Game stoppages as a tactical means in soccer – a comparison of the FIFA World Cups™ 2006 and 2014

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Abstract

The intention of the present study was to examine, if interruptions are used as a tactical means in international competitions and if law changes influence the duration. Therefore, the 32 matches of the knockout stage of the FIFA World Cups 2006 and 2014 were analysed and compared. Free kicks in 2014, when vanishing spray was used, took significantly longer than in 2006 ($P < .01$). Players were substituted faster by teams behind than at even score ($P < .01$), but not slower by leading teams ($P > .05$). The number of injuries with medical intervention was significantly higher for teams ahead than for teams behind ($P < .05$). When injured players had to be carried off the field by law in 2006, play was continued faster than in 2014 ($P < .05$). Overall, in 2014 leading teams used game stoppages more intensively to kill time than in 2006. To hinder this undesired development officials could think about introducing the concept of net playing time. At least referees should be sensitised for this behaviour even more than nowadays.

Keywords: football, game interruptions, law change, time wasting, vanishing spray

1. Introduction

Soccer is one of the most popular sports today. There exist many studies to understand the character of the game in detail. One of the major themes is the physical load of a soccer match (Bangsbo, 1994; Tschan *et al.*, 2001; Stolen *et al.*, 2005; Dellal *et al.*, 2012; Mallo *et al.*, 2015). According to this aspect, some authors examined the playing time and showed that the effective playing time of the German Bundesliga matches in the seasons from 1992/93 to 1997/98 and in the World Cup matches in 1990, 1994 and 1998 ranged from 45 to 63 min on average (Meyer *et al.*, 2000). However, playing time was also examined from the referees' perspective. Siegle and Prüßner (2015) analysed 31 games of the European Championship 2012 in regard to the additional time at the end of a half. They showed that in 51% of all matches the additional time was set too short. In a follow-up study Prüßner and Siegle (2015) analysed 669 elite league matches in Spain, Italy, Germany and England. In the Premier League the additional time was set too short in 31% of the matches, in the Primera Division 36%, in the Seria A 43% and in the German Bundesliga 57%. These results may lead to the conclusion, that in national leagues as well as in international competitions, interruptions may be used not only for the physical regeneration of the players, but also as a tactical instrument to kill time by the leading team. That, at least, is what coaches, spectators and sport reporters subjectively suppose. However, there is only one international study in which the score at each stoppage was recorded, so that it could be detected, if interruptions served tactical purposes (Siegle and Lames, 2012). For sixteen matches of the German Bundesliga in the 2009/2010 season

the authors could show that free kicks and goal kicks of the leading teams took significantly longer in comparison to the trailing teams. Although there is evidence that interruptions are used to run out the clock, the data situation is still insufficient. Thus, one of the major aims of our study was to analyse whether the duration of stoppages was used as a tactical means in international competitions.

Furthermore, FIFA is permanently looking for law changes to improve and develop the game. One of those laws of the game was that stretcher-bearers should enter the field with a stretcher immediately after the referee decided to allow a doctor on the field so that injured players could be removed from the field swiftly (FIFA, 2006). This law was practised in the World Cup 2006. In 2010 the law was changed, now specifying that the referee has to decide whether stretcher-bearers should enter the field or if an injured player could leave the field on foot (FIFA, 2010). The question arises, if this law change did have an influence on the interruption length. A further law change was the use of vanishing spray to keep the defending players the required distance away from the ball during a free kick. The first FIFA Men's World Cup, where the spray was used was in 2014 (FIFA, 2014a). Therefore, the study compared the World Cup matches in 2006 and 2014, asking, if the change of laws such as the transport of injured players off the field or the use of vanishing spray influenced the duration of interruptions.

