Kicking velocity and physical, technical, tactical match performance for U18 female soccer players – effect of a new ball

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Introduction
Over the last decade the number of female soccer players has doubled and in many countries soccer is the most popular sport for girls. Recent scientific studies have revealed that the physical demands are high in female soccer games (Knudstrup et al. 2005, Andersen et al. 2010). Time–motion analyses and heart rate measurements have been conducted in youth soccer games with similar findings, but to date only boys’ soccer has been investigated. The inherent physiological gender differences supports the need to scale the equipment to the participants, as seen in team sports such as basketball and team handball.

Elite male soccer players achieve maximal ball speeds of approximately 30 m s\(^{-1}\) when kicking under laboratory conditions, whereas female players kick at speeds of up to 22 m s\(^{-1}\). This phenomenon possibly influence the characteristics of female soccer match play; it is more difficult for women to make long passes, to pass the ball quickly between players and to score goals from a long distance.

Figure 1: Ball velocities. Ball velocities plotted as a function of their corresponding foot velocities. Kicks with the new ball (NB) are marked by filled circles (○) and with the standard ball (SB) are marked by filled circles (●). The solid line is a linear regression on the kicks with the new ball and the dashed line on kicks with a standard ball.

Purpose
In the present study, a new ball (NB) for female soccer, with a mass of 360 g, was tested. The mass of the ball was determined by calculations that took into account that equal foot velocities for mass of the ball was determined by calculations.

Accordingly, the aims of the present study were to:
1. Investigate the heart rate (HR) response, locomotor activities, fatigue development and technical-tactical performance of youth female soccer players during games.
2. Evaluate the effects of a smaller ball (NB) on soccer match play for U18 female players.

Methods

Subjects

150 female players from 10 regional U18 team were recruited. The subjects mean age, height and body mass was 15.9±0.2 yrs, 1.69±0.01 m and 58±2 kg, respectively. Their Yo-Yo intermittent endurance level 1 performance was 2067±15 m. 16 players from 3 teams took part in the kicking analyses.

Experimental protocol
Five maximal velocity instep kicks were performed with a standard ball (SB, 445 g) and the NB.

Technical–tactical match performance was analysed during five games with NB and five games with the SB, opponents being the same and the balls used in a randomised order.

Fifty outfield players from five clubs were included in physical match analyses, and they were randomly selected in order to keep every playing position and every team represented.

Match analyses

Heart rate was recorded during matches with SB and NB with chest monitors (POLAR Team 2 System, Kempele, Finland).

Immediately after the matches with the SB and the NB, the same 50 players reported the rating of perceived exertion (RPE) by filling in a brief questionnaire that asked 1) how hard the players rated the lower-limb muscle strain, 2) the cardiorespiratory strain and 3) the overall strain in the match.

Individual video filming for time-motion analyses were performed during matches with NB and SB, and each player was filmed close-up during the entire match by digital camera (Canon DM-MV 600, Tokyo, Japan). The following locomotor categories were used: standing (0 km h\(^{-1}\)), walking (6 km h\(^{-1}\)), jogging (9 km h\(^{-1}\)), low-speed running (12 km h\(^{-1}\)), moderate-speed running (15 km h\(^{-1}\)), high-speed running (18 km h\(^{-1}\)), sprinting (25 km h\(^{-1}\)), sideways running (10 km h\(^{-1}\)) and backwards running (10 km h\(^{-1}\)). The locomotor categories were chosen in accordance with Knudstrup et al. (2005).

Technical-tactical analyses

An additional video camera was following the ball and technical match activities were registered from these video recordings (Sports Code Elite, version 5.1.9. Sportcode International, New South Wales, Australia).

Every time a player was in contact with the ball, a recording was made. The ball contacts were separated into passes, receptions, tackles and headings, throw-ins, free kicks, and “other activities”. The position on the pitch for passes and receptions was registered either as defending, midfield or attacking zone.

Results

The ball velocity was 4±1% higher when kicking the NB compared to the SB (23.2±1.7 vs. 22.4±1.1 m/s; p<0.01).

Mean HR during matches played with the new ball was 168±2 b.p.m. corresponding to 85±1% HR\(_{\text{max}}\), which was not different from matches played with the standard ball (170±2 b.p.m.; and 86±1% HR\(_{\text{max}}\), SB). The time spent with heart rate from 80-90% and >90% of HR\(_{\text{max}}\) was 37±2% and 38±3% of total time, respectively, during matches played with the NB which was not significantly different from matches played with the SB (36±2% and 40±4% of total time, respectively).

The locomotor activities were similar during games with NB and SB, including total distance covered (9.1±1.0 km) and high-intensity running (HIR) (1.0±0.08 vs. 1.1±0.07 km). Interestingly, the distance covered by HR increased (p<0.05) from the last to the first 20-min game period with NB (34%; 0.29±0.03 vs. 0.22±0.02 km) as well as SB (37%; 0.32±0.03 vs. 0.24±0.01 km).

The number of long and short passes, crosses, ball receptions, headings, shots on goal, goals scored did, and success rates for both long and short passes did not differ between matches (p>0.05).

The lower-limb muscular RPE was lower (p<0.05) in matches with the NB compared to the SB (VAS 3, 4.2±0.4 vs. 5.2±0.3), whereas the overall self-reported RPE (VAS 1, 4.5±0.3 vs. 5.1±0.4) and the cardioventilatory RPE (VAS 2, 4.6±0.3 vs. 5.6±0.4) were not significantly different for matches with the NB compared to the SB (p<0.05).

Conclusion

The aerobic loading and the number of high-intensity runs are high during youth female soccer and fatigue occurs towards the end of the game. The players can kick faster and report lower muscular exertion during games played with a lighter and smaller ball, however the locomotor activities, HR and overall technical-tactical game performance are unaffected.

References

