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Full Length Research Paper

Mechanical assessment of artificial turf football pitches: The consequences of no quality certification

Pablo Burillo[1]*, Leonor Gallardo[2], José L. Felipe[3] and Ana M. Gallardo[4]

[1]Instituto de Ciencias del Deporte, Camilo José Cela University, Madrid, Spain.
[2]Faculty of Sport Sciences, University of Castilla-La Mancha, Toledo, Spain.
[3]Faculty of Sport Sciences, European University of Madrid, Madrid, Spain.
[4]Faculty of Health, Physical Activity and Sport, Catholic University of San Antonio, Murcia, Spain.

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The aim of the study is to assess a sample of twenty artificial football turf pitches (3rd Generation) of the Spanish football league. 7 regulatory tests were conducted '*in situ'* as presented in EN 15330-1:2007 and Fédération Internationale de Football Association (FIFA) rules. None of the pitches examined passed the 7 field tests of the certification protocols. Only 1 of the fields assessed passed 5 of the 7 tests in the EN protocol. The characteristics of the artificial turf system, such as the type of fibre, type of rubber infill or elastic base have an influence on the mechanical properties of the pitch. Standardization should be compulsory in new artificial turf grounds, regardless of the sporting competition that is held.

Key words: Artificial turf, quality, field test, Fédération Internationale de Football Association (FIFA), EN rules.

INTRODUCTION

Artificial turf aims to imitate the mechanical and aesthetic properties of its natural counterpart. Its purpose is to solve many of the problems of maintenance and care associated with natural turf as a living organism. Since the installation of the first artificial turf pitch in 1965, this medium has experienced spectacular growth in many sports, including hockey, rugby, paddle tennis, baseball, golf, and tennis (Andersson et al., 2008; Fuller et al., 2010; Rielly, 2005).

In football, artificial turf has taken a long time to be implemented and accepted. The third-generation artificial football turf that represents a quantum leap over previous generations (Foster, 2007) with the addition of rubber and sand to the synthetic surface appeared in the 90 s. Since then, some of the drawbacks when comparing natural and artificial turf that existed previously, particularly with regard to its mechanical properties and sports injuries, have reduced (Bocca et al., 2009; Bjørneboe et al., 2010; Castellano and Tranfo, 2008; Dragoo and Braun, 2010; Ekstrand et al., 2006; Fuller et al., 2010; Li et al., 2010; Meyers and Barnhill, 2004; Naunheim et al., 2004; Pasanen et al., 2008; Sandkuehler et al., 2010; Steffen et al., 2007). Thus, synthetic turf has now come to the training grounds of large professional clubs (Kirby and Spells, 2006). Fédération Internationale de Football Association (FIFA) has defended the position of artificial turf as an alternative surface to natural turf (particularly in areas with extreme climates and fewer economic resources) but not as a replacement (FIFA, 2007a).

In current sports facilities management, the certification of products and fittings is a fundamental requirement (Bartlett et al., 2009). The mechanical properties of synthetic turf depend on the components used in its manufacture, the way it is installed, the rate of use a surface receives, and the level of maintenance. The purpose of standardization is to comply with a set of requirements to ensure that the pitch is suitable for playing on, safe for the players, and meets the minimum set standards. According to Bartlett et al. (2009), the motivation for, or purpose of, testing sports surfaces can be split into four categories: (1) comparison between pitches or with standards; (2) assessment of facilities provision and quality for both recreational sport and

*Corresponding author. E-mail: pburillo@ucjc.edu. Tel: +34 91 815 31 31, ext. 1218. Fax: +34 91 860 93 33.

across elite competitions; (3) informing operation and maintenance decision making; or (4) for research into surface design, function, or injury risk.