2. Methods

For our study, the 32 FIFA World Cup matches of the knockout stage in 2006 and 2014 were recorded. The videos of each match were systematically analysed by noting down the particular variables for each stoppage. The duration of the stoppage was measured from the moment when the referee whistled or when the ball passed a boundary line until the moment when play was continued. This could be either when the referee restarted play by whistling or when the players threw in or hit the ball for a goal kick, a free kick or a corner kick. If the end of the stoppage could not be seen in the video because of slow motion (16.9% of the stoppages), the moment of continuation was assessed considering the distance of the ball from the place of stoppage and the movement of the players or by listening to the referee's whistle resuming play. For each stoppage the score was recorded from the perspective of the taking team counting the goals ahead or behind. Zero was set while the score was even. The categories for the stoppage were throw-in, free kick, goal kick, corner kick, penalty, kick-off, and dropped ball. It was documented if an injured player or a substitution delayed the game, and which team caused the delay. Except for a dropped ball, in case of a delay, the stoppage was eliminated for the calculation of mean durations for each category, but it was still counted as an occurrence in the category. Analyses of mean durations per match, overall, and per category referred only to the first and second half. Extra times were not used for the analyses, because the duration of stoppages may be distorted by the fatigue of the players. The analyses of dependence on score, of delays and of free kicks in the attacking zone considered the whole match, including extra times.
For free kicks in the attacking zone, it was recorded for the World Cup 2014, if vanishing spray was used, when at least two players formed a defensive wall. The attacking zone included five grass stripes from the opponents' goal line.

The categories for the delays were goals, substitutions and injuries. Noting injuries it was further distinguished between two kinds: injuries, which led to a medical intervention, which means that a team doctor or paramedics entered the field, and injuries which only received the referee's attention without a subsequent treatment. Sometimes there was more than one reason for the delay. In this case, every reason was counted as an occurrence. For the calculation of delay durations in dependence on the score, these cases were only considered if players of the same team caused the delay, e.g. when an injured player was also substituted. If, for example, both teams substituted a player within the same interruption, the case was eliminated. When calculating the dependence of occurrences on score, it was only differentiated between being behind or ahead, as the expected frequencies at even score would depend on the time the game was on even score.

For the statistical analyses of differences between stoppage frequencies and durations in 2006 and 2014 t-tests were performed. Student's t-tests were used for equal variances of the two groups, and Welch's t-tests if the variances were different. The number of occurrences of delays being ahead or behind was compared by chi² tests. Interactions between durations and the World Cups or the score were assessed by ANOVAs. The level of significance was set to $P < .05$ for all statistical tests.

3. Results

In the final matches of the two FIFA World Cups 2006 and 2014, 4129 stoppages were registered altogether (World Cup 2006: 2083; World Cup 2014: 2046). The mean duration of all stoppages increased from 20.4 s (± 18.0 s) in 2006 to 23.1 s (± 21.8 s) in 2014, *$T = -4.299$, $df = 3955$, $P < .001$*.

3.1. Analyses per match

3.1.1. Number and duration of stoppages and playing time per match

The number and the overall duration of stoppages as well as the playing time per match are shown in Table 1.

Table 1. Descriptive data and t-test statistics comparing all variables per match between the World Cups 2006 and 2014.

	2006 (n=16)	**2014 (n=16)**	**T**	**df**	**P**
Number of stoppages	116.9+8.4	109.4+13.4	1.893	30	.068
Duration of stoppages [min]	39:42+3:20	41:39+6:10	-1.111	30	.275
% play stopped	41.8+3.2	43.3+6.1	-.877	30	.387
Additional time [min]	4:55+1:36	5:49+1:56	-1.436	30	.161
Gross playing time [min]	94:55+1:36	95:49+1:56	-1.436	30	.161
Net playing time [min]	55:12+2:58	54:10+5:37	.657	30	.516

On average, a match was stopped more than once per minute. The number of stoppages slightly decreased from 2006 to 2014, while the mean overall duration of stoppages per match increased by almost two minutes. The referees accounted for this phenomenon by increasing the additional time for nearly one minute. Still, the remaining effective net playing time diminished by one minute to 54 min and 10 s in 2014.

3.1.2. Number and overall duration per category and match

Table 2 provides the mean number of occurrences of each stoppage category per match. In addition, the overall duration of stoppages per category and match are listed. The most frequent reasons for stoppages were throw-ins, which in average occurred almost every two minutes. Free kicks are the category with the longest overall duration of the stoppages per match. Each match was interrupted almost a quarter of an hour because of a free kick. The number of free kicks decreased significantly from 41 in 2006 to 33 in 2014. Goals (kick-offs, respectively), penalties and dropped balls did not occur in every match within the regular playing time. But if so, they mostly took more than a minute.

