, among the 17 respondents to the equipment question, free weights were selected by 17/17 (100.0%), bands by 15/17 (88.2%), and jump/agility equipment by 11/17 (64.7%). Free weights had the highest count in transition.

We also coded the 31 nonblank responses to the open-ended challenges item. Coding is described in Data Analysis; ambiguous descriptions were kept in "other". Among 31 respondents, equipment/resources appeared in 12/31 answers (38.7%), time/scheduling in 5/31 (16.1%), facilities/space in 6/31 (19.4%), club or staff support in 7/31 (22.6%), and other challenges in 22/31 (71.0%). Illustrative translated excerpts were "Equipment and time" (respondent 6), "The facilities and equipment" (respondent 8), and "Acceptance by the club and/or other members of the coaching staff" (respondent 5).- Translations retain the sense of the original Spanish.

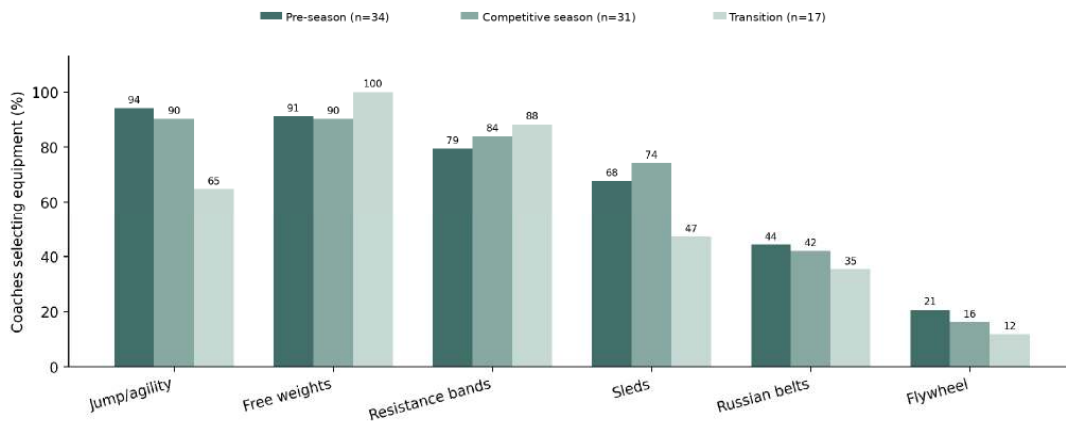


Figure 2. Percentage of respondents selecting each equipment type by phase (pre-season n = 34; competitive season n = 31; transition n = 17). Multiple selections were allowed.

Discussion

This 2021 convenience sample describes how respondents reported planning strength training in team sports. Respondents rated strength training as very important for their sport (mean 9.00 of 10) and, on average, as less important to their club (6.47; SD $\pm$ 2.72) and to their players (6.74), and 33/34 (97.1%) reported planning it. These are the coaches' own perceptions. The gap may relate to the resource, time and club-support challenges

named in the free-text answers, but the survey cannot test that link. In exploratory coding of free-text challenges, respondents named equipment/resources (12/31, 38.7%), scheduling/time (5/31, 16.1%), facilities/space (6/31, 19.4%), and club or staff support (7/31, 22.6%); 22/31 (71.0%) gave other challenges, such as individualization or player education.

The modal frequency was three sessions per microcycle in pre-season and two in-season. Among the 31 paired responses, 10/31 coaches (32.3%) reported fewer sessions in-season, 19/31 (61.3%) the same number and 2/31 (6.5%) more, so most coaches reported no change. A lower in-season frequency is compatible with evidence from professional soccer, where one weekly maintenance session during the first 12 weeks of the competitive season preserved the strength and sprint gains obtained in the preparatory period (Rønnestad et al., 2011). Three sets and six to eight repetitions were the most common responses in pre-season and the competitive season. The frequencies reported here are in line with earlier coach surveys. In a systematic review of eight surveys (318 coaches), strength sessions were most often held three to four times per week in the off-season and two to three times in-season, and training volume was consistently reduced in-season (Weldon, Duncan, Turner, Lockie, et al., 2022); our earlier narrative review summarizes the same pattern (Nour-Frías et al., 2024). Our most frequent values (three sessions in pre-season, two in the competitive season) fall at the lower end of those ranges. In professional soccer, 62% of coaches reported two in-season sessions and 90% used three to four sets (Weldon, Duncan, Turner, Sampaio, et al., 2021), and three sets per exercise was also the most frequent answer here. A survey of futsal coaches from Spain and Portugal reported three sessions per week in both pre-season and in-season (Spyrou et al., 2024), a higher in-season frequency than we found. The systematic review also notes that 48 h was the interval most commonly employed between strength sessions and competition, and that outside competition weeks strength sessions in soccer and cricket were most commonly held on the same day as sport training (Weldon, Duncan, Turner, Lockie, et al., 2022). We found a similar pattern: 30/34 coaches (88.2%) placed strength training on the same day as technical-tactical work in pre-season, and 48 h was the most frequent interval before competition in both pre-season and the competitive season (13/33, 39.4%, and 13/32, 40.6%, respectively). Coaches in professional soccer most often named fixture congestion, time, and scheduling as their main problems (Loturco et al., 2022; Weldon, Duncan, Turner, Sampaio, et al., 2021), and coaches in the Spanish first and second futsal divisions named lack of time, limited resources, and limited access to facilities (Albalad-Aiguabella et al., 2025). Equipment, resources and facilities were also among the challenges named by our respondents. These comparisons are descriptive: the studies differ in sport, level, country, season terminology, item wording and response options. Our item asked for the average number of sessions per microcycle, whereas the review and the futsal survey cited above express frequency per week, so these frequency comparisons are approximate.

Free weights, jump/agility equipment, and resistance bands were commonly selected. Some free-text answers independently mentioned limited material and space, but price, access to each device, and club resources were not measured as quantitative exposures. Free weights, not jump/agility equipment, had the highest count in transition. Most respondents who answered the screening item reported monitoring strength training, and rating of perceived exertion was the tool selected most often among them, ahead of player observation. Session RPE was also the most common method among amateur rugby union coaches, 73% of whom monitored training load (Griffin et al., 2021), and 72% of strength and conditioning practitioners surveyed in Southeast and East Asia used it to quantify training load (Washif et al., 2025). In Portugal, Spain and Romania, perceptual scales were likewise the preferred method of recovery monitoring (53.2% among Spanish coaches; Wen et al., 2024). Those surveys asked about training load or recovery in general, not strength training specifically, so the comparison is only indicative.

A strength of this study is the availability of respondent-level survey data across three phases, which allows paired responses to be described within coaches rather than only through phase-level counts. The questionnaire was reviewed by academic experts and experienced coaches before administration; however, no independent psychometric validation is available, so the instrument should be described as expert-reviewed rather than formally validated. The small convenience sample, different item denominators across phases, self-report, and data collected in 2021 constrain generalizability and current relevance. All respondents were male. The challenge item was voluntarily answered by 31/34 (91.2%); one researcher used broad descriptive codes, which were not independently checked.– Self-report does not directly document coaching behavior, and the paired comparison of session frequency is descriptive only.

Larger, more recent and more diverse samples, alongside direct observation and prespecified comparisons between phases, could assess whether the patterns persist. Future qualitative work could use independent coding and interviews to test the provisional themes raised by the open-ended challenges item.

Conclusions

In this 2021 survey of 34 male team-sport coaches in Spain, the modal reported frequency was three strength sessions per microcycle in pre-season and two in the competitive season, although most coaches with paired responses reported no change. Free weights and jump/agility equipment were widely selected, with free weights selected more often in transition. Exploratory coding of open-text challenges identified resources, scheduling, space, and institutional support as self-reported concerns.

From a practical perspective, these descriptive data can serve as a reference against which coaches and practitioners in Spanish team sports may compare their own planning. In this sample, the most frequent responses were three sessions per microcycle in pre-season and two in the competitive season, three sets per exercise in every phase, and the use of free weights and jump/agility equipment, while sessions of 31-45 minutes were reported by about 38-42% of respondents in each phase. The challenges reported by respondents (i.e., resources, time, facilities, and club or staff support) suggest that programming decisions may need to be adapted to the material and organizational context of each team. In the competitive season, most coaches also scheduled strength training on the same day as technical-tactical work, and the most frequent choice was four to six exercises per session. Which practices improve performance cannot be determined from a survey; this requires intervention research.

Institutional Review Board Statement

The ethics committee of CEU Cardenal Spínola reviewed and approved the completed study on 7 July 2025 (reference CS-10-070725). The approval was requested after data collection and covers the study as conducted; it was not a prospective approval of the 2021 survey.

Informed Consent Statement

All participants were informed of the study objectives and of the anonymous and confidential handling of their data before responding, and all 34 recorded their affirmative consent.

Conflicts of interest The authors declare no conflicts of interest.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used artificial intelligence tools (Claude, Anthropic) to improve the English language, grammar, clarity, and readability of the manuscript, to review its internal coherence and methods reporting, and to check the references. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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