The evolution of the individual factors performance in the elite of the world soccer, between 1970 and 1998

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ABSTRACT: Introduction: changes in some rules and evolution of tactical outlines, in the last 35 years flagrantly altered not only the way to play soccer, as well the players’ morphologic aspect, who were forced to adapt themselves to the new demands, as for the corporal composition, displacement speed, muscular potency, anaerobic threshold speed (ANt), maximum consumption of oxygen (VO2max), maximum aerobic speed (MAS), maximum aerobic potency (MAP), anaerobic potency (AnP), anaerobic capacity of work in 30s (AnC) and anaerobic fatigue (AnF), among other varies. Materials and Methods: with the aim to check some changes in these indicators, the Brazilian Selection was observed regarding the profiles presented in 1970, 1990, 1994 and 1998. Results: In the comparisons among components of the somatotype, just the mesomorphy was considered significantly larger (p<0.01) in the team of 1990, in relation to the team of 1994. As for the endomorphy and to the ectomorphy, there were not significant differences. There was a significant decrease (p<0.05) of the body fat in 1998, in relation to the team of 1994. The average height of the selections in 1990 and 1994 did not present significant differences (p>0.05). In spite of not having shown any significant difference (p>0.05) among the adult team of 1994 and the selection that disputed the sub 17 World Championship in 1998, the average ANt presented a significant decrease (p<0.001) in the adult team of 1998 when compared to the team of 1994. The comparisons among AnP, AnC and AnF of the selections of 1994 and 1998 didn't proved significant differences (p>0.05). The average MAS of the three times world champion team of 1970 was significantly smaller (p<0.05) than of the four times world champion team, of 1994, however there was neither alteration in PAM nor in VO2max. Discussion: the fact that MAS have increased and MAS and VO2max have not been altered, suggests that, in 1994, the players may have been more skilful in terms of technical ability to run, what allowed them to develop a larger speed with the same consumption of oxygen. The selection’s performance was, therefore, more economical than the performance of 1970’s team and worked as if the team of 1994 had a virtually larger VO2max. Probably, the largest energy expense for the same running speed registered in the selection of 1970 was due to the fact that the World cup of that time had been disputed in Mexico’s altitude, where the data were collected.

Keywords: Oxygen Consumption, Soccer, Anaerobic Threshold.

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Submitted: February / 2008
Accepted: February / 2008

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Fit Perf J Rio de Janeiro 7 107-111 Mar/Apr 2008
One week before the start of the World Soccer Cup, Pelé, enshrined in 2000 as the “Athlete of the Century”, responding to a question from British journalists, said that the Brazilian team of 1970 was better than that of 2006. The former player, the three times world champion team had characteristics that highlighted from others teams so far formed, overcoming all the way to play.

The declarations of Pelé caused controversy and prompted responses, between the irony and indignation. The technician of the Brazilian National Team, 2006, Carlos Alberto Parreira, who in 1970 was one of the physical coaches of the team, said he was not able to compare the two teams, because in soccer the time changes the tactical conditions. He acknowledged that the two teams were excellent, but impossible to comparisons. Cafú, the captain of 2006, also responded the statements of Pelé, saying that with 36 years separating the two selections, any comparison would be mere speculation.

It seems that today, the athletes, especially the attackers, have more muscle mass than their congeners of forty years ago. Also, the game is faster and sometimes more violent. Presumably, the athletes to also adapt their morphologies to the demands that the evolution of the sport requires to them.

The purpose of this study was to investigate possible changes in these references of elite athletes in the soccer world, from 1970 to 1998, which is a period which covered eight World Cups.

It is apparent that with the way that soccer is being played in the elite world in recent decades, marking schemes are increasingly intense and demanding players of a high physical conditioning so they can fulfill their tactics duties on the field with the same efficiency throughout the conduct of the match, has forced the athletes to also adapt their morphologies to the demands that the evolution of the sport requires to them.

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MATERIALS AND METHODS

Approval
This study was approved by the Ethics Committee at the Universidade da Força Aérea (UNIFA) under number - 003/2007.
The Brazilian Soccer team, the only team 5 times world champion and, at the beginning of the twenty-first century, placed as first in the FIFA’s ranking, was observed on the submitted profiles in physical qualities of importance to the performance in the years of 1970, 1990, 1994 and 1998, when won two championships and one vice-world championship.

The Brazilian teams that acted in four World Cups had their profiles compared to average values of anaerobic potency (AnP), anaerobic work capacity in 30s (AnC), anaerobic fatigue (AnF), maximum aerobic potency (MAP), maximum oxygen consumption (VO2max), displacement speed, muscle potency, somatotype, total corporal mass (TCM), fat percentage (%F), anaerobic threshold speed (ANt) and maximum aerobic speed (MAS).

The Brazilian National Team that played the Under-17 World Cup in 1998 was also compared with the studied adult teams. For the study were investigated the results of evaluations carried out during the teams preparations. Due to different approaches of physical coaches and/or physiologists that evaluated the selections at different times, some variables have been prioritized over others that, on some occasions, were not considered.