Table 2. Descriptive data and t-test statistics comparing the stoppage categories per match between the World Cups 2006 and 2014.

Category		**2006 (n=16)**	**2014 (n=16)**	**T**	**df**	**P**
Throw-in	Number	44.3+9.4	44.8+9.6	-.130	30	.898
	Overall duration [min]	7:00+1:49	8:12+1:48	-1.884	30	.069
Free kick	Number	41.2+9.1	32.9+7.6	2.787	30	.009
	Overall duration [min]	13:59+2:55	12:54+5:15	.715	30	.480
Goal kick	Number [N]	19.6+5.0	19.0+4.5	.370	30	.714
	Overall duration [min]	6:12+1:37	7:01+1:44	-1.355	30	.186
Corner kick	Number [N]	8.8+2.6	10.4+4.3	-1.284	30	.209
	Overall duration [min]	3:30+1:12	4:27+2:06	-1.573	30	.126
Kick-off	Number [N]	(n=12) 2.2+1.1	(n=10) 2.7+2.0	-.790	20	.439
	Overall duration [min]	1:37+0:57	2:37+1:35	-1.813	20	.085
Penalty	Number [N]	(n=5) 1.0+.	(n=3) 1.0+.	-	-	-
	Overall duration [min]	1:10+0:18	1:45+0:38	-1.639	5	.162
Dropped ball	Number [N]	(n=10) 1.6+.8	(n=7) 1.0+.0	2.250	9	.051
	Overall duration [min]	1:55+1:07	1:15+0:37	1.415	15	.177

3.2. Analyses of stoppage durations for all matches

3.2.1. Durations of all categories of stoppages

Table 3 gives an overview of the mean durations of all categories of stoppages during the FIFA World Cup matches in 2006 and 2014. During the regular playing time of the final matches in 2014 penalties took longest on average. An interruption restarted by a dropped

ball, which was mostly caused by a player's injury, also took more than a minute on average. For these two categories, as well as for corner kicks, there were no differences between the World Cups. However, throw-ins, free kicks, goal kicks and the celebration of goals took significantly longer in 2014 than in 2006.

Table 3. Descriptive data and t-test statistics comparing the durations of all categories of stoppages between the World Cups 2006 and 2014.

	Duration [s]		**T-test statistics**		
Category	**2006**	**2014**	**T**	**df**	**P**
Throw-in	(n=658) 10.2+5.4	(n=684) 11.5+7.3	-3.743	1256	<.001
Free kick	(n=628) 21.4+16.5	(n=493) 25.2+19.4	-3.439	967	.001
Free kick in the attacking zone	(n=37) 54.9+20.4	(n=32) 70.1+20.5	-3.093	67	.003
Goal kick	(n=292) 20.4+6.7	(n=288) 23.4+10.0	-4.205	502	<.001
Corner kick	(n=135) 25.0+8.7	(n=158) 27.1+12.7	-1.734	279	.084
Kick-off	(n=26) 45.1+10.9	(n=27) 58.3+15.8	-3.509	51	.001
Penalty	(n=4) 70.3+18.4	(n=3) 105.3+38.1	-1.639	5	.162
Dropped ball	(n=16) 72.2+36.7	(n=7) 75.3+37.6	-.185	21	.855

3.2.2. Free kicks in the attacking zone

For the World Cup 2006 as well as for the World Cup 2014, 64 free kicks occurred in the attacking zone during the knockout matches. In 2014 in five cases no defensive wall was formed. When only one player formed a wall, the referees did not use vanishing spray in 7 out of 20 cases in 2014. Therefore, in order to get a comparable sample, only free kicks were considered when at least two players formed a wall, and for the World Cup 2014, when vanishing spray was used. Furthermore, free kicks were eliminated, which were delayed by a player's injury or by substitutions. Consequently, for the World Cup 2006, 37 free kicks in the attacking zone remained for comparison and 32 free kicks for the World Cup 2014. When vanishing spray was used, a free kick in the attacking zone in 2014 took 70 s on average, which was significantly longer than in 2006 (s. Table 3).

