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Has the pandemic changed soccer training methodologies?
¿La pandemia ha cambiado la metodología de entrenamiento del fútbol?

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Abstract. Introduction. The covid-19 pandemic affected the world of sports very directly. This forced the coaching staffs of the different clubs to reinvent themselves in their training processes in order to avoid the loss of sports performance of their squads, adapting their training methodologies to the conditions that prevailed at all times. Therefore, the objective of this research has been to find out if there are changes in the training and planning modes of soccer coaches during and after the pandemic. Methods: For this work, a cross-sectional descriptive study was carried out in a sample made up of 517 coaches from different divisions and nationalities. To characterize the sample, descriptive measures were used and Pearson's chi-square was used to study whether there is a relationship between the variables studied. All statistical analyses were performed with Stata version 12 (StataCorp., United States) and statistical significance was always established at a p value < 0.05. Results: The results of this study indicated that, regardless of the division in which they developed their profession, the coaches were forced to make methodological changes and substantial modifications in the planning of the sessions. They avoided contact exercises and focused on tactical and psychological aspects during and since the pandemic. Conclusion: The results of this study can be very useful for future technical bodies when it comes to distributing training and workload.
Keywords: soccer; methodology; training; coaches; pandemic; COVID-19

Resumen. Introducción. La pandemia de la covid-19 afectó directamente al mundo del deporte. Esto obligó a los cuerpos técnicos de los distintos clubes a reinventarse en sus procesos formativos con el fin de evitar la pérdida de rendimiento deportivo de sus plantillas, adaptando sus metodologías de entrenamiento a las condiciones que prevalecían en cada momento. Por tanto, el objetivo de esta investigación ha sido conocer si existen cambios en los modos de formación y planificación de los entrenadores de fútbol durante y después de la pandemia. Métodos: Para este trabajo se realizó un estudio descriptivo transversal en una muestra conformada por 517 entrenadores de diferentes divisiones y nacionalidades. Para caracterizar la muestra se utilizaron medidas descriptivas y se utilizó el chi-cuadrado de Pearson para estudiar si existe relación entre las variables estudiadas. Todos los análisis estadísticos se realizaron con Stata versión 12 (StataCorp., Estados Unidos) y la significación estadística siempre se estableció con un valor de p < 0,05. Resultados: Los resultados de este estudio indicaron que, independientemente de la división en la que desarrollaban su profesión, los entrenadores se vieron obligados a realizar cambios metodológicos y modificaciones sustanciales en la planificación de las sesiones. Evitaron ejercicios de contacto y se centraron en aspectos tácticos y psicológicos durante y desde la pandemia. Conclusión: Los resultados de este estudio pueden ser de gran utilidad para futuros organismos técnicos a la hora de distribuir formación y carga de trabajo.
Palabras clave: fútbol; metodología; entrenamiento; entrenadores; pandemia; COVID-19

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Introduction

The covid-19 pandemic affected the entire planet, altering the way people lived: health, freedom, the economy, culture, and security. The world of sport was not left out of this context (Azevedo et al., 2021; Dauty et al., 2021; Desiderio & Bortolazzo, 2020; Isaza-Gómez et al., 2023; Ortiz Marholz et al., 2022; Rampinini et al., 2021) and social responsibility emerges in football in the same way it does with other professional sectors in society (Sanmiguel-Rodríguez et al., 2022). Thus, the practice of soccer was also seriously affected by these effects of the pandemic, including the postponement of several championships and competitions (Azevedo et al., 2021; Boschilia et al., 2021; Dauty et al., 2021; Fatih et al., 2021; Ortiz Marholz et al., 2022; Peña González et al., 2022). This forced clubs, leagues and/or sports federations to reinvent themselves in their training processes in order to avoid the loss of sports performance of their squads, adapting their training methodologies to the conditions that existed at all times with the accompaniment of the coaches remotely (Isaza-Gómez et al., 2023).