Artificial turf football pitches may be standardized according to various certifications. The European norm drawn up by the European Committee for Standardisation (CEN) is EN 15330-1:2007. This standard specifies performance and durability characteristics for synthetic sports surfaces used outdoors, including those for football. The standard is recommended for a surface used for amateur, educational, and recreational sport. On the other hand, FIFA, as the international football governing body, has published another quality standard called 'FIFA Quality Concept for Football Turf' (FIFA QCFT), the latest version having appeared in 2009 (FIFA, 2009a, b). FIFA proposes two certifications: FIFA 1-Star and FIFA 2-Star. The former is more closely linked to community and amateur football, and the latter, to the professional and top-flight games. By applying these norms, manufacturers and builders provide playing surfaces of proven quality and safety.

However, standardization is a protocol that is seldomly used for football pitches. Neither EN 15330-1:2007 nor FIFA QCFT is compulsory, except for international competitions, when the pitch is usually required to comply with the FIFA 2-Star standard. Furthermore, in most of the studies on artificial turf published previously, it is not specified exactly whether the sample of artificial turf pitches (very small in some studies) has met international quality standards (EN or FIFA QCFT). The European Synthetic Turf Organisation (ESTO) estimated that in 2008, there were more than 15,000 synthetic pitches in Europe (ESTO, 2008), of which, according to FIFA (2011), only 2.5% had FIFA certification (1- or 2-Star). The quality certification proposals of field properties in most of the Spanish artificial turf fields (third generation), and probably in other European countries, are not carried out (Burillo, 2009); thus, it remains unknown whether these are safe and functional surfaces for sports users.

Aims

The principal aim of this study was to assess a sample of synthetic football pitches used by the Spanish football league at various levels. It also aims to test the influence of characteristics of artificial turf and the socio-demographic, usage, and infill material aspects on the mechanical conditions of the pitch

METHODS

A quantitative study was drawn up using a descriptive and comparative methodology via the technique of protocol data collection and a battery of tests (Thomas et al., 2005). For this, seven field trials were assessed, according to the quality standards established in EN 15530-1: 2007 for football and the 2009 FIFA quality concept for Football turf.

Characterisation of the pitch sample

Twenty artificial turf grounds were selected at random from synthetic football grounds in the region of Castilla-La Mancha (93 grounds) in the centre of Spain, with an associated standard error of 10%. The artificial turf system used was 3rd Generation, with sand and rubber infills. None of the 93 fields had previously been approved by any quality standards (neither EN 15330-1:2007 nor FIFA QCFT).

All our sample was less than ten years old (Table 1). The pitches are used for national, regional, and local football competitions. The predominant pitch is of fibrillated synthetic fiber (65%) with a synthetic pile height of 6 cm (55% of the sample) and without an elastic base (90% of the cases studied).

Seventy-five percent of the fields use styrene-butadiene-rubber (SBR) infill. The remaining installations use other types of rubber, such as ethylene-propylene-diene-monomer (EPDM) or thermo-plastics. 15% of the pitch samples do not receive specific continuous maintenance for artificial turf. In 55% of the cases studied, the pitches are used for more than 35 hours per week.

Protocols and regulatory testing

For the study, the following 7 regulatory tests were conducted '*in situ'* as presented in EN 15330-1:2007, Annexe A for football and the FIFA Quality Concept for Football Turf 2009, in the Handbook of Test Methods for Football Turf, in the field tests section: vertical ball rebound, ball roll, vertical deformation, shock absorption, rotational resistance, surface regularity, and pile length (Table 2). There are no great differences between the two protocols as far as the list of tests is concerned. The main discrepancies are related to the temperature of the pitch, wind speed, the number and location of testing positions, and the instructions for testing ball rotation.

Regulatory requirements

Each of the regulatory protocols, EN 15330-1 and FIFA QCFT, establishes a set of requirements for the qualification of a football pitch. The test results must come between a set range in all areas of the pitch for it to be declared suitable (in other words, it must be suitable to the entire extension of the pitch, regardless of the average values). Although each of the regulations sets permitted ranges, EN 15330-1:2007 and FIFA 1-Star are fairly similar, whereas FIFA 2-Star is much more restrictive. Another difference is the field positions to be assessed: EN 15330-1 sets 5 positions that need to pass, whereas for the FIFA QCFT protocol, it is 6 (Figure 1).