3.2.3. Dependence on score

Upon analysing the dependence of the stoppage durations on score, it was noted if the taking team was behind, ahead or if the score was even. Stoppages with special delays (injuries, substitutions, celebration of goals) were analysed separately. In 2014 the duration of stoppages was significantly dependent on the relative scores, $F(2, 1883) = 23.322$, $P < .001$, $eta^2 = .024$. The post-hoc tests revealed significant differences for teams behind (15.8 s), at even score (19.5 s) and for teams ahead (23.3 s; all $P < .001$). In 2006 the duration of stoppages also significantly depended on the relative scores, $F(2, 1908) =$

14.049, P < .001, eta² = .015. This was mainly due to the considerable differences between teams behind (14.0 s), and at even score (17.9 s). However, the stoppage durations at even score and for teams ahead (18.4 s) were very similar (*P = .799*).

Further analyses considered the number of goals behind or ahead. Figure 1 illustrates the finding that, with more than one goal ahead, stoppage duration did not differ from the duration of even scores (2006: *P = .987*; 2014: *P = .739*). On the other hand, stoppage duration was shorter, when the team was behind regardless of the number of goals (all *P < .05*).

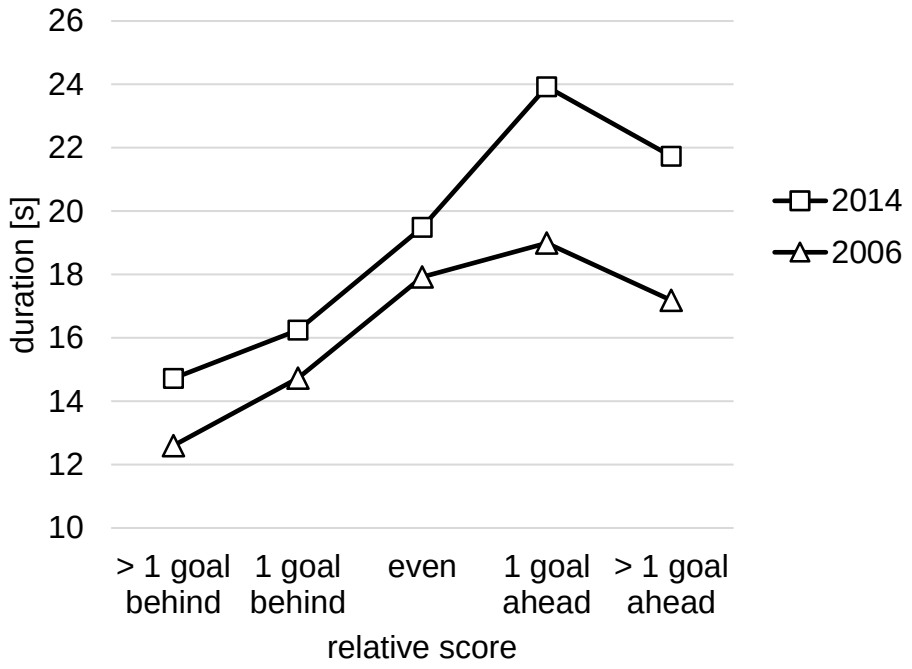

Figure 1. Stoppage durations in dependence on the relative score

3.3. Analyses of delays

Stoppages were eliminated in the above comparisons of the stoppage durations of different parameters when special forms of delays occurred. Otherwise, the values would have been distorted. Nevertheless, especially these delays may be used by players and coaches to kill time for tactical reasons. Thus, all delays by injuries, substitutions and celebration of goals were analysed separately. In 2006, 171 out of 2083 stoppages were caused or followed by such a delay, and in 2014, 155 out of 2046. Descriptive data and t-test statistics comparing the delays of interruptions between the World Cups in 2006 and 2014 are shown in Table 4.