The athletes had to confine themselves like the rest of the population, but this implied for them a prolonged detraining that caused the loss of many of the physical and psychological adaptations that training generates, reducing, or even preventing, sports practice (Dauty et al., 2021; Desiderio & Bortolazzo, 2020). The result was that football clubs had to prescribe players to train in isolation for an extended period of time in an attempt to stay fit (Unnithan et al., 2022). The confinement caused by the COVID-19 pandemic poses a great unknown regarding the physiological changes induced in elite soccer players. Although it will vary from country to country, the return to sport of professional footballers following enforced lockdown and longer than the normal annual season breaks could lead to reduced performance and increased risk of injury (Bisciotti et al., 2020). Desiderio and Bortolazzo (2020) pointed out that alterations were generated in the cardiorespiratory, immune, osteomuscular and endocrine systems, in metabolism, and an increase in fat mass to the detriment of lean mass, which could generate injuries upon return to activity. For all these reasons, the clubs and the different technical bodies adopted palliative measures so that the detraining was not so profound, but, nevertheless, these measures were not enough and did not fully replace the training

model that they had before the pandemic (Desiderio & Bortolazzo, 2020). In fact, Bisciotti et al. (2020) indicated that the preseason is always a period with a specific epidemiology of injuries in soccer, with an increase in the incidence and prevalence of injuries due to excessive loads. Therefore, it seems appropriate to recommend that specific training and injury prevention programs be developed, with careful monitoring of said load (Bisciotti et al., 2020).

Many professional footballers around the world were confined at home. The maintenance of physical capacity is a fundamental requirement for the athlete; so training must be adapted to this unique situation. Specific recommendations should be followed on the type of training, its intensity, the precautions that must be taken to avoid the possibility of contagion and the restrictions depending on the presence of any symptoms (Eirale et al., 2020). In this way, during this period, the technical bodies of the clubs fought against all adversities, acquiring new skills in the use of technological tools and consolidating different work groups through different social networks (Loaiza Zuluaga et al., 2021). However, it was necessary for government entities to look at the coach to generate support, training and updating networks that would allow them to consolidate a new sports culture through digital media, since the outlook was discouraging for many technical bodies, who have they had to endure all the rigors of the pandemic and have been left without work or income (Loaiza Zuluaga et al., 2021). Sanmiguel-Rodríguez (2021a) pointed out that soccer coaches value autonomy, self-efficacy and varied and demanding training sessions as positive aspects for their professional satisfaction. On the other hand, other base coaches indicated that what they like least about their profession has been the relationship, treatment and behaviour of families (Sanmiguel-Rodríguez et al., 2023).

The evidence on the relationship between training load and psychological aspects in isolation due to the COVID-19 pandemic is scarce and studies aimed at preventing sports injuries in competitive soccer are required. Montealegre Mesa et al. (2023) tried to determine the training load and its relationship with the psychological response of professional players, during confinement due to the COVID-19 pandemic. Professional soccer players usually have regular training sessions and play matches for most of the annual macrocycle with limited time focused solely on improving physical development (Anderson et al., 2023). The 2020 COVID-19 outbreak caused massive disruption to professional soccer, but provided an opportunity for an alternative approach to training in an attempt to develop the fitness levels of professional soccer players (Anderson et al., 2023). Physical condition is one of the most important aspects for footballers. The physical condition must be maintained by the footballers throughout the season as it is part of the strategy to improve the technical-tactical aspects (Limayyasya et al., 2022).

For all these reasons, the objective of this research has been to find out if there are changes in the training and planning modes of football coaches during and after the pandemic.

Methodology

Experimental design and study participants

For this work, a descriptive cross-sectional study was carried out in a sample made up of 517 coaches (men n= 500; women n= 17) from different divisions and levels with a mean age of more than 37 years (M = 37.16 ± 9.925) and an average professional experience of more than 10 years (M = 10,08 ± 7,857).

