

INTRODUCTION

The fatigue caused by football has been well documented [e.g. 1]. Nevertheless, most of the research concerning the intensity during a football game [2] as well as match analysis [3] has been conducted with elite male players and thus, less information is available on junior players in different age categories. The purpose of this study was to analyze game events and examine work intensity of junior players at 10, 12 and 14 years of age.

METHODS

The subjects of this study were 10 (1.43 ± 0.05 m, 32.5 ± 3.5 kg, 9.2 ± 3.4 %, n= 13), 12 (1.54 ± 0.10 m, 41.6 ± 7.6 kg, 10.1 ± 4.2 %, n=16) and 14 (1.68 ± 0.09 m, 54.5 ± 7.7 kg, 8.3 ± 5.5 %, n=14) years old Finnish male football players. Each age group played a 90 min game (11 vs. 11) on a full-sized indoor football field. Previously analyzed match and heart rate (HR) values of adult [A] Finnish national team and highest level club team were used as reference.

- Maximal oxygen uptake (VO₂max) on a treadmill (ml/kg/min)
- Exercise intensity (SuuntoT6 HR monitor + Firstbeat software):
 - average HR (HRavg) (beats/min)
 - average HR relative to maximal HR (%HRmax)
 - average oxygen consumption (VO₂avg) (ml/kg/min)
 - average VO₂ relative to VO₂max (% VO₂max)
 - energy expenditure (MJ)
 - proportion of time <50%, 50 - 75% and >75% of VO₂max
 - excess post exercise oxygen consumption (EPOC)
- Match analysis (average/player/game):
 - number of total actions (Total)
 - number of defensive actions (Def)
 - number of offensive actions (Off)
 - successful percentage of offensive actions (Off%)

One-way Anova with Tukey's post hoc test was applied to detect differences between the age groups and playing positions. The differences between the two halves in each age group were analyzed using a T-test. Pearson's correlation coefficient was applied to evaluate the relationships between HR and match analysis data. The level of significance was set at p<0.05.

RESULTS

The match analysis and HR results of different age groups are presented in tables 1, 2, 3 and figure 1. When examining the effects of playing positions on the total number of actions in all subjects it was found that midfield players (95.0 ± 30.8) differed significantly (p<0.05) from defenders (81.9 ± 21.8) and forwards (70.6 ± 25.1).

Table 1. Number of defensive and offensive actions and the percentage of successful offensive actions.

| | Entire Game | | | | 1 st half | | | 2 nd half | | |
|-----|---------------|---------------|---------------|--------------|----------------------|---------------|--------------|----------------------|---------------|---------------|
| | Total | Def | Off | Off% | Def | Off | Off% | Def | Off | Off% |
| 10y | 85.6 ±18.8 | 18.8 ±4.5 | 66.8 ±19.2 | 73.3 ±9.1 | 11.1 ±3.9 | 36.9 ±13.5 | 73.8 ±7.7 | 7.6 ±3.0 | 30.7 ±10.8 | 72.2 ±12.0 |
| | ns. | ns. | ns. | **A | ns. | ns. | *14y | ns. | ns. | ns. |
| 12y | 91.4 ±41.5 | 20.1 ±12.7 | 71.3 ±34.2 | 75.5 ±5.5 | 10.5 ±6.2 | 37.3 ±14.0 | 72.9 ±7.2 | 8.3 ±6.5 | 34.9 ±23.5 | 79.2 ±8.4 |
| | ns. | ns. | ns. | ns. | ns. | ns. | ns. | ns. | ns. | ns. |
| 14y | 85.4 ±33.1 | 20.1 ±7.4 | 65.3 ±30.6 | 70.8 ±4.2 | 11.5 ±5.3 | 32.8 ±17.5 | 66.1 ±8.2 | 8.6 ±4.1 | 32.1 ±15.0 | 74.8 ±7.3 |
| | ns. | ns. | ns. | ***A | x | x | x | x | x | x |
| A | 84.5 ±17.2 | 20.1 ±6.3 | 64.4 ±17.5 | 81.5 ±7.7 | x | x | x | x | x | x |

Table 2. VO₂max (laboratory) and average heart rate, estimated oxygen consumption and energy expenditure during the game in different age groups.

| | VO ₂ max | HRavg | %HRmax | VO ₂ avg | %VO ₂ max | MJ |
|-----|---------------------|------------------|-----------------------|--------------------------|-------------------------|----------------------------|
| 10y | 48.8±5.2 **A | 157 ± 14 *14y | 76.5 ± 6.3 *14y *A | 30.4 ± 5.1 **14y ***A | 62.3 ± 9.7 **14y **A | 1.98 ± 0.34 ***14y ***A |
| 12y | 49.4±4.3 **A | 158 ± 11 ns. | 79.0 ± 6.3 ns. | 31.8 ± 4.1 *14y ***A | 65.9 ± 8.9 *(A) | 2.40 ± 0.32 ***14y ***A |
| 14y | 50.5±5.9 **A | 171 ± 12 ns. | 82.5 ± 4.0 ns. | 37.4 ± 6.2 *A | 72.8 ± 5.9 ns. | 3.62 ± 0.67 ***A |
| A | 58.6±4.4 | 162 ± 8 | 85.0 ± 4.3 | 44.0 ± 4.6 | 75.0 ± 6.0 | 6.03 ± 0.75 |

Table 3. Proportion of playing time under 50%, between 50-75% and over 75% of VO₂max in different age groups.

| | Entire Game | | | 1 st half | | | 2 nd half | | |
|-----|---------------|---------------|---------------|----------------------|---------------|---------------|----------------------|---------------|---------------|
| | <50% | 50-75 | >75% | <50% | 50-75 | >75% | <50% | 50-75 | >75% |
| 10y | 24.5 ±18.1 | 43.3 ±11.4 | 32.1 ±18.7 | 19.2 ±17.3 | 43.3 ±14.1 | 37.4 ±21.4 | 30.1 ±19.8 | 43.3 ±10.8 | 26.5 ±18.2 |
| | **14y **A | *A | **14y **A | *A | *A | **14y **A | **14y **A | ns. | **14y **A |
| 12y | 18.7 ±15.8 | 42.8 ±16.2 | 38.5 ±22.7 | 18.1 ±17.0 | 38.7 ±14.4 | 43.2 ±22.1 | 19.3 ±17.5 | 46.7 ±19.3 | 33.9 ±27.2 |
| | ns. | *A | **A | ns. | ns. | *A | ns. | *A | *A |
| 14y | 7.2 ±8.1 | 33.6 ±15.0 | 59.2 ±20.6 | 5.9 ±7.1 | 28.7 ±17.1 | 65.3 ±22.1 | 8.6 ±9.2 | 38.7 ±14.0 | 52.9 ±20.1 |
| | ns. | ns. | ns. | ns. | ns. | ns. | ns. | ns. | ns. |
| A | 6.7 ±4.7 | 25.4 ±14.3 | 67.8 ±18.3 | 4.6 ±4.4 | 23.5 ±15.0 | 71.1 ±17.4 | 8.6 ±6.4 | 28.3 ±14.7 | 62.7 ±20.0 |

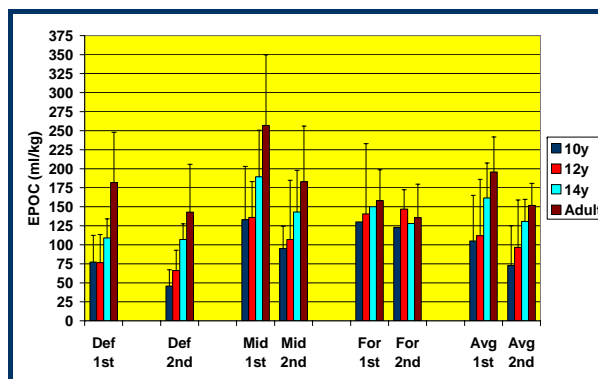


Fig 1. Exercise intensity of the game in different playing positions and age groups (Def=defenders, Mid=midfielders, For=forwards, Avg=average).

In the first half of the game a significant difference (p<.01) in EPOC was found between defenders - midfielders and in the second half between defenders - midfielders (p<.05) and between defenders - forwards (p<.05). A weak correlation (r=0.34, p<.05) was found between the changes in EPOC and changes in total number of actions from 1st to 2nd half.

The differences between the 1st and 2nd half in HR and match analysis:

- 10y: <50 % (**), >75 % (*), EPOC (*), Def (*)
- 12y: 50-75 % (*), Off% (*)
- 14y: <50 % (*), 50-75 % (**), >75 % (**), EPOC (**), Off% (*)
- A: <50 % (*), >75 % (*) and EPOC (**)

DISCUSSION

- The match analysis revealed no differences between the age groups in the number of offensive or defensive actions. Both offensive and defensive actions declined in the 2nd half compared to the 1st. The midfield players did approximately 20 % more actions in the game than defenders or forwards. The success of offensive actions in the 12y and 14y groups increased from 1st to the 2nd half. One reason for improved success could be fatigue related weakening of defence.
- The intensity during the game gradually increased with increasing age. In addition, the intensity demands of different playing positions varied greatly. The EPOC values indicated that only 14y were able to sustain a HR close to adult values in both halves. Intensity of the game decreased 15-30 % when comparing the EPOC between two halves. Corresponding decreases have also been reported previously and the main reason has been proposed to be a depletion of muscle glycogen [4].
- The relationship between the changes in EPOC and changes in total number of actions from 1st to 2nd half implies that the reduction in physical effort reflects also to the total number of actions i.e. less effort less actions.

CONCLUSIONS

- From the results of this study it can be concluded that before puberty, children rely on aerobic energy production more than adult players and that the playing position has an influence on the physical load of the game and the number of actions made. These aspects are important to take into consideration in youth football to avoid discrepancy (or overload) in training as the playing positions of the players are not finally defined.

REFERENCES

- [1] Mohr, M. & al. (2005) Journal of Sport Sciences, 23(6): 593-599.
- [2] Reilly, T. (1997) Journal of Sport Sciences, 15(3): 257-263.
- [3] Luhtanen, P. (1993) Science and Football II.E&FN SPON: London,215-220.
- [4] Bangsbo, J. (1994) Acta Physiologica Scandinavica, 151.