Table 4. Descriptive data and t-test statistics comparing the delays of stoppages between the World Cups in 2006 and 2014.

	Duration [s]		T-test statistics		
Category	**2006**	**2014**	**T**	**df**	**P**
Injury without medical intervention	(n=24) 36.5+12.7	(n=12) 36.7+15.6	-0.043	34	.966
Injury with medical intervention	(n=37) 82.8+25.5	(n=35) 99.3+29.7	-2.534	70	.014
Substitution	(n=62) 40.4+13.2	(n=61) 45.2+16.1	-1.801	121	.074
Goal	(n=28) 42.5+11.6	(n=35) 60.3+18.9	-4.360	30	<.001
Multiple reasons	(n=20) 86.7+43.9	(n=12) 110.1+33.2	-1.589	30	.123

While the number of injuries without medical intervention was twice as large in 2006 in comparison to 2014, the time of the delay remained constant. In contrast, the number of injuries with medical help was very similar in both World Cups, but in 2014 the caused delays were significantly longer than in 2006. In both World Cups, two of three possible substitutions were performed on average by each team, which delayed the game slightly more in 2014. It took significantly longer for the game to resume after a goal in 2014 than in 2006.

Comparison results of stoppages with a delay in dependence on the score are shown in Table 5.

Table 5. Descriptive data and ANOVA statistics comparing the delays of stoppages in dependence on the score.

			Duration [s]		ANOVA statistics			
Category	**Score**	**N**	**Mean**	**SD**	**F**	**df**	**P**	**eta²**
Injury without medical intervention	behind	7	35.9	20.0	0.048	2	.953	.003
	even	22	37.1	12.4				
	ahead	7	35.4	11.0				
Injury with medical intervention	behind	7	79.3	22.4	0.664	2	.518	.019
	even	45	91.4	29.0				
	ahead	20	93.6	30.0				
Substitution	behind	31	35.5	12.7	5.664	2	.004	.087
	even	52	43.9	16.1				
	ahead	39	46.8	13.0				
Goal	behind	5	38.6	7.6	1.588	2	.213	.050
	even	7	52.1	15.0				
	ahead	51	53.7	19.0				

The situation that a team was still behind after scoring a goal only occured 5 times in the 32 final matches of both World Cups. An equalizer was scored 7 times. The time until kick-off did not depend on the score after the goal.

The number and duration of injuries of players without following medical intervention were very similar while the team of the injured player was either behind or ahead. For injuries with medical intervention, the situation was different. The number of cases was significantly higher for leading teams, $chi^2 = 6.259$, $df = 1$, $P = .012$. The difference in the duration, however, was not significant. A separate consideration of both World Cups reveals that the duration of treated injuries in 2006 (79.3 ± 27.3 s) and 2014 (79.3 ± 22.5 s) was almost identical for teams behind, whereas there was a significant difference during lead (2006: 73.4 ± 37.8 s; 2014: 102.3 ± 35.8 s), $T = -2.183$, $df = 33$, $P = .036$. To assess the practical relevance of this behaviour, all cases of delay by treated injuries were summed up per match. Players behind had to be treated 22 s on average per match (± 42 s), whereas players ahead required an additional minute (82 ± 134 s), $T = -2.389$, $df = 37$, $P = .022$.

Almost as many substitutions were performed behind as ahead. However, there was a significant difference in the duration of substitutions in dependence on the score. Post-hoc tests showed evidence that the players were substituted faster when the team was behind than at even score, $P = .041$, and when the team was ahead, $P = .006$. However, there was no difference in the duration of substitutions when the score was even in comparison to teams ahead, $P = .625$.

Summing up the delays of players' injuries or substitutions per match in dependence on the score shows that the game was delayed significantly longer by leading teams, $T = 2.832$, $df = 45$, $P = .007$. The difference adds up to 81 s (behind: 67 ± 71 s; ahead: 148 ± 145 s).

4. Discussion

First, we found that the net playing time was about 55 min in the World Cup matches in 2006 and 2014. This net playing time is similar to the World Cup 1990 (54:58 ± 02:51 min), but lower than in 1994 (61:05 ± 03:20 min) and 1998 (62:38 ± 02:29 min) (Meyer *et al.*, 2000). Still, in the World Cup matches the net playing time seems to be longer than in matches of the German Bundesliga (45-55 min during the seasons 92/93-97/98) (Meyer *et al.*, 2000).

Concerning the number of stoppages per categories, the study revealed no differences between the two World Cups, except with free kicks. It can be seen as a positive development that the number of free kicks per match decreased significantly from 2006 to 2014, as this, besides other kinds of free kicks, mainly results from fewer fouls. However, in 2014 the average stoppage duration of free kicks was significantly longer than in 2006. In addition, throw-ins and goal kicks also took significantly longer in 2014 than in 2006. The reasons for this cannot yet be clarified by our study. Considering climate tables one could expect that the temperatures in Brasil in 2014 compared to those in Germany in 2006 would have been higher (Haeseler *et al.*, 2014) and that this would lead the players to use interruptions for regenerative purposes. However, the measured average temperatures at the knockout matches of the both World Cups were quite similar (FIFA, 2014b; WetterOnline, 2016).

The fact that free kicks took longer in 2014 than in 2006 could be seen as a distortion, when comparing free kicks with and without vanishing spray. However, the difference between the duration of free kicks in the attacking zone in 2006 and 2014 amounted to 15 s, whereas free kicks in general took only 4 s longer. Thus, the conclusion that the use of vanishing spray has lengthened the execution of a free kick still seems reasonable. This law change by FIFA aimed to reduce attempts of encroachment by players (FIFA, 2013). Our study showed that a side effect of this change was a lengthened duration of a free kick when the opponents formed a defensive wall.

Another law change, which our study examined, was that in the World Cup 2006 every injured player who needed medical intervention had to be carried off the field on a stretcher, whereas in 2014 the stretcher only came in use when the referee demanded it (FIFA 2006, 2010). Our results revealed that the time of delay was significantly higher in 2014, when a player got medical treatment on the field, in comparison to 2006, when the player was carried off. Moreover, the possibility to get medical intervention on the field was definitely used as a tactical instrument to kill time by the leading teams in 2014. With the prior law in 2006 this was not possible. Therefore, on the one hand this law change lengthened the duration of interruptions after injuries. On the other hand, the gained time added up to not more than one minute per match, which seems to be rather a psychological than a relevant tactical advantage. Besides, the questionable behaviour of some players jumping off the stretcher immediately after crossing the boundary line could be minimised by this law change.

Concerning the question whether stoppages were used as a tactical means by the leading team to kill time, our study showed interesting results. In the recent World Cup 2014 this indeed was the case. Stoppages of teams ahead took significantly longer than of teams behind or at even score. However, in the World Cup 2006 we could only show evidence that teams behind continued the match faster than teams ahead or when the score was even. On the other hand, teams ahead did not need significantly more time after stoppages than at even score. Obviously, the subjective impression of the leading team killing time was not sustained by our study for the World Cup 2006. According to this finding, the duration of substitutions did not differ significantly for leading teams in comparison to even scores during both examined World Cups. This might be in contrast to a spectator's perception. Concerning substitutions, it was only confirmed by our study that teams behind substituted their players faster. The same behaviour was found for the situation after scoring a goal. If a team was still behind after scoring a goal, the game was continued significantly faster than after an equalizer or after scoring the go-ahead goal, but there was no difference between an equalizer and a go-ahead goal.

A further interesting result was that by more than one goal ahead the stoppage duration did not differ from the duration at even scores anymore for both World Cups. The teams seemed to be confident about winning when they were at least two goals ahead, so that there was no need of killing time anymore. In contrast, teams behind by more than a goal still continued the game significantly faster. They still seemed to believe in their chance to level.