To calculate the sample size, the database of federated licenses issued in Spain by the Royal Spanish Football Federation in 2022 (Ministerio de Cultura y Deporte, 2023) was used, registering a total of 1,137,651, which establishing a margin error of 5% and a confidence interval of 95%, a minimum sample size of 385 subjects is required. The calculation of the sample size for research that uses surveys is key in order to guarantee conclusive results.

For the analysis of the results, the sample was divided into categories according to the division in which they were training, being first division/national team (n=7), second division (n= 4), third division (n= 17), preferred (n= 64), regional (n= 77), base (n= 333) and no team (n= 15).

Instrument and materials

The instrument used was an ad hoc questionnaire validated by experts to collect information on the distribution of training (number of sessions, time dedicated to basic skills, technique, tactics, methodology, psychological variables and other questions related to satisfaction with the profession). To obtain information, they completed a questionnaire of 35 questions divided into 3 sections (Table 1).For the elaboration of this study, only 7 questions out of the 35 of the questionnaire were used, since these questions were the ones that focused on the objective of this investigation.

Table 1
Questionnaire Sections and Questions

Questionnaire Sections	Questions
Demographic aspects (9 items)	Gender, age, years of dedication, nationality, division in which you trained or currently train, highest category in which you trained and in which you most enjoyed.
Distribution of the training session (19 items)	Number of sessions, time dedicated to different capacities, technique, tactics, methodology and psychological variables,
Other general aspects (7 items)	Aspects of satisfaction with the profession and training changes during COVID-19

All the study factors were treated as continuous variables, and the response format used in all the instruments was a scale with closed and open responses. The reliability of the questionnaire was determined by standardizing the survey administration protocol for all participants.

Procedure

The questionnaires were completed online from August

to September 2020. The questionnaire was available through Google Forms containing informed consent and information related to research ethics. Said questions were provided randomly to coaches and members of the technical staff of different clubs and, in turn, the presidency of the Football League and the Galician Football Federation were contacted so that they distributed said questionnaire among the base of coaches they have.

Statistical analysis and ethical issues

To characterize the sample, descriptive measures (frequencies, percentages, mean, and standard deviation) were used. Pearson's chi-square was used to study whether there is a relationship between the variables studied. All statistical analyses were performed with Stata version 12 (StataCorp., United States) and statistical significance was always established at a p value < 0.05.

At all times, the ethical recommendations for research in the field of Sports Sciences (Aragón-Vargas, 2015) were followed, maintaining the confidentiality of the data, the anonymity of the participants and informing them that at any time during the study they could cancel their participation in the work.

It was explained to all the participants that the study respected the ethical principles of the Declaration of Helsinki and the Data Protection Law 15/1999 (Gobierno de España, 1999).

Table 2.
Have you made changes for training in the pandemic?

Actual division			Frequency	Percentage
Regional	Valid	No	17	22.1
		Yes	60	77.9
		Total	77	100.0
Base/children	Valid	No	88	26.4
		Yes	245	73.6
		Total	333	100.0
Preferred	Valid	No	12	18.8
		Yes	52	81.3
		Total	64	100.0
Second div.	Valid	Yes	4	100.0
Third div.	Valid	No	4	23.5
		Yes	13	76.5
		Total	17	100.0
First/National team	Valid	No	2	28.6
		Yes	5	71.4
		Total	7	100.0
No team	Valid	No	3	20.0
		Yes	12	80.0
		Total	15	100.0

Results

The mean age of the 517 participants in this study was over 37 years (M = 37.16 ± 9.925), with a mean professional experience of more than 10 years (M = 10.08 ± 7.857), of whom of which 7 (1.36%) were training in the first division or national team, 4 (0.77%) in the second division, 17 (3.29%) in the third division, 64 (12.38%) in preferential, 77 (14.89%) in regional, 333 (64.41%) in the base and 15 (2.90%) were at that moment without a team. When asked if they had made changes to training during the pandemic, 100% of second division coaches and 81.3% of preferred coaches had made changes. These results were similar in the coaches of other divisions and categories, with 77.9% in the regional being those who had made changes in their training methods, 76.5% those in the third division, 73.6% in those who were in the base with children and 71.4% those who trained in the first division or national team (Table 2). These changes affected all categories, since they indicated that it was not possible to train due to the COVID protocol. In addition, most of the coaches, regardless of the category in which they worked, indicated avoiding contact exercises, mask training, and tactical training as the most relevant change (Table 3 and 4).