Procedure

The tests were conducted on the 20 football grounds under stable meteorological conditions (dry), with wind speed between 0 and 0.5 m/s and temperature between +8 and +25℃ during the 20 08/2009 season. Data were taken from the 7 test methods, in the 5 positions set by the EN 15330-1 protocol for football, Annexe A3, and in the 6 positions of the FIFA QCFT protocol. The equipment and laboratory materials specified in the regulations for each test were used.

Data analysis

The SPSS 15.0 statistics programme for Windows was employed for the data analysis. Various statistical tests were applied: a descriptive analysis of the variables (average, standard deviation, and percentage). First we used the Kolmogorov-Smirnov test to analyze the distribution normality. The non-normal nature of the

Table 1. Characterization of the sample.

Categorical variable		Nº	Percentage
Age of football field	Up to 5 years	10	50
	5-10 years	10	50
Category of football field	National	7	35
	Regional	7	35
	Local	6	30
Fibre	Fibrillated	13	65
	Monofilament	7	35
Rubber	SBR	15	75
	Others (EPDM/Thermoplastics)	5	25
Shock pad	Yes	2	10
	No	18	90
Specific and regular maintenance	Yes	9	45
	No	11	55
Use per week	Up to 35 h	9	45
	> 35 h	11	55
Total		20	100

data and the small sample size made it difficult to compare the averages of each subgroup of data in terms of the independent variables. The auxiliary calculations showed the closeness of the average and median values in each subgroup, so we proceeded to apply the Mann-Whitney or Kruskal-Wallis test, which enabled us to determine whether there were significant differences between medians. By applying a nonparametric method, it provided indirectly a comparative indicator of the distribution averages. A confidence level of 95% was established, and the statistical significance was $p<0.05$.

RESULTS

Certification protocol

None of the pitches examined passed the 7 field tests in the three certification protocols. We found that only 1 of the fields assessed passed 5 of the 7 tests in the EN protocol, although the same pitch passed 6 of the tests for the FIFA 1-Star protocol. The average mark in tests passed for the EN or FIFA protocols was less than 3 (Table 3). Approximately, 70% of the pitches passed 2 of the tests or fewer. In the FIFA 2-Star protocol, with more restrictive ranges, 25% of the pitches passed none of the tests carried out. Similarly, no pitch passed more than 3 tests in the FIFA 2-Star protocol.

Mechanical tests

In each of the field tests, we see that the tests with the highest pass rate are the surface regularity and the loss of pile length (Table 4). Nevertheless, both tests are far from being passed by the whole sample, and the passing percentage is around 50% of the pitches. Noteworthy is the fact that in the FIFA 1-Star protocol, ball roll had a 60% pass rate, a much higher percentage than for the EN or FIFA 2-Star protocols, in which only 2 fields passed.

Similarly, the test with the worst results obtained by the pitches was shock absorption, in which only 5% of the sample (in other words, just one installation of the twenty analyzed) possessed the safety requirements laid down in the regulations for the entire extension of the ground. The field results are somewhat deficient according to the '*in situ'* certification protocols. The EN protocol obtained similar results to the FIFA 1-Star protocol. However, the FIFA 2-Star certification (with much more restrictive parameters) was the protocol with the lowest pass rate in each of the tests.

Characteristics of the artificial turf fields

Table 5 shows the results of the EN 15330-1:2007 protocol, regarding the different sociodemographic and management characteristics of the sporting facility: years since opening, specific artificial turf maintenance, hours of use per week and competition level of the field.

With regard to the age of the fields, significant

Table 2. Normative references and field test requirements used.

Test method		Requirement		
		EN 15330-1:2007	FIFA quality concept for football turf:2009	
			FIFA 1 star	FIFA 2 star
Vertical ball rebound	Standards	EN 12235:2004; EN12235:2004/AC	FIFA Test Method 01	
	Requirements	0.608 – 1.012 m	0.60 - 1 m	0.60– 0.85 m
Ball roll	Standards	EN 12234:2002; EN 12234:2003 Erratum	FIFA Test Method 03	
	Requirements	4 - 10 m	4 m - 12 m	4 - 10 m
Shock absorption	Standards	EN 14808:2005	FIFA Test Method 04	
	Requirements	55 - 70%	55 - 70%	60 - 70%
Vertical deformation	Standards	EN 14809:2005, EN 14809:2005/AC	FIFA Test Method 05	
	Requirements	4 - 10 mm	4 - 9 mm	4 - 8 mm
Rotational resistance	Standards	EN 15301-1:2007	FIFA Test Method 06	
	Requirements	25 - 50 Nm	25 - 50 Nm	30 - 45 Nm
Surface regularity	Standards	EN 13036-7:2003		
	Requirements	< 10 mm	< 10 mm	< 10 mm
Pile length of artificial turf	Standards	ISO 2549		
	Requirements	≤ 10%	≤ 5%	≤ 5%
Nº Field Test positions		5	6	6

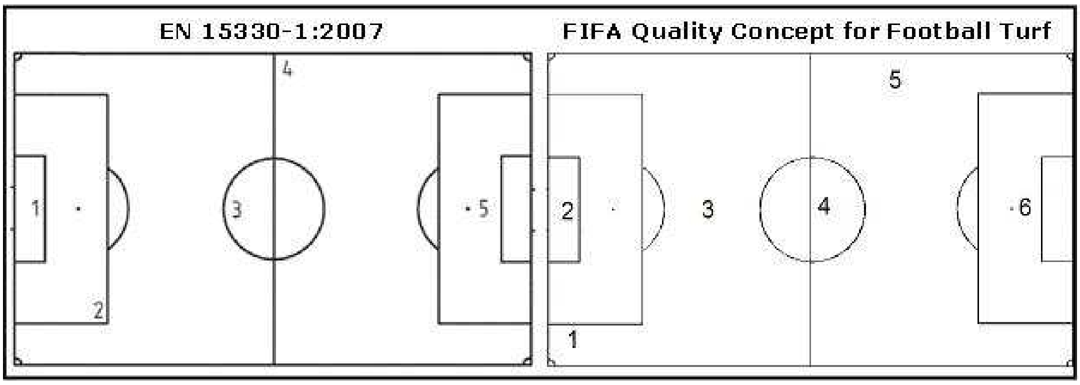

Figure 1. Field tests positions, by EN 15330 (left) and FIFA QCFT (right).

differences were obtained in most of the variables studied. The results show that in the vertical bounce, shock absorption, vertical deformation, pile length tests ($p<0.01$) and ball roll ($p=0.014$), the facilities that are 5 years old or less displayed significantly different averages, closer to those required by the international regulations (EN and FIFA) for those grounds of more than 5 years old.

The sample was subdivided into fields that carried out continuous maintenance operations (45% of the sample) and those that did not (55% of the sample), controlling that the types of surfaces and the weekly hours of use

Table 3. Number of suitable fields according to the specific rules.

Test passed	Nº Field		
	EN 15330-1: 2007	FIFA1 star	FIFA 2 star
0	2	1	5
1	5	7	5
2	6	1	7
3	5	7	3
4	1	3	-
5	1	-	-
6	-	1	-
7	-	-	-
$\overline{X}$ (s)	2.05 (1.28)	2.40 (1.50)	1.40 (1.05)

Table 4. Number of suitable fields according to the test methods.

Test method	Pass EN 15330-1:2007		Pass FIFA1 star		Pass FIFA 2 star	
	Nº Field	Percentage	Nº Field	Percentage	Nº Field	Percentage
Vertical ball rebound	6	30	5	25	0	0
Ball roll	2	10	12	60	2	10
Shock absorption	1	5	1	5	1	5
Vertical deformation	3	15	3	15	2	10
Rotational resistance	8	40	8	40	4	20
Surface regularity	10	50	10	50	10	50
Pile length artificial turf	11	55	9	45	9	45

were homogeneous in both group. The maintenance procedure enables shock absorption and vertical deformation to be significantly higher, as compared with fields that receive no type of specific care. Furthermore, these grounds display a significantly lower percentage of pile height loss.