5. Conclusions

This study showed some interesting new findings about game stoppages. First, one can state that in 2014 game stoppages took significantly longer and were used as a tactical instrument more intensively than in 2006. Second, law changes by FIFA certainly resulted in changes in the behaviour of the players, such as stoppage durations in our study. Thus, after law changes it should be monitored for a certain time if the intended effects actually are achieved and if side effects occur. Concerning the increased use of time killing by leading teams, it should be discussed if this trend is desired or not, and if not, what should be done against it. From the point of view of a neutral spectator, the excitement decreases as such time delays increase, because there is less time to turn the game around. For the supporters of the team behind, however, the provocation when the leading team is delaying the game has emotional appeal. To ensure equal opportunities for both teams, the fairest solution certainly would be to introduce the concept of net playing time in soccer. However, this would have far-reaching consequences for the whole system and should be discussed meticulously. A less disruptive possibility would be to instruct the referees to spend even more attention in rating the additional time in order to create equal opportunities for both teams.

6. References

Bangsbo, J. (1994), Energy demands in competitive soccer, **Journal of Sports Sciences,** 12, S5-S12.

Dellal, A., Owen, A., Wong, D.P., Krustrup, P., van Exsel, M. and Mallo, J. (2012), Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer, **Human Movement Science,** 31, 957–969. doi:10.1016/j.humov.2011.08.013

FIFA (2006). **Laws of the Game 2006**. Retrieved from http://www.fifa.com/mm/document/affederation/federation/lotg2006_e_1581.pdf

FIFA (2010). **Laws of the game 2010/2011**. Retrieved from http://www.fifa.com/mm/document/affederation/generic/81/42/36/lawsofthegame_2010_11_e.pdf

FIFA (2013). **The vanishing spray is to be utilised at FIFA competition for the first time**. Retrieved from http://www.fifa.com/u20worldcup/news/y=2013/m=6/news=vanishing-spray-used-for-first-time-fifa-competition-2114751.html

FIFA (2014a). **2014 FIFA World Cup Brazil™. Technical report and statistics**. Retrieved from http://resources.fifa.com/mm/document/footballdevelopment/technicalsupport/02/42/15/40/2014fwc_tsg_report_15082014web_neutral.pdf

FIFA (2014b). **2014 FIFA World Cup Brazil™ - Matches**. Retrieved from http://de.fifa.com/worldcup/archive/brazil2014/matches/index.html

Haeseler, S., Lefebvre, C. and Kirsch, B. (2014), **Klima in Brasilien im Juni/Juli zur Zeit der Fußball-WM 2014 [Climate in Brasil in June/July during the Football Worldcup 2014]**. Retrieved from https://www.dwd.de/DE/presse/hintergrundberichte/2014/WM_Klima_Brasilien.pdf

Mallo, J., Mena, E., Nevado, F. and Paredes, V. (2015), Physical Demands of Top-Class Soccer Friendly Matches in Relation to a Playing Position Using Global Positioning System Technology, **Journal of Human Kinetics,** 47, 179–188. doi:10.1515/hukin-2015-0073

Meyer, T., Ohlendorf, K. and Kindermann, W. (2000), Longitudinal analysis of endurance and sprint abilities in elite German soccer players, **Deutsche Zeitschrift für Sportmedizin,** 51, 271–277.

Prüßner, R. and Siegle, M. (2015), Additional Time in Soccer – Influence of League and Referee, **International Journal of Performance Analysis in Sport,** 15, 551–559.

Siegle, M. and Lames, M. (2012), Game interruptions in elite soccer, **Journal of Sports Sciences,** 30, 619–624. doi:10.1080/02640414.2012.667877

Siegle, M. and Prüßner, R. (2015), Additional time in soccer, **International Journal of Performance Analysis in Sport,** 13, 716–723.

Stolen, T., Chamari, K., Castagna, C. and Wisloff, U. (2005), Physiology of soccer – an update, **Sports Medicine,** 35, 501–536.

Tschan, H., Baron, R., Smekal, G. and Bachl, N. (2001), Belastungs-Beanspruchungsprofil im Fußball aus physiologischer Sicht [Physiological aspects of the load-strain-relation in soccer], **Österreichisches Journal für Sportmedizin,** 19, 7–18.

WetterOnline (2016): **Wetter Rückblick Deutschland [Weather retrospect Germany]**. Retrieved from http://www.wetteronline.de/rueckblick

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