Table 3.
Have you made changes for training in the pandemic?

	Division_cat		
	Children	Adults	Total
No	81	45	126
	24.32	24.46	24.37
Yes	252	139	391
	75.68	75.54	75.63
Total	333	184	517
	100.00	100.00	100.00
Pearson chi2(1) =	0.0011	Pr = 0.973	

Table 4.
What kind of changes have you made during the pandemic?

	Division		
	Children	Adults	Total
As indicated by COVID protocols	34	17	51
	11.22	9.71	10.67
Did not train	128	72	200
	42.24	41.14	41.84
Avoid contact exercises	41	17	58
	13.53	9.71	12.13
Training with a mask	54	40	94
	17.82	22.86	19.67
Disinfection methods	46	29	75
	15.18	16.57	15.69
Total	303	175	478
	100.00	100.00	100.00
Pearson chi2(4) =	3.1671	Pr = 0.530	

When asked if they worked more on any aspect since the pandemic, first division or national team coaches (28.6%) and preferred coaches (15.6%) indicated that they spend more time on psychological aspects; while the regional and base coaches dedicated more time to physical condition, with values of 20.8% and 20.1% respectively. Psychological work was indicated as one of the variables that coaches worked on the most since the pandemic (Table 5).

Table 5.
Are you working more on any aspect since the pandemic?

	Division		
	Children	Adults	Total
More physical work	41	25	66
	12.65	14.12	13.17
More psychological work	53	35	88
	16.36	19.77	17.56
We couldn't train	191	102	293
	58.95	57.63	58.48
All the above aspects	39	15	54
	12.04	8.47	10.78
Total	324	177	501
	100.00	100.00	100.00
Pearson chi2(3) =	2.3303	Pr = 0.507	

Finally, when asked how football has changed since the pandemic, the regional, base, preferred, first division or national team coaches indicated that they worked more on the physical field (32.5%, 24.9%, 28 .1%, 42.9% respectively); while second division coaches spent more time on technology with 50% of the sample (Table 6).

Table 6.
Logistic regression on coaches' preferences during pandemic training

Division	Odds ratio	Std. err.	z	P>|z|	[95% conf.	interval]
What do you like most about training?	1.211658	.0622829	3.73	0.000	1.095533	1.340091
_cons	.2619993	.0580093	-6.05	0.000	.16976	.4043568
Division_cat	Odds ratio	Std. err.	z	P>|z|	[95% conf.	interval]
What do you like least about training?	1.167264	.051359	3.52	0.000	1.07082	1.272394
_cons	.3318167	.0584516	-6.26	0.000	.2349383	.4686436
Division_cat	Odds ratio	Std. err.	z	P>|z|	[95% conf.	interval]
change due to pandemic	.9928571	.2123192	-0.03	0.973	.6529203	1.509779
_cons	.5555556	.1032914	-3.16	0.002	.3858943	.7998097

Discussion

The objective of this study was to find out if soccer training has changed during the pandemic. The results of this investigation showed that there have been changes in training during this period; mainly when planning different aspects such as technique and tactics. First-class or national team coaches have spent more time on psychological work, while second-class coaches used more technological means during confinement. In the same way, other authors (Radzimiński et al., 2022) observed that the confinement due to COVID-19 negatively influenced the physical performance of professional soccer players. Following these results, Isaza-Gómez et al. (2023) evidenced that the Covid-19 pandemic affected sports performance, given the difficulties in accessing training sessions, the little face-to-face interaction with the coach, and the quality of the technological tools that generated difficulties in remote training processes from home. In athletes, the suspension of training is highly negative for their physical and mental health. Athletes lose the adaptations that are generated in the body when exercising. The main problem was the long periods of personal isolation, which led to long-term detraining and this generated physical and mental alterations (Desiderio & Bortolazzo, 2020). Grimson et al. (2022) showed that physical activity in trained athletes has promoted positive mental health and increased well-being, when physical activity was greater than 250 minutes during lockdown. Similarly, Azevedo et al. (2021) pointed out that it is essential that all these exercises are fun during the period of social isolation. Home training recommendations can and should be adjusted by coaches based on their own ideas and athletes' access to equipment such as treadmills or virtual reality.

The results of other authors (Limayyasya et al., 2022) indicated that the physical conditions of soccer players need to be improved during confinement. Likewise, Quezada-Vargas et al. (2022) tried to identify the level of physical condition and technical foundations in football players after isolation due to COVID-19 and found that the physical and technical condition of soccer players suffered a great impact, which is shown that in 55 % their condition is regular, performance has dropped by 50% compared to the final stage before the start of the pandemic. Based on these results, they concluded that the confinement due to COVID-19 has negatively influenced soccer players; therefore, upon their return they reveal a high degree of limitations in physical and technical condition due to a long period of lack of adequate training (Quezada-Vargas et al., 2022). Peña González et al. (2022) reported a general decrease in the workload in the competition and in the parameters related to high-intensity actions such as accelerations and decelerations. The results of this research (Peña González et al., 2022) showed high negative correlations between percentages reached by the variables according to the workload in matches before and after confinement.

For their part, Radzimiński et al. (2021) analysed whether the pandemic lockdown during the season influenced the physical performance of professional soccer players who participated in the German Bundesliga and Polish Ekstraklasa competition. The physical performance of the Bundesliga teams after the lockdown did not differ significantly from the first part of the season. In contrast, the Polish teams, after lockdown, showed significantly shorter total distances, shorter high-intensity running distances, and fewer high-intensity actions. Radzimiński et al. (2021) indicated that when effective game time was considered, teams covered significantly less relative total distance and relative high-intensity running distance. The results of these authors (Radzimiński et al., 2021) suggest that physical performance during Bundesliga matches was not affected by the COVID-19 lockdown, unlike Ekstraklasa matches; however, this difference could be due to the different duration of the breaks and the different restrictions implemented in these countries during the lockdown due to the pandemic. For their part, Díaz Díaz and Ramos Verde (2021) analysed the effect of the cessation of competition due to COVID-19 on the technical-tactical performance of soccer players from the Spanish 1st division and indicated that there were no significant differences between the parameters analysed, with the exception of the lost balls, which had less evidence in the days of the end of the season.

Anderson et al. (2023) conducted body composition assessments, a countermovement jump test, an eccentric hamstring strength test, and a submaximal intermittent fitness test before and after the training program and noted that Fitness levels were maintained. Although the specific training load of team-based soccer was removed and the prescribed training programs had a greater physical focus. This suggests that alternative modes of training can potentially be used in cases where a team-based football specific training load is not required or available, without negatively affecting physical development. On the other hand, the results of another study (Segalés-Gill et al., 2021) showed

that detraining induced by confinement produces a significant loss of aerobic performance with an increase of 0.4% in body weight, being more relevant the detraining at the cardiorespiratory level than at the muscular level. Following these contributions, Fatih et al. (2021) showed that there are statistically significant variations in the parameters of body weight, body mass index, concluding that the performance levels of amateur football players deteriorated significantly during the period of detraining due to the pandemic.

On the other hand, motor skills, such as resistance and the optimal level of physical activity, play a fundamental role in soccer, since they are necessary to maintain the high effectiveness of the training process. After the stoppage caused by the COVID-19 restrictions, a decrease in the level of cardiorespiratory resistance was noted. Only after two training mesocycles was a significant increase in mean value observed compared to the pre-pandemic period. Considering the negative impact of the restrictions, coaches and physiotherapists should exercise caution when planning training, taking into account the level of physical activity during the pandemic (Kalinowski et al., 2021). Rampinini et al. (2021) noted that within-period changes in aerobic fitness showed a significant improvement after the COVID-19 lockdown and a significant decrease during the summer vacation. Home training during lockdown was effective in improving aerobic fitness, although it did not allow players to maintain the power levels of their competitive period. Likewise, for Dauty et al. (2021) the 2-month period of strict home confinement due to the pandemic was responsible for decreased aerobic capacities and running distance in adolescent soccer players, despite a remotely monitored multimodal exercise program.

Unnithan et al. (2022) suggest that a longer preseason program may improve aerobic conditioning and mitigate injury risk upon return to competitive matches in elite soccer players. For Pucsok et al. (2021) agility, speed, and explosive power can be maintained at the same level under home conditions, although it was challenging for athletes to increase their endurance capabilities to pre-pandemic levels. Bisciotti et al. (2020) provided practical recommendations for preparing training sessions for professional footballers returning to the sport after lockdown. Thus, training sessions should include specific aerobic exercises, resistance, speed and flexibility training programs, and injury prevention exercises, with a particular focus on overuse injuries such as tendon and muscle injuries. Aerobic, resistance and speed training must respect specific phases depending on the progressivity of the training load and the consequent response of physiological adaptation. In another study (Sanmiguel-Rodríguez, 2021b) it was pointed out that sports injuries are becoming a big problem for professionals who work with athletes and that it is necessary to identify the characteristics and types of injuries to be able, in this way, to carry out a more individualized and targeted training, especially during the pandemic. Other researchers (Matsunaga et al., 2023) reported that the median time out of training caused by COVID-19 in 2020 was 39.9 days, and the median time out of play was 70.1 days. The overall incidence of injuries per 1,000 hours of exposure was 5.7 in 2019 and 5.8 in 2020. The overall burden of injuries per 1,000 hours of exposure was 155.5 days in 2019 and 130.2 days in 2020. The incidence of muscle injuries was highest in May 2020, immediately after the isolation period.

For Montealegre Mesa et al. (2023) the affectation of the mood was inversely correlated with the demand and training. There was a direct significant correlation between the daily training time prior to this time in isolation and also with the weekly time during preventive isolation. Therefore, the greater demand and dedication to training is associated with less affectation of psychological response in mood states and the history of greater pre-pandemic training favored a greater intensity of training, in the special period. Other authors (Ortiz Marholz et al., 2022) indicated that soccer players showed average levels of trait anxiety and a good level of general well-being. There is also a correlation between the two; however, maintaining working and active conditions for an athlete seems to be key to feeling a certain degree of control in the face of uncertainty, as well as coping strategies that allow for a high sense of well-being (Ortiz Marholz et al., 2022). Strategies to maintain athletic potential and general well-being include maintaining safe access to training facilities and resources, implementing injury prevention programs, organizing athlete support networks, and incorporating training into resilience and coping (Vincent et al., 2022).

Conclusions and limitations

As the main conclusion, the coaches, regardless of the category in which they trained, indicated that the most relevant change during the pandemic was avoiding contact exercises, mask and tactical training. In addition, the psychological variable has been one of the aspects most worked on by all coaches during and since the pandemic.

On the other hand, one of the main limitations has been the number of publications found in the different scientific databases focused on the subject of this study. Thus, there are publications that associate the pandemic with training, especially in this sport. However, a large part of these articles focus mainly on the return to competition after confinement, on injuries, anxiety and other psychological aspects. It would also be interesting to expand the study and know the methodological differences perceived by the players, depending on their professional level or how the managers of the different teams have appreciated these changes.

For all these reasons, the results of this study can be very useful for future technical bodies when it comes to distributing training and workload.

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