EFFECTS OF FOUR DAYS OF COMPETITION MODELLING FOLLOWED BY SIX DAYS OF TAPERING ON SPORT PERFORMANCE IN JUNIOR GOLFERS: A CASE STUDY

Marius Zienius, Antanas Skarbalius, Aurelijus Kazys Zuoza
Lithuanian Sports University, Kaunas, Lithuania

ABSTRACT

Background. The use of competition modelling or tapering to improve sport performance in golf has not been extensively studied. Due to the specific conditions of the main competition, the simulation of competition modelling followed by tapering has been suggested as a means of improving junior golfers' sport performance. The aim of this study was to determine the most suitable precompetition model and taper for junior golfers to optimize their performance.

Methods. Two male golfers (subject A: age 17 years, height 1.75 m, body mass 62 kg, basal heart rate 60 beats·min^{-1}, handicap index 10.1; subject B: age 17 years, height 1.87 m, body mass 68 kg, basal heart rate 60 beats·min^{-1}, handicap index 11.2) participated in this study. Sport performance indicators in golf were recorded using a personal sport performance statistical protocol. Locomotion and physiological demands were recorded using the FRWD W^{400} Series (Finland) device. Furthermore, tapering training programmes were recorded.

Results. The simulation of four days of competition modelling followed by six days of tapering allowed the subjects to improve their performance; their scoring average at the Lithuanian Amateur Open Golf Championship 2011 was by 6.02% (subject A) and 3.77% (subject B) lower than that for the four-day competition modelling stage.

Conclusions. Findings suggest the effectiveness of four days of competition modelling, which allowed the simulation of the specific conditions of the main competition, and also of the practice round held three days before the competition for junior golfers.

Keywords: golf, simulation, locomotion, physiological demands, training loads.

INTRODUCTION

Golf is a game in which a small advantage in one area can mean the difference between finishing first or finishing 20th (Draovitch & Simpson, 2007). For this reason, sports scientists, coaches and athletes are constantly looking for ways to provide a slight, legal advantage in sport performance (Nevill, Atkinson, & Hughes, 2008; Hellström, 2009 a). The sport performance indicators (Hellström, 2009 a), physiological demands (Smith, 2010) and psychological hallmarks (Hellström, 2009 b) of elite golfers are the fundamental factors in the development of golf performance. Furthermore, an overall analysis of each golfer's performance is an excellent way to keep track of improvements, identify areas that need practice, and build players' confidence (Schempp & Mattsson, 2005). For coaches or players who do not acknowledge and integrate physiological aspects of performance into their development plan, the chances of reaching optimal movement capabilities will not be realized (Smith, 2010).

How a player's physical state is managed during the play could therefore have a significant effect on optimal golf performance in the latter stages of the round or competition (McKay, Selig, Carlson, & Morris, 1997). The training process involves the

manipulation of the training variables – intensity, duration and frequency – with training load being the combination of all three elements (Smith, 2003). A taper is the training phase characterized by a reduction in the amount of training that athletes undergo during the final days leading up to a major competition (Mujika, 2010). The primary question for coaches and athletes is how to manipulate the type, frequency, duration and intensity of training to enhance or optimize performance (Pyne, Mujika, & Reilly, 2009; Toubekis et al., 2013) depending on the competition structure.

In general, golf competitions in Lithuania last one or sometimes two days (two or three times per season) and golfers play off the yellow tees (as used by amateur men golfers). The development of golf in Lithuania has increased dramatically, and in attempts to raise the level to professional competition standards, the Lithuanian Amateur Open Golf Championship 2011 (LAOGC 2011) was held over three days and golfers played off the white tees (as used by professional men golfers). Therefore, golfers had to adjust their preparation programmes to optimize their performance at LAOGC 2011. Research and professional experience support the concept of the specificity of training: the more closely that conditioning can assimilate the physiological demands and conditions of competition, the greater the performance improvement that can be expected will be (Rhea, Hunter, & Hunter, 2006). Furthermore, with tapering, fitness and skills should reach relatively high levels so that the level of performance is optimized through physiological adaptations (Smith, 2003; Mujika, 2010).

The aim of this study was to evaluate the effects of four days of competition modelling followed by six days of tapering on the sport performance of junior golfers.

METHODS

Participants. Two male golfers participated in this study; subject A: age 17 years, height 1.75 m, body mass 62 kg, basal heart rate 60 beats·min^{-1}, golf handicap index 10.1; subject B: age 17 years, height 1.87 m, body mass 68 kg, basal heart rate 60 beats·min^{-1}, golf handicap index 11.2. The experimental procedures were performed in accordance with the Declaration of Helsinki. The participants and their parents gave their written informed consent. The Ethics Committee of Kaunas Regional Biomedical Research approved this study.

Experimental design. Both golfers participated in the three stages of the study. Stage I was the four-day period of competition modelling; Stage II was the six-day period of tapering; Stage III was the three-day period of LAOGC 2011 (August 12–14) (Figure). We recorded sport performance indicators, locomotion indicators and physiological demands in Stage I, training loads in tapering (Stage II) and sport performance indicators in the main competition (Stage III).

Measures. Sport performance indicators in golf (Table 1) were recorded using a sport performance personal statistical protocol (Schempp & Mattsson, 2005). Locomotion and physiological demands (Table 1) were recorded using the FRWD W^{400} Series (Finland) device, which allowed us to determine locomotion and physiological indicators according to the age, height, body mass and the basal heart rate indicators of the participants (Perez-Turpin et al., 2009).

Procedures. The study was conducted over 13 days (August 2–14) at the Capitals Golf Club, Lithuania (par 71; white tees 6255 m), a course that has moderate elevation changes.

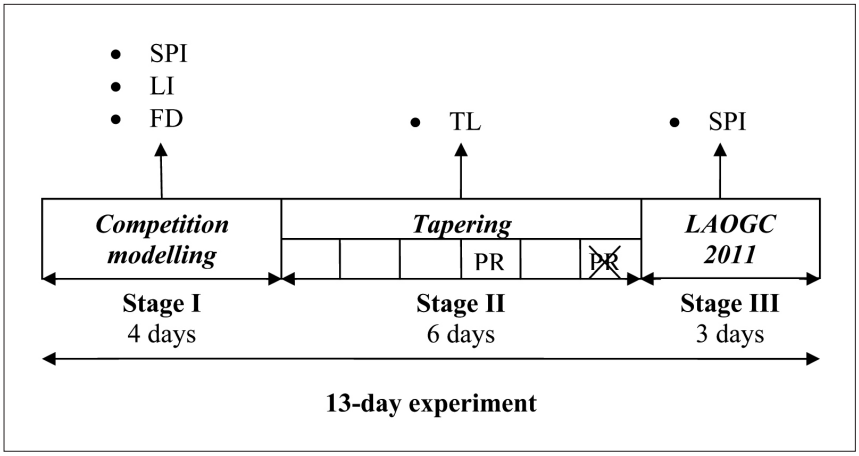

Figure. **Experimental design of four days of competition modelling, six days of tapering and three days of the main competition**

Notes. SPI – sport performance indicators; LI – locomotion indicators; FD – physiological demands; TL – training loads; PR – practice round; LAOGC 2011 – Lithuanian Amateur Open Golf Championship 2011.

Table 1. **Sport performance indicators, locomotion and physiological demands**

Sport performance indicators	Driving accuracy (DA) (%); green in regulation (GIR) (%); scrambling (%); putts per GIR; putts per round; score (holes 1–9; 10–18; 1–18) (strokes).
Locomotion demands	Duration of play (h); distance covered (km); distance covered in excess of course distance (km and %).
Physiological demands	Heart rate (HR) (beats·min^{-1}); maximal heart rate (HR_{max}) (beats·min^{-1}); total energy expenditure (kcal); energy expenditure per minute (kcal·min^{-1}); energy expenditure per kilogram (kcal·kg^{-1}); maximal excess post-exercise oxygen consumption (EPOCmax) (mL·kg^{-1}); maximal oxygen uptake (VO_2max) (mL·kg^{-1}·min^{-1}); maximal ventilatory response (L·min^{-1}); maximal respiration rate (breaths·min^{-1}); training effect (TE) (scale, 1–5).

Notes. Driving accuracy (DA), the percentage of times a player hits the fairway with the tee shot on par 4 and par 5 holes (regardless of club). **Green in regulation (GIR)**, the percentage of times a player hits the green in regulation (greens hit in regulation/holes played); a green is considered hit in regulation if any portion of the ball touches the putting surface and the number of strokes taken is two or less than par. **Scrambling**, the percentage of times a player misses the GIR, but still makes par or better. **Putts per GIR**, the average number of putts per GIR. **Par**, a hole is classified by its par, meaning the number of strokes a skilled golfer should require to complete play of the hole; a hole is either par 3, 4 or 5. **Training effect (TE)**, this indicates how a work-out improves aerobic (endurance) fitness; TE has five levels (1–1.9 – easy recovery; 2.0–2.9 maintaining fitness; 3.0–3.9 improving fitness; 4.0–4.9 highly improving; 5.0 – overreaching).

According to LAOGC 2011 regulations, the competition comprised three rounds (with a practice round one day before) off the white tees with three players in one group. Therefore, our two subjects (plus a third player of similar skill: age 16 years, height 1.85 m, body mass 70 kg, basal heart rate 72 beats·min^{-1}, golf handicap index 14.0) played four rounds off the white tees with the aim of modelling the competition conditions of LAOGC 2011.

Over these four days, participants recorded sport performance indicators in golf (using the sport performance personal statistical protocol). For the validation tasks, the subjects exchanged protocols and checked them after every hole. Locomotion and physiological indicators were recorded (FRWD W^{400} Series). Play started at 10 a.m. each day (conditions of play: carrying their own golf clubs; sunshine and light breeze, average temperature 20°C).

Before the start of play, a global positioning system device (FRWD W^{400} Series) was attached to the upper right arm of the subjects to record locomotion indicators. After 1–2 minutes, a signal from the device indicated its connection with the satellite. A pulsometer (FRWD W^{400} Series) was also attached to the chest of the subjects. The recording of locomotion and physiological indicators was started by the subject pressing a button on the device when teeing up at the 1st hole and continued until play finished with the final putt at the 18th hole when the device was turned off. It should be noted that the procedure of recording sport performance protocol and using the FRWD W^{400} Series (Finland) device was usual for the golfers because they previously applied it in the training and competition environment. In Stage II, the tapering training programmes were recorded and analysed; for the validation tasks, the coach of golfers observed that everything was correctly performed. In Stage III, the sport performance indicators were analysed using personal statistical protocols of sport performance and result protocols of LAOGC 2011.

Statistical analysis. The statistical analysis was carried out using SPSS 21.0 package for Windows. Standard statistical methods were used to calculate means and standard deviations (± *SD*), and percentages (%).

RESULTS

The four-day period of competition modelling. Subjects' driving accuracy was higher than 50% over the four-day period of competition modelling. It should be noted that both subjects hit all their tee shots at par 4 and par 5 holes (the driving accuracy percentage is recorded for these holes) with a 1-wood (driver). The green in regulation percentage, reflecting a player's skill in approach to the green, was lower or equal to 50% over the four days. The scrambling percentage, reflecting a player's ability around the green, was very low for both subjects, with an average of no higher than 15%. Ability on the putting green was assessed using putts per green in regulation and putts per round indicators. Over the four-day period of competition modelling, both subjects averaged no fewer than 36 putts per round; only once was the average (per round) of putts per green in regulation less than two putts (Table 2).

Despite these similar results, indices of scoring average for subject A varied while those for subject

B were more stable. The scoring average of the third player was slightly higher (4.25 and 5.25) than for subjects A and B respectively. The skill level of the third golfer was therefore roughly similar to that of subjects A and B.

Both subjects played the same duration on average (4 hours and 22 minutes), covering nearly 10 km; that is, they exceeded by 60% the course distance off the white tees (Table 3).

Four days of play confirmed that the physiological demands that arise from golf were not considered intense (Table 4). The indices of HR, energy expenditure, EPOCmax, VO_2max, maximal respiration rate and training effect varied slightly over the four-day period of competition modelling.

Seasonal training programme. Neither subject followed a physical conditioning programme to prepare for the 2011 golf season. During the pre-season, both subjects undertook different kinds of physical activity 2–3 times per week for about 1.5 h per training session: subject A played tennis, subject B played basketball. Furthermore, subjects only did technical training (in the practice areas, playing rounds of golf) and not physical conditioning during the golf season.

The annual technical training programme before LAOGC 2011 was as follows: 57% of the time was spent on improving long-game skills (37% with low-numbered irons and 20% with woods, especially drivers), compared with 43% of the time spent on improving short-game skills (22% on the putting green, 17% in the practice areas for chipping and pitching, and 4% in the sand bunkers).

On average, subjects had four training sessions of roughly 2 h and played three 18-hole rounds of golf (not including the competitions) per week. In addition, subject A participated in two competitions per month and subject B in three competitions per month on average.

The six-day period of tapering. Subjects' training loads decreased during the six-day period of tapering. They had three training sessions of roughly 1 h 40 min on the first, third and fifth days; that is, the frequency (25%) and volume (16.67%)

Table 2. **Sport performance indicators during the four-day period of competition modelling (mean ± SD)**

Sport performance indicators	Golfer	1st day	2nd day	3rd day	4th day	Average
Driving accuracy (%)	A	53.85	76.92	76.92	76.92	71.15 ± 11.54
	B	61.54	69.23	76.92	69.23	69.23 ± 6.28
Green in regulation (%)	A	44.44	22.22	50	50	41.67 ± 13.23
	B	44.44	44.44	44.44	38.89	43.05 ± 2.78
Scrambling (%)	A	10	14.29	11.11	0	8.85 ± 6.17
	B	10	20	30	0	15 ± 12.91
Putts per green in regulation	A	2.13	2.25	2	2.33	2.18 ± 0.14
	B	1.88	2.25	2.63	2.14	2.23 ± 0.31
Putts per round	A	38	36	36	38	37 ± 1.15
	B	37	38	37	38	37.5 ± 0.58
Strokes (1–9 holes)	A	41	48	42	46	44.25 ± 2.87
	B	43	43	44	47	44.25 ± 1.89
Strokes (10–18 holes)	A	46	44	39	43	43 ± 3.37
	B	42	42	42	42	42
Strokes (1–18 holes)	A	87	92	81	89	87.25 ± 4.65
	B	85	85	86	89	86.25 ± 1.89

Table 3. **Locomotion indicators during the four-day period of competition modelling (mean ± SD)**

Locomotion demands	Golfer	1st day	2nd day	3rd day	4th day	Average
Playing duration (h:min)	A	04:14	04:17	04:40	04:17	04:22 ± 00:12.08
	B	04:13	04:18	04:41	04:16	04:22 ± 00:12.83
Covered distance (km)	A	9.93	9.71	9.95	9.86	9.86 ± 0.11
	B	10.05	9.80	10.16	9.86	9.97 ± 0.17
Covered distance in excess of course distance (km and %)	A	3.68	3.46	3.70	3.61	3.61 ± 0.11
	A	58.75	55.24	59.07	57.63	57.67 ± 1.74
	B	3.80	3.55	3.91	3.61	3.72 ± 0.17
	B	60.67	56.67	62.43	57.63	59.35 ± 2.67

of training sessions decreased, but the intensity remained the same. In addition, subjects played two 18-hole rounds on the second and fourth days; that is, the frequency (33.33%) of playing rounds decreased, but the intensity and volume remained the same. The final day of tapering was given over to recovery.

The three-day period of the Lithuanian Amateur Open Golf Championship 2011. In total, 104 golfers (including 32 foreigners from seven countries) participated in LAOGC 2011. Both subjects performed well, taking 7th and 8th places overall, coming 2nd and 3rd in the Lithuanian ranking.

Subjects' driving accuracy percentage varied in the same range as in the modelling stage. It should again be noted that both subjects hit all their tee shots at par 4 and par 5 holes with a 1-wood (driver). The green in regulation percentage was higher than 44% over the three-day period of LAOGC 2011, while the scrambling percentage for both subjects was below 30%. Over the three-day period of LAOGC 2011, both subjects averaged no fewer than 33 putts per round; only once was the average (per round) of putts per green in regulation less than two putts (Table 5).

Subject A's sport performance score declined round by round, nevertheless he achieved individual

Table 4. **Physiological demands during the four-day period of competition modelling (mean ± SD)**

Physiological demands	Golfer	1st day	2nd day	3rd day	4th day	Average
HR response (beats·min^{-1})	A	116	112	109	114	112.75 ± 2.99
	B	115	108	109	111	110.75 ± 3.1
HR_{max} (beats·min^{-1})	A	155	151	150	157	153.25 ± 3.3
	B	155	147	148	156	151.5 ± 4.65
Total energy expenditure (kcal)	A	1447	1446	1594	1456	1485.75 ± 72.31
	B	1582	1590	1742	1573	1621.75 ± 80.47
Energy expenditure per minute (kcal·min^{-1})	A	5.69	5.63	5.69	5.67	5.67 ± 0.03
	B	6.25	6.16	6.19	6.14	6.19 ± 0.05
Energy expenditure per kilogram (kcal·kg^{-1})	A	23.34	23.32	25.71	23.48	23.96 ± 1.17
	B	23.26	23.38	25.62	23.13	23.85 ± 1.19
EPOCmax (mL·kg^{-1})	A	10	8	8	9	8.75 ± 0.96
	B	10	6	7	8	7.75 ± 1.71
VO_2max (mL·kg^{-1}·min^{-1})	A	44	42	43	44	43.25 ± 0.96
	B	43	39	40	42	41 ± 1.83
Maximal respiration rate	A	40	38	39	39	39 ± 0.82
	B	41	38	38	40	39.25 ± 1.5
Maximal ventilatory response (L·min^{-1})	A	71	60	67	64	65.5 ± 4.65
	B	76	62	60	73	67.75 ± 7.93
Training effect (scale, 1–5)	A	1.3	1.2	1.2	1.3	1.25 ± 0.06
	B	1.3	1.2	1.2	1.2	1.23 ± 0.05

Table 5. **Sport performance indicators in the Lithuanian Amateur Open Golf Championship 2011 (mean ± SD)**

Sport performance indicators	Golfer	1st day	2nd day	3rd day	Average
Driving accuracy (%)	A	76.92	61.54	61.54	66.67 ± 8.88
	B	53.85	69.23	69.23	64.1 ± 8.88
Green in regulation (%)	A	61.11	44.44	44.44	50 ± 9.62
	B	44.44	55.56	50	50 ± 5.56
Scrambling (%)	A	28.57	10	10	16.19 ± 10.72
	B	10	12.5	22.22	14.91 ± 6.46
Putts per green in regulation	A	1.82	2.25	2.13	2.07 ± 0.22
	B	2	2.3	2.11	2.14 ± 0.15
Putts per round	A	33	35	37	35 ± 2
	B	36	37	35	36 ± 1
Strokes (1–9 holes)	A	37	46	41	41.33 ± 4.51
	B	39	41	45	41.67 ± 3.06
Strokes (10–18 holes)	A	38	38	46	40.67 ± 4.62
	B	44	41	39	41.33 ± 2.52
Strokes (1–18 holes)	A	75	84	87	82 ± 6.24
	B	83	82	84	83 ± 1

career record in the 1st round (Table 5). The scores for the front and back nine holes were variable. Subject B's score was stable over the three days, even though the round-by-round score increased for the front nine holes and decreased for the back nine holes.

DISCUSSION

The aim of this study was to determine a suitable precompetition model and taper for junior golfers to optimize their sport performance. The simulation of four days of competition modelling followed by six days of tapering, with the practice round held more than one day before the main competition, had a positive effect on our amateur junior golfers' sport performance. Hence, the findings suggest that adequate preparation is necessary for competitions with specific conditions, as was the case with LAOGC 2011, which expanded play to three rounds.

The modelling of competition conditions (Morya, Ranvaud, & Pinheiro, 2003; Rhea et al., 2006; Gore, McSharry, Hewitt, & Saