

Swedish soccer coaches' experiences and application of physical training in male elite soccer

A qualitative content analysis study

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Abstract

In elite soccer, training becomes more systematic and soccer clubs try to optimise their physiological training programs. Previous research has investigated many aspects of soccer, but research into the coaches' own experiences and continuous improvement of physical training is lacking. The aim of this study was to describe the coaches' experiences and their application of physical training in male elite soccer. The design of the study was explorative and based on a qualitative content analysis with an abductive approach based on a custom version of the four-step quality model—the plan-do-check-act (PDCA) cycle. Fifteen elite soccer coaches in Sweden were interviewed. The result showed that physical training in male elite soccer is an ongoing continuously improvement process that contains four different categories: 1) planning, containing gained experiences, teamwork, and lack of resources; 2) executing with different training methods, weekly rotation, and individual training; 3) evaluating containing monitor training load and physiological testing, and 4) improving with search for knowledge and long-term development. The coaches try to absorb new knowledge and continuously improve their training methods, although lack of resources sometimes does not allow them to introduce new training methods.

Key words: coaches, elite soccer, experience, physical training, qualitative study, evaluation, ongoing process, continuous improvement.

Introduction

Soccer (football) remains the most popular sport in the world and involves both women and men, at different ages, backgrounds, and skill levels (Stølen et al., 2005; Williams, 2013). At the elite level, clubs try to optimize the training programs for their players to prepare the team both mentally and physically for the demands of the game. Scientific results combined with practical experience could be important tools for coaches when planning the optimal physical training for their players. The focus on expert performance also reflects a growing awareness of the subject in academic literature (Hodges and Williams, 2012; Farrow et al., 2013) and there is an increasing interest in the science of coaching (Cushion et al., 2003; Gilbert and Trudel, 2005; Jacobs et al., 2016). The complexity of the coaching process requires both an individual and a social process linked to human interaction, and habitus and practice come from meeting with other experienced coaches (Cushion et al., 2003).

Coaching includes interaction with many people (athletes, managers, colleagues, and agents) both in a social and cultural context (Jones et al., 2002). In order to develop elite sport athletes, a well-educated and skilled coach is essential (Christensen, 2014). For elite clubs of today, expertise in sport-specific technical, physical, and mental aspects has been shown to be important factors in training to optimise game performance (Côté and Gilbert, 2009; Christensen, 2014). Coaches learn to coach in two different ways: through experience and through coach education programs (Werthner and Trudel, 2006), hence, it is important that coach education programs include both theory and supervised field experiences in order to allow the coaches to make mistakes and to reflect and learn from those mistakes (Cushion et al., 2003), but also to give them opportunities to meet other coaches and experts to discuss coaching philosophy (Christensen, 2014). Development of coaching skills is a long-term process. Although many gadgets, instruments, and training aids are advertised to be the ultimate item for coaches, no shortcuts can replace the coaching knowledge gained through education and practice with introspection as an important part to allow an individual to reach their ultimate potential. Coaches often tend to rely more on other coaches and their own experience than on formal education courses (Cushion et al., 2003), which contain for instance physical training education. Other studies have identified that coaches preferentially search for new knowledge, from informal sources, such as internet, social

networking and other coaches, as they are easy to access and seem to be contextually relevant (Walker et al., 2018). Given the pervasive nature of informal learning, it is important to understand themes and trends in a sport context, the methods, and means of learning from different sources (Walker et al., 2018). A previous study of youth sport coaches with the aim to study to how skilled coaches translate their experiences into knowledge and skills found that they developed a model of experiential learning, based on reflection and comprised of six components: (1) coaching issues, (2) role frames, (3) issue setting, (4) strategy generation, (5) experimentation, and (6) evaluation (Côté, 2006). The reflection process has often been cited as a way to learn from experience, but this process might vary from coach to coach, depending on the presence of different conditions (Gilbert and Trudel, 2005).

Continuous improvement is an ongoing effort to improve products, services, or processes. This approach has become a popular methodology for change and improvement in many organizations (Miller et al., 1992; Garrison et al., 2003). One of the most widely used tools for continuous improvement is a four-step quality model—the plan-do-check-act (PDCA) cycle, also known as Deming Cycle or Shewhart Cycle (Shewhart and Deming, 1986; Deming, 2018). The cycle consists of: Plan: Identify an opportunity and plan for change; Do: Implement the change on a small scale; Check: Use data to analyze the results of the change and determine whether it made a difference; Act: If the change was successful, implement it on a wider scale and continuously assess your results. If the change did not work, begin the cycle again.

Methods of continuous improvement are widely used in business development, e.g. Six Sigma, DMAIC (Define, Measure, Analyze, Improve and Control) (Zare Mehrjerdi, 2011), and Lean where the core idea is to create more value for customers with fewer resources (Liker and Morgan, 2006; Holtskog, 2013).

Besides business development, some of the best examples of continuous improvement culture can probably be found in elite sports, one good example of this would be Formula 1 motor racing. The best teams do not always win, but they learn from every race and are systematic and rigorous in applying those learnings to ensure that they perform better in the next race. In the sports field, it has become more common for sports coaches to make use of scientific literature in their quest to continuously improve their coaching skills, although not universally used by all coaches or coaching staff (Bloom et al., 2014). The coach does not work alone in

a continuous improvement process, and to be successful the coach must convince all the members of the team including coaches, athletes, and medical support (Bloom et al., 2014).

An ideal culture of continuous improvement is where an organization looks to improve all aspects of its performance every day at every level (Aij and Rapsaniotis, 2017), however, to study this, it helps to break it down into smaller entities. An important part of a head coach's job in soccer, besides tactics and skills development, is to make sure that the athletes are physically ready and stay uninjured throughout the season. The amount of physical work performed in soccer matches today is much higher compared to 10–20 years ago. For example, during the 2012–2013 season Premier League players performed 30–35% more high intensity running, and sprinting compared to 7 years earlier (Barnes et al., 2014). During the last decades, top level soccer players have increased their physiological capacities (Stølen et al., 2005; Slimani et al., 2019). The trend in top soccer clubs goes towards scientific systematization of the physical training where the areas of most interest seem to be in performance analysis, strength and conditioning, and to some extent nutrition and physiology (Reilly and Gilbourne, 2003; Reilly, 2009), and practices and matches are carefully monitored to provide detailed performance feedback to the players and coaches (Drust and Green, 2013; Reilly and Gilbourne, 2003). However, research concerning the continuous improvement culture among coaches, based on their own experiences and training improvement strategies is scarce. There is a need to gain a more comprehensive understanding of the continuous improvement culture in male soccer coaches and how they experience, improve and apply the physical training on daily basis.

Thus, the aim of this study was to describe the coaches' experiences and their application of physical training in male elite soccer.

Method

Design

The present study used an explorative design, based on qualitative content analysis, with an abductive approach. The study design was chosen to explore the phenomenon, i.e., coaches' own coaching context and its application to physical training. Qualitative content analysis offers researchers a flexible, pragmatic method for developing and expanding

knowledge of individuals' experiences, reflections, or attitudes. It provides a systematic means of making valid inferences in order to describe a specific phenomenon and focuses on the interpretation of texts transcribed from recorded interviews. When used with an abductive approach, the analysis aims to enhance a more complete understanding moving between inductive and deductive approaches. The foundation in the deductive approach was the iterative four-step approach for continually improving processes – the plan-do-check-act (PDCA) cycle.

Qualitative content analysis interprets meaning from text data and hence belongs to the naturalistic paradigm (Graneheim and Lundman, 2004; Graneheim et al., 2017). The intention is to describe variations by identifying differences and similarities in the content, which are formulated as categories in which context plays a vital role, constituting the manifest content (Graneheim and Lundman, 2004; Graneheim et al., 2017).

Participants

The participants were chosen from among professional male soccer coaches in Sweden. The coaches (n=15) were chosen depending on their education level, age, number of years as a coach, and previous experience as a player. The initial contact was by e-mail with an attached letter explaining the study, and the positive responses were followed up by telephone contact.

The important part in recruiting professional coaches to the study was that they were solely or partly responsible for the physical training part of the team, and thus, the study included head coaches, assistant coaches, and strength and conditioning coaches. Participating soccer coaches (10 head coaches, 2 assistant coaches and 3 strength and conditioning coaches), all worked in teams playing in the professional soccer divisions for men in Sweden, called Allsvenskan (16 teams), Superettan (16 teams), and Division I (28 teams). All coaches in a team are important, contributing with their knowledge. In order to get a holistic picture of their overall experience and application of physical training, it is important that all coaches' experiences are included. We present the results as coaches, hence, the expression "coaches" is used for all the different types of coaches throughout this article. In all, coaches aged between 35 to 60 years of age participated in the current study. Their education level ranged from upper secondary school (n=6) to undergraduate studies

(n=9). Eleven of them were coaches in Allsvenskan (level 1), three in Superettan (level 2), and one in Division one (level 3). Their coaching experience averaged 13 years with a range of three to 29 years, and nine of the coaches had the highest soccer coach education (PRO). Some of the coaches had previously been professional soccer players (n=9) themselves. Not all the coaches worked full-time, although they worked as professional coaches.

Data collection

Data collection took place in the coaches' hometowns between March and August 2013, while two additional interviews took place in the autumn of 2014. The two last interviews were conducted to achieve saturation in the data material and to be sure that no new data emerged. An interview guide was developed following a review of the literature examining coach education and physical training in soccer (Reilly and Gilbourne, 2003; Reilly, 2009; Cushion et al., 2010), with some additional questions based on the first author's experience working with elite-level coaches and athletes. The guide was initially tested on one professional-level coach prior to the data collection period commencing. The pilot interviews enabled minor adjustment of some questions. The final interview guide consisted of 2 sections: 1) background data and 2) coaches experiences of physical training in soccer, (i.e., mostly regarding aerobic endurance training, divided into prefatory, e.g., "how do your own coach education affect the application of the teams physical training?"; "describe how you plan endurance training?"; "how you evaluate players' physical capacity"; and sequel questions, e.g., "Please, can you tell me more about...?"; or "How do you mean?"; or "What are you thinking of when you say this?

All interviews were face to face and were conducted by the first author. Despite that semi-structured interview enables a certain element of structure to the interviews, the questions and subsequent exploration varied depending on participant responses. At the end of each interview, the participants were asked if all the appropriate responses had been discussed and explored totally. Each interview lasted between 30 and 75 minutes and was audiotaped. The interviews generated a total of 75 pages of transcripts.

Data analysis

The analysis was performed in a seven-step process in accordance with Graneheim and Lundman (2004). In the analysis process, the intention was to remain close to the text, preserve contextual meanings, and continuously move between the whole and the parts. The data was analysed by focusing on the manifest content (content aspect that describes the visible, obvious components in the text; Graneheim and Lundman, 2004; Graneheim et al., 2017). This form of analysis involves coding the transcribed interview, condensation, and interpretation to find similarities in the interviews. The first author performed the analysis and the fourth author acted as co-assessor. The analysis utilized combined deductive and inductive content analysis based on Krippendorff's (2018) descriptions and started with a verbatim transcription of the interviews by the first author as the intention was to remain close to the text and preserve contextual meaning (Graneheim and Lundman, 2004; Graneheim et al., 2017). The interviews were carefully read several times to get an understanding of the whole of the material and to get a sense of the overall picture. The first phase was an inductive analysis where the statements were analyzed one by one. Each statement consisted of a meaning unit. The meaning units were condensed into a description close to the text. The condensation of meaning units was used to compress long statements into briefer statements to find the main sense of what was really said. The condensed meaning units were coded, each code received a tag that was relevant to its content, resulting in 391 codes. The next phase was deductive in which statements regarding continuous improvement were distinguished and sorted into the different categories, corresponding to the different components in the PDCA cycle, planning to Plan, executing to Do, evaluating to Check, and improving to Act, derived from the Deming PDCA-cycle. This led to a change into an inductive approach where the codes with similar content were grouped into subcategories, e.g., strain test and players testing in the sub-category physiological testing below the main category evaluating (Graneheim and Lundman, 2004; Graneheim et al., 2017).

Ethics

The study conformed to the Declaration of Helsinki (World Medical Association 2013). All personal data was registered according to the General Data Protection Regulation (GDPR 2016/679), and the data was

stored in accordance with the Archive Act in Sweden (SFS 1990:782). The ethics were approved by Halmstad University (School of Business, Engineering and Science). According to the Swedish Research Council (2011), this study fulfils the four requirements on research: information, consent, confidentiality, and safety of the participants. The information given to the participants covered the aim of the research, voluntary participation, the right to withdraw from the research at any time without giving a reason, and confidentiality. Written informed consent was obtained from all participants.

Findings

The findings, based on the analysis of the 15 interviews, reveals that elite soccer coaches' own experiences and application of physical training can be understood as an iterative cyclic process of continuous improvement following the division in four categories: planning, executing, evaluating, and improving similar to the PDCA model (Figure 1).

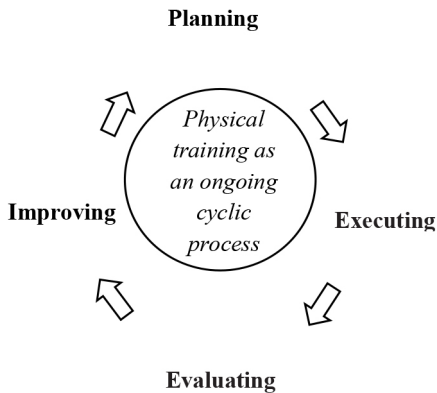


FIGURE 1. *Application of physical training in male elite soccer is interpreted by the ongoing cyclic process, including planning, executing, evaluating, and improving.*

The ongoing cyclic process was interpreted into four different categories: planning, executing, evaluating, and improving. Each category includes two to three subcategories (Table 1). The coaches use this iterative process to reflect on their training sessions and seasonal planning, and to continuously improve their coaching skills.

TABLE 1. *Overview of categories and subcategories that emerged from qualitative content analysis of interviews with elite soccer coaches. Interpretation of physical training in male elite soccer as an ongoing cyclic process*

Categories	Planning	Executing	Evaluating	Improving
Subcategories	Gained experiences	Different endurance training methods	Monitor training load	Search for knowledge
	Teamwork	Weekly rotation	Physiological testing	Long-term development
	Lack of resources	Individual training		

Planning

The planning element was important for the coaches in their goal to optimize the physical training sessions for the players on their team, and consisted of gained knowledge, teamwork, and lack of resources.

Gained experiences

The coaches' gained knowledge came from different areas and influenced their planning, including their experiences as players, formal education, and inspiration from others. The coaches described that their own experiences as players were of great value in their planning to optimize physical training; they understood their own players and their reactions better, as one coach stated:

If I had not been a player, I would probably have had to work harder being a coach. (P4)

The coaches experienced that educational soccer coaching courses introduced new knowledge over and above that gained by being a player. Things like periodization (changing of volume and intensity of the training throughout the course of a week, month and year) and planning training sessions were examples learned in these courses. They highlighted the importance of learning from other course participants and engaging in useful discussions. The coaches also studied bigger leagues, but with caution, since clubs in bigger leagues often have greater resources compared to Swedish clubs. Knowledge gained from other

coaches, and previous coaches from the period when they were players themselves, influenced their planning, one coach explained:

I have picked up influences from other coaches also, it is important to get the team to work towards the same goal, no one is bigger than the team; it is harder today to get the players to understand that. (P8)

Teamwork

Teamwork was important for the coaches. The team of coaches who worked together contributed to gained knowledge in the planning process and had a basic plan for periodization of physical training, depending on when the matches were played. When physical training was in focus, the head coaches with better resources could delegate some of the physical training responsibilities to an assistant coach or strength and conditioning coach, who then kept track of the total training load. Furthermore, the coaches felt that it was important to have good dialogue with the players in order to plan optimal training sessions. One coach said:

It is not easy to get the players to participate in their own progress, it will not happen without effort. (P7)

Lack of resources

Some coaches experienced lack of resources; some clubs did not employ any strength and conditioning coaches, implying that some specific parts of the soccer training sessions could not be performed, thus affecting the planning and the possibility to optimize physical training. The coaches had high ambitions and would like to be able to adjust and individualize the training more often. One coach said:

It is a question of resources, sometimes it is like there is not enough time. In my opinion it is important to have enough coaches, so everyone can work in their area of expertise. (P6)

Another coach stated:

I would like to individualize the training more than today with more positions based physical training, but it feels like that there are not enough coaches, we need a coach dedicated to physical training. (P4)

Executing

Executing of the coaches' application of physical training in male elite soccer included different endurance training methods, weekly rotation of training programs, and individual training.

Different endurance training methods

The coaches used different endurance training methods largely integrated into their soccer practice to reach their aims, with different sessions and season plans. The purpose of endurance training was to ensure that players could cope with all the demands of a soccer game and were able to perform during the entire match. One coach explained:

To expose the players for so much stress both mentally and physically, in order to cope to play 11 versus 11 better. (P3)

The aerobic endurance training methods were based on the teams' style of play. There were coaches who preferred small-sides games for endurance training, but there were some concerns that the players did not get the right amount of training load and therefore the coaches added some track running. As one coach stated:

If the training levels are up to 50% it is hard to perform 100% during the match. (P4)

Weekly rotation

It was important for the coaches to provide the optimal training load for their players, therefore weekly rotation of the training program was important. Generally, it included recovery training scheduled the day after a match, a day off from training two days after a match, and endurance training during the third day. Days preceding match day were devoted to preparing for the match. One coach explained that:

One must find a periodisation between high and low intensity; there is a big difference between the weeks, depending on games. (P5)

Individual training

One way to ensure that substitute players had the right training load could be to use the match day for individual training of the substitute in the players' position since it was easier when all players were not present. Individual training was important for optimising physical training, according to the coaches; their opinion was that almost all training was individual, and position based, as one coach expressed:

It seems stupid to do the same thing with, for example, a fullback as a wingback. (P₂)

In the pre-season some coaches did not individualise their practices; instead, these coaches used individualised training closer to the start of, and during, the season.

Evaluating

Evaluating the coaches' application of physical training in male elite soccer included monitoring training load and physiological testing of the players.

Monitor training load

Carefully monitoring training load was important to the coaches so that players did not train too much or too little. The coaches thought it was of extra importance to have control over the younger players' training load since they would not tell the coaches if they were tired; they just kept on training. It was common to use a heart-rate monitor to evaluate the training load to ensure that the session gave the optimal effect. Some coaches commented that it was impossible to conduct endurance training with small-sided games without monitoring the heart rate because there was a risk that some of the players did not increase their heart rate to the necessary level, as one coach expressed:

If you train small-sided games with five against five or seven against seven, it is good to be able to measure the training load. (P₄)

Physiological testing

The coaches agreed that physical fitness was important to evaluate but they used different methods for physiological testing and evaluation of players. Some coaches tested the players' physical status at the start of the pre-season, with a second test at the end of pre-season. After that they did not perform any more tests, as one coach mentioned:

There is some kind of test hype from January to March, we must know what to use them for, and could we make better use of the time? (P₃)

Instead, some coaches performed a maximal oxygen uptake test to evaluate aerobic capacity at the end of the season. These coaches explained that testing was not that important and the results were not useful since they might not reflect the players' performance during the game. In addition, some coaches agreed that it was important to test their players who had previous injuries before they returned to full training.

Improving

Improving the coaches' application of physical training in male elite soccer consisted of the subcategories search for new knowledge and long-term development.

Search for knowledge

The coaches searched for knowledge in different ways; they learned from others and players and other coaches, from formal education, they studied scientific research or read soccer literature to improve their methods, but also outside the world of soccer. They attended different types of scientific conferences, however, the coaches also meant that it was important to be somewhat critical of the research since the studies sometimes seemed to follow trends, as one coach mentioned;

Researchers follow one another, one must ask what is new with this, what has changed during the last ten years. (P₂)

Long-term development

The coaches perceived that the clubs nowadays took more responsibility for the long-term development in physical training and were not as

dependent on the ideas a new coach would bring along. The coaches also perceived that player development must be long-term, the focus could not switch every year.

That is a process, it is something you build up over the years, and I feel that this is something that you must work on with adolescents. (P2)

The coaches experienced that the higher technical quality and game awareness of today's players improved the training sessions since higher skill levels increased the intensity at practice. The coaches use their new knowledge from evaluating the players' and their own performance and try and to make improvements in their short- and long-term planning:

What you always try to... if something was not good during the past game, and then you have to improve that in the next training session. (P1)

Discussion

The analyses of the text, based on the interviews, revealed that elite soccer coaches' experiences and their application of physical training in male soccer, is an ongoing cyclic process, a continuous improvement approach, consisting of four steps: planning, executing, evaluating, and improving. The present categories are elaborated from four-step approach for continuous improvement; plan, do, check and act, the PDCA cycle, used in the abductive analysis. Although there are similarities to how corporations and businesses use the PDCA model, coaches and sports teams operate much differently out of necessity. There are not too many sports that rely on lagging indicators to adjust performance, i.e., waiting until the game is over as an example. To illuminate the process of continuous improvement in sports a match could be used as a vantage point. Before the game, the coach must study the opponent and *plan* how to defend and attack during the game. The team train accordingly to this plan and *execute* it during the match. During the game, the coaching team keep tracks on score, players performance and *evaluate* the situation. The *improvement* happens throughout the entire game. The cycle is repeated over and over during the game in contrast to the business manager who looks at results just once a month, and only after the end of the month.

Therefore, the category names were altered compared to the PDCA model to better illuminate the continuous improvement cycle performed by the coaches in the present study.

The concept of continuous improvement is also in accordance with the concept of action research, aiming to improve players and generate generalizable knowledge, also described as a continuous process (Altrichter et al., 2002; Zuber-Skerritt, 2002; Bessant and Caffyn, 1997). The continuous improvement of the coaches' experiences and their application of physical training does not only affect the outcomes, but also to the process by which they can be achieved. It is important that the process of continuous improvement works over a long time in order to be effective.

In the planning element of the ongoing cyclic process within elite soccer physical training, the results show that the coaches' experiences came from different areas, such as their own player experiences, influence from other soccer coaches, and soccer coaches' education. This is supported by Jones et al. (2012), who found that learning from others is essential for professional coaching knowledge. Nelson and Cushion (2006) confirmed that coaches learn from reflecting on practical coaching experience, linking this with, for instance, observation and education. Moreover, coaches' face-to-face meetings and discussions about soccer philosophy are helpful (Christensen, 2014).

The coaches in the present study emphasized the importance of good teamwork and agreed it is imperative that all the various staff members are involved in the process of planning the sessions. The idea that careful planning by team staff is important is supported by Owen et al. (2009), who concluded that coaches who are involved in developing physical performance should establish good training strategies.

The pre-season period is the most important in which to execute planning to develop and enhance the physical abilities of soccer players (Ziogas et al., 2010). Previous research has showed that coaches decreased the amount of high-intensity endurance training during the competitive season to possibly preserve energy reserves (Owen et al., 2009). This was not found in the present study and could be an important knowledge for the coaches to pay attention to, so overtraining and fatigue can be avoided in the players during the competitive season. Little and Williams (2007) stated that key factors for preventing under- and/or over-training are to monitor plans and divide training load into periods. The coaches in the present study emphasized a careful weekly rotation, with the

right workload to minimize the risk of fatigue. The weekly rotation with recovery training scheduled the day after a match, and a day off from training two days after a match differ from previous studies where English and Italian soccer teams' weekly planning include a day off scheduled directly after match day (Impellizzeri et al., 2004; Impellizzeri et al., 2005; Owen et al., 2009).

Some of the coaches in the present study considered it important to have a special strength and conditioning coach for the physical abilities of the players, and to better individualise the training for each player. Individual training is further highlighted by the coaches who think it is not beneficial to perform the same type of training for players in different positions. This is in line with earlier findings, which showed the importance of an individual training program (Hencken and White, 2006), position-specific training, in particular for defenders (Wehbe et al., 2014), and that slower players only improve endurance capacity if they train using high-volume continuous running (Faude et al., 2013).

The next step in the ongoing cyclic process is evaluating the physical training. The present study reveals that coaches use different methods to evaluate whether their physical training goals are achieved. Some coaches agreed that endurance training is essential to cope with match demands and highlighted that the heart rate should be monitored during practice to ensure correct training load. These findings are supported by previous research, pointing to the need to measure heart rate and to train at 90–95% of maximal heart rate (Castagna et al., 2013; Hoff et al., 2002; Ziogas et al., 2010).

In the present study, some coaches argue heart rate monitoring during practice is mainly time consuming and uses up resources that could be better spent being elsewhere, in line with Rebelo et al. (2012), who means that heart rate is not a good indicator of very high-intensity exercises. Instead, the use of Visual Analogue Scale (Rebelo et al., 2012) or the 15-point Borg Rate of Perceived Exertion in combination with heart rate monitors has been suggested (Little and Williams, 2007). On the other hand, Hoff et al. (2002) conclude that monitoring heart rate is a valid measure of exercise intensity in both small-sided games and dribbling tracks.

The results concerning coaches' experiences of the usefulness of physiological testing of their players were divergent, and no unanimous opinion was identified. Those in favour of physiological testing in soccer players are supported by Svensson and Drust (2005), who found that

the information gained from testing players could be used to develop optimal training strategies, but also to assess fitness profiles of players. Similarly, Hencken and White (2006) found that players' anthropometric measurement should be an integral part of their performance-profiling program. In contrast, other coaches believed that physiological testing does not reflect the players' performance during the match. This contrary finding is supported by Jovanovic et al. (2011) who found that in modern soccer it is more important to enhance each player's ability rather than search for seconds or centimetres in physiological testing.

After coaches have evaluated physical training, the next step in the ongoing process is improving their work. The results demonstrate that today's elite male soccer coaches are interested in increasing their knowledge and consult research findings for new information. The coaches use influences both from other coaches and from players to learn. Interactions with other experienced coaches are highly valued by the coaches (Occhino et al., 2013). Additionally, they find knowledge outside the world of soccer (Forslund, 2017), but it also seems clear that some kind of education before becoming a coach is useful (Callary et al., 2012). Education is also useful for coaches to improve their knowledge on good coaching praxis (Chesterfield et al., 2010). Even though coaches find formal education beneficial, they also perceive it as somewhat too extensive in the field of physiology (Nelson and Cushion, 2006). Gaining knowledge from scientific reports has also been illustrated as useful and injury prevention research can make the sport safer (Ekstrand et al., 2013). The results from our study reveal that the coaches considered new methods and scientific findings in the ongoing cyclic process of their work, which utilises planning, executing, evaluating and improving. The coaches evaluate their work and, depending on the result, adjust the planning in order to improve their training sessions or seasonal planning and their players' performance.

Methodological considerations

In qualitative research, the concepts credibility, dependability, and transferability have been used to describe trustworthiness (Lincoln, 1985; Graneheim and Lundman, 2004; Graneheim et al., 2017). Credibility was strengthened by the large number (391) of meaning units, which were described by several of the participants, and by the fact that the

categories covered the data. The authors read the interviews carefully several times to get a deeper understanding of the data; the first author is familiar with the topic so a deeper insight in participants' answers was possible. Since the aim of qualitative content analysis is to identify variation in experiences, the participants were selected from a strategic sample. A limitation could be the small number of coaches and the duration of the interviews, 30–75 minutes might be too short. However, the interview texts were deemed rich and contained great variety (Graneheim and Lundman, 2004; Graneheim et al., 2017). The interview guide guaranteed that the same opening questions were posed to all participants. Dependability was also strengthened because the fourth author was familiar with the methodology employed, and the continuous discussion among the authors. The data were compared and examined until the categories were finally decided. Transferability is met when the qualitative research actually identifies and investigates the phenomena intended to be studied, and if the context is described so the result can be transferred to a similar context (Graneheim and Lundman, 2004; Graneheim et al., 2017). If the selection of participants represents a strategic sample of professional soccer coaches, the result can be transferable in particular to Scandinavia, but also to a wider population if the prerequisites are similar. Since all but one subject was from the two highest divisions in Swedish male soccer, the result potentially is not transferable to amateur level.

There are some areas in soccer elite level physical training which need further studies; the fact mentioned by one coach, that soccer teams train more technique as opposed to endurance nowadays, could be worth investigating, to see the influence on training methods. This study concerns elite soccer coaches for male players; it would be interesting to compare with elite soccer coaches for female players, as well. A quantitative study to follow up on the present study could also be of interest in comparing elite clubs' different training methods. Further research of the cyclic process in different soccer teams could be of importance.

Conclusions

The main findings of this study are that planning, executing, evaluating, and improving are central phenomena in the coaches' continuous improvement process and their application of physical training in male elite soccer, and that these phenomena are intertwined with the PDCA cycle. The coaches' experiences are that planning contains gaining experience and that teamwork is important in this process. However, lack of resources is sometimes a problem for the coaches. In the execution of training the coaches use different training methods and both individual training and weekly rotation of the training program. In the ongoing cyclic process, coaches evaluate their training sessions by monitoring training load and test the players' physiological capacities. Depending on the outcome, some improvements are made before planning the next session. The cyclic process is also applicable in improving the coming season. As a part of the ongoing process, the coaches try to follow the development in sports science with a critical attitude. After careful consideration, the coaches attempt to incorporate new knowledge into their training methods to improve their practice, although lack of resources does not allow them to introduce new training methods to the extent they would wish.

Applications in sport

The present study provides an extension to previous work that has examined coaches' experiences and physical training. And, in addition, it has coaches at different levels that may contribute to a greater holistic view of their experiences and application of physical training. For the coaches to be effective and play a role in the development of athletes, their learning environment need to be consistently revisited and adapted, which according to this study can be challenging. The ongoing process described as planning, executing, evaluating, and improving based on the PDCA model seems to be useful for soccer coaches in higher divisions, and a more general application in soccer can be recommended based on our findings. Using the model may evolve coach education regarding application of physical training in elite soccer, and in lower divisions as well. A structured approach will aid the coaches to reflect on their work on daily

basis, it may enhance their knowledge and support a teamwork approach to physical training in soccer.

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