Thus, were not always found all the necessary data to make comparisons between all variables, in all teams. Because of this, comparisons were made between the teams that had records of the same variable.

Comparisons were made between the components of somatotype were made through the t-test of Student, as shown in Tables 1, 2 and 3. The average fat percentage was compared between the selections of 1994 and 1998, also through the t-test of Student, and results are presented in Table 4.

Even using the t-test of Student, the average heights of 1990 and 1994 selections were compared, as displayed in the Table 5.

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Analysis of “one way” variance, fixed model (Table 6, 7 and 8) were used to compare, respectively, the MAP, the VO2max and MAS of selections of 1970, 1990 and 1994.

The same statistical procedure compared the TCM of the selections of 1990, 1994 and 1998 (Table 9) and ANt of the selections of 1994-adult, 1998-under17 and 1998-adult (Table 10).

In comparisons of the somatotype components, only mesomorphy proved to be significantly higher (p<0.01) in the 1990 team against the 1994 team. For endomorphy and ectomorphy, there were not significant differences.

The results also showed a significant decrease (p<0.05) of corporal fat in 1998, comparing to the team of 1994.

Sample
The Brazilian Soccer team, the only team 5 times world champion and, at the beginning of the twenty-first century, placed as first in the FIFA’s ranking, was observed on the submitted profiles in physical qualities of importance to the performance in the years of 1970, 1990, 1994 and 1998, when won two championships and one vice-world championship.

The Brazilian teams that acted in four World Cups had their profiles compared to average values of anaerobic potency (AnP), anaerobic work capacity in 30s (AnC), anaerobic fatigue (AnF), maximum aerobic potency (MAP), maximum oxygen consumption (VO2max), displacement speed, muscle potency, somatotype, total corporal mass (TCM), fat percentage (%F), anaerobic threshold speed (ANt) and maximum aerobic speed (MAS).

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Thus, were not always found all the necessary data to make comparisons between all variables, in all teams. Because of this, comparisons were made between the teams that had records of the same variable.

Comparisons were made between the somatotype components and heights averages were held between the teams of 1990 and 1994. The average fat percentage, as well as AnP, AnC and AnF were compared between the 1994 and 1998 selections. Already the MAP, the VO2max and MAS were compared between the selections of 1970, 1990 and 1994. The TCM was compared between the selections of 1990, 1994 and 1998, while the ANt was compared between the selections of 1994-adult, 1998-adult and 1998-under17.

For the choice of the statistical treatment, after confirmation that the distribution of different variables in the samples do not differ from the normal curve, was opted for the use of parametric tests.

RESULTS

Comparisons between the components of somatotype were made through the t-test of Student, as shown in Tables 1, 2 and 3. The average fat percentage was compared between the selections of 1994 and 1998, also through the t-test of Student, and results are presented in Table 4.

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The results also showed a significant decrease (p<0.05) of corporal fat in 1998, comparing to the team of 1994.
Comparisons of heights showed non-significant difference (p>0.05) between the selections of 1990 and 1994.

**DISCUSSION**

The results showed that the average MAS of the 1970 team, three times world champion was significantly lower (p<0.05) than the 1994 team, four times world champion, but were not detected significant changes in either MAP and VO\textsubscript{2max}. The fact of MAS have increased and MAP and VO\textsubscript{2max} have not been changed, suggests that perhaps in 1994 the players had better technical skills for the race, which allowed them to develop greater speed with the same consumption of oxygen. Its performance was therefore more economical than the 1970 team and worked as the 1994 team had a virtually greater VO\textsubscript{2max}.

Given that the 1970 selection assessments were made in the heights of Mexico, where the World Cup of that year occurred, probably the biggest energy expenditure for the same speed in this race it is actually its explanation.

The ANt average, despite having shown non-significant difference (p>0.05) between the 1994 adult team and the selection that played the under17 World Cup in 1998, showed a significant decrease (p<0.001) in the 1998 adult team when compared to the 1994 team. Comparisons between the AnP, the AnC and AnF of selections from 1994 and 1998 showed non-significant differences (p>0.05), the same occurring in the comparisons between the TCM of the selections of 1990, 1994 and 1998.

When made conclusions on the study results, we must consider that were not always used the same tools in assessing the considered physical aspects. The 1970 team predominantly used field tests\textsuperscript{1,2}, whereas in 1990, 1994 and 1998 there was a large number of variables that were measured by laboratory testing\textsuperscript{3,4,5}.

However, although there may be some room for variation on the results obtained by different employed instruments, whereas they all...
were validated for the estimation or the measurement of objectified physical qualities, it is acceptable that these results are reliable in comparative studies. Even more when do not exists data with longitudinal evaluations using similar tests for the last 28 years.

Thus, the importance that has the Brazilian soccer on the world stage, the existent databases, even if incomplete, can be used for comparative research and contribute to a perspective vision on the evolution of the physical attributes of elite athletes in three successive decades.

The findings of this study may serve as reference for further research and warning to members of professional technical committees, in the sense to preserve and feed scientific achievements of the federations and confederations, to facilitate and make further investigations into the exact soccer development in relation to its historical context.

**REFERENCES**