Most of the artificial turf fields have an average use of 35 h or more than 35 h per week (11 fields), with the rest receiving up to 35 h per week (9 fields). The hours of usage of the fields mainly affect the ball roll test ($p=0.0049$). There also are significant differences with regard to the vertical rebound and loss of pile length tests. In the vertical rebound test, a significantly higher result (average 1.09 m), as well as a higher percentage of pile loss (around 15.5%), was obtained for grounds used for more than 35 h per week. No significant differences were found in terms of the three categories of matches held at these facilities (‘national’, ‘regional’ and ‘local’).

Characteristics of the artificial turf system

Table 6 shows the results of the EN 15330-1:2007 protocol, regarding the different characteristics of the artificial turf system: type of fibre, type of rubber granules and shock pad. The type of fibre used had significant influence in 4 of the 7 tests conducted. Monofilament-type fibre pitches obtained average results that were significantly closer to the ranges specified by the regulations in the mechanical vertical rebound (0.77 m), ball roll (9.24 m), and pile length loss (-1.65%) tests, compared with the fibrillated-type pitches, that is, better ball rebound, a more suitable ball displacement, and a lower percentage of pile length loss. On the other hand, the fibrillated fields obtained significantly better average results in the rotational resistance test than the monofilament pitches did.

The majority of the sample used recycled rubber infills, of the SBR type (15 fields), whereas the rest (5 fields) used virgin rubber infills (EPDM or Thermoplastics). The type of rubber did have an effect in some of the mechanical tests. The pitches with SBR-type rubber gave significantly better results for shock absorption, with a vertical deformation that was closer to the regulations and a more suitable vertical rebound for the players ($p<0.01$).

After comparing pitches with and without an elastic base, significant differences were found in shock absorption and vertical deformation: grounds with an elastic base had significantly higher shock absorption and displayed a more suitable vertical deformation than the

Table 5. Results according to the age of football field, specific maintenance, use per week and competition level of the field by U of Mann-Whitney and Kruskal-Wallis test.

Test	Age of football field			Specific and regular maintenance			Use per week			Competition level of the field			
	Up to 5 years	5-10 years	M-W Sign.	Yes	No	M-W Sign.	Up to 35 h	> 35 h	M-W Sign.	National	Regional	Local	K-W Sign.
Vertical ball rebound (m)	0.81	1.14	0.00**	0.95	0.99	0.18	0.84	1.09	0.03*	0.99	0.88	1.06	0.57
Ball roll (m)	10.06	12.03	0.01*	10.50	11.49	0.09	9.83	12.05	0.00**	10.88	10.42	11.97	0.29
Shock absorption (%)	53.55	35.72	0.00**	49.89	40.33	0.04*	49.32	40.80	0.34	49.05	42.79	41.62	0.69
Vertical deformation (mm)	4.64	2.96	0.00**	4.401	3.31	0.04*	4.31	3.39	0.34	4.37	3.50	3.49	0.55
Rotational resistance (Nm)	50.55	45.08	0.11	49.28	46.61	0.52	49.45	46.47	0.27	51.86	46.28	44.87	0.14
Surface regularity (%)	90.30	77.50	0.26	93.05	76.40	0.07	85.06	82.95	0.59	78.57	86.14	87.50	0.97
Pile length of Artificial turf (%)	-2.75	-18.22	0.00**	-3.43	-16.26	0.02*	-4.35	-15.50	0.00**	-10.58	-10.05	-10.89	0.95

* p<0.05; **, p<0.01.M-W sign, Mann-Whitney significant difference; K-W Sign, Kruskal-Wallis significant difference.

Table 6. Results according to the type of fibre, type of rubber and shock pad by U of Mann-Whitney test.

Test	Fibre			Rubber			Shock pad		
	Fibrillated	Mono-filament	M-W Sign.	SBR	Others (EPDM/ thermo-plastic)	M-W Sign.	Yes	No	M-W Sign.
Vertical ball rebound (m)	1.09	0.77	0.02*	0.91	1.19	0.00**	0.74	1.00	0.10
Ball roll (m)	12.02	9.24	0.00**	10.77	11.86	0.16	10.88	11.06	0.80
Shock absorption (%)	41.22	50.98	0.29	49.76	29.25	0.00**	63.88	42.49	0.03*
Vertical deformation (mm)	3.45	4.45	0.29	4.30	2.30	0.00**	6.11	3.55	0.04*
Rotational resistance (Nm)	45.60	51.91	0.04*	48.17	46.75	0.63	53.84	47.14	0.17
Surface regularity (%)	87.50	87.93	0.78	88.53	70.00	0.35	81.25	84.19	0.46
Pile length of Artificial turf (%)	-15.25	-1.65	0.02*	-8.21	-17.31	0.14	-1.43	-11.49	0.38

*P<0.05, **P<0.01.

pitches without such a base.

DISCUSSION

In Spain, there are more than 3,000 artificial turf football pitches, 80% of which are used for Spanish football league games at various levels (Burillo, 2009). Only 5 of them are certified by FIFA (4 FIFA 1-Star and 1 FIFA 2-Star pitches) (FIFA, 2011), and around 15 pitches hold the EN 15330-1:2007 certificate (according to the Spanish laboratories accredited for this standardization by the EA, European Co-operation for Accreditation). In this study, none of the 20 artificial turf football grounds had been previously certified, which seems to be the general situation in Spain, although 7 grounds host national competition matches.

There is increasing variation in surface design specification, with a range of fibre materials, fibre lengths, sub-base construction profiles, shock pads and infill materials as manufacturers and installers aim to reduce costs, increase durability and improve surface performance against international sports governing body criteria such as those of FIFA (James and McLeod, 2010). The low incidence of standardization for playing surfaces has meant that there is no monitoring of mechanical properties in most areas where football is played, although it is the organized sport that is most practiced in Spain (Queen et al., 2008). The arrival of standards, such as EN and FIFA, has improved this situation. However, these regulations have not yet been used continuously, possibly because of various factors, such as unfamiliarity and lack of interest (many sports managers are unaware of these regulations), economic resources (it represents a major financial investment for the organisation), or lack of obligation (being only compulsory for international competitions).

The results display a deficient mechanical comportment regardless of the certification protocol used. The average number of tests passed in protocol EN 15330-1 was 2.05 tests of 7 (s=1.28), a similar result to the FIFA 1-Star (2.40 tests passed; s=1.50). The FIFA 1-Star protocol obtained better results than EN 15330-1 as a direct consequence of the modification of the range of ball roll in the 2009 edition of the FIFA QCFT, where the limit was increased to 12 m, whereas in the 2008 edition, it was identical to the EN 15330-1 standard (up to 10 m). The FIFA QCFT standards have changed four times in only 6 years (2006, 2008, 2009 and 2012 editions), which gives an idea of the vagueness that still exists in the ideal requirements for football on synthetic turf.

Half the fields pass the flatness (50% passed the surface regularity test) and pile loss tests (45-55% of pitches in terms of the regulation), which means that players, spectators, and managers perceive the pitch as being in apparently good condition (flat and ‘completely green’). However, the safety tests provide the worst results: shock absorption was passed by one ground, vertical deformation by 3 grounds (2 under the FIFA 2-Star protocol), and rotational resistance by 8 grounds (4 under the FIFA 2-Star protocol). Similarly, in the sports practicability tests, the vertical rebound was adequate in only 25 to 30% of the sample (none under the FIFA 2-Star protocol) and suitability in ball roll varied between 10% for EN and FIFA 2-Star and 60% for FIFA 1-Star. That is to say, these synthetic fibre grounds were neither safe nor functional for football matches. It is extremely important to detect any shortcomings or deficiencies in artificial turf football pitches, even before the work is completed or handed over.

This situation can cause a great many problems because sporting practicability is one of the aspects of most concern to players because it is directly related to their ultimate sporting performance (Hughes and Franks, 2005). FIFA studies (2007b, c) that analyzed practicability and running of play in competitions on artificial turf display clear similarities with natural turf in most criteria (ball possession, ball control, attacking play, etc.) but only on pitches certified under the FIFA 2-Star protocol, which represent a minute proportion of the total number of pitches worldwide. Similarly, these results may call into question the idea that the risk of sporting injuries is similar on synthetic and natural turf pitches, particularly on grounds that have not been certified under the EN and FIFA norms, as has been claimed in studies by Ekstrand et al. (2006), Fuller et al. (2007), and Steffen et al. (2007). But, this study has not compared accredited fields vs. non accredited fields, so we cannot express that they are better than non-accredited.

Had the advice given by the EN 15330-1:2007 norm been followed and a standardization of the surface with mechanical tests carried out just after installation, many of the deficiencies detected in this study could have been avoided. According to Burillo (2009), an identification of problems at the very outset would facilitate research and development for the organization as well as for the installers and manufacturers of artificial turf. Subsequently, the condition of the surface should be assessed every two or three years, depending on use. However, the main problem is the voluntary nature of assessment and standardization for this surface, despite its growing deployment and demand. Young (2009) advocates the need for the sports governing bodies to ratify a testing procedure to measure the performance of the synthetic turf systems, before and after installation.

There are significant differences in the mechanical properties of the fields depending on the specific maintenance, age of the facility, and hours of use, but no differences are to be found in sporting category. The lack of specific maintenance is related to worse results in safety tests (shock absorption and vertical deformation).

The misinformation that artificial turf surfaces are maintenance-free has been very unhelpful and detrimental to the industry, client, and long-term quality of these facilities (Young, 2009). Furthermore, after 5 years of life, the mechanical properties of artificial turf pitches are worse (significant differences in 5 of the 7 tests). These results, together with the high level of use of artificial turf pitches (55% with more than 35 hours per week) mean that it is unlikely that they can be expected to last more than 6 or 7 years in optimum condition.

According to James and McLeod (2008), most synthetic turf pitches are overused, between 55 and 66 h per week, which makes for premature deterioration. The specific maintenance can cause a minor reduction in performance over time artificial turf (Fleming, 2011). Young (2009) states that a life expectancy for artificial turf of more than 10 years is not feasible, even with continuous professional maintenance, in view of the current levels of use.

Also, there are significant differences in the mechanical properties depending on the type of pile, rubber type, and the existence of elastic layer (shock pad). Monofilament fibre pitches with SBR infill provide better mechanical performance than fibrillated-type grounds or those with any other type of infill (EPDM or Thermoplastics). Similar results are to be found in other studies in both standardized tests (Cox, 2008; Severn, 2009; Villwock et al., 2009) and player satisfaction (Zanetti, 2009). Furthermore, the incorporation of rubber in the infill led to the disappearance of the lower elastic base in many grounds (Severn, 2009). However, the pitches with an elastic base display better shock absorption and vertical deformation values, close to the specifications laid down in the FIFA or EN norms, as shown by the Low and Dixon (2010) and O'Donell (2008).

Thus, we find that the artificial turf field standard, based on the results has monofilament fiber, the pile length not less than 60 mm with 10 mm of free pile length. The infill is composed with sand and Styrine butadiene rubber (SBR) granulated, with shock pad preferably. About the maintenance, we found that perform specific and performed by a specialist. The utilization of the field is up to 35 h per week. Finally, its realized test of the mechanical properties field every two years or three.

Conclusion

The artificial turf football fields of the study are found to be inadequate in some conditions relating to the security and functionality sport, according to the protocols of certification EN 15330-1 and FIFA Quality Concept of Football Turf (1 and 2 stars). The characteristics of the artificial turf system, such as the type of fibre, type of rubber infill, or elastic base have an influence on the mechanical comportment of the pitch.

The lack of control in the field installation, a very high usage and the limited maintenance may be the causes of low mechanical properties of the fields. So it is possible that the life expectancy of these surfaces has been reduced even less than 5 years. In any case, with the imminent increase of artificial turf around the sports field, there is a need to implement controls on fields by the sports authorities to ensure quality, safety, and functionality, thus stimulating innovation in the industry. Standardization should be compulsory in new artificial turf grounds, regardless of the sporting competition that is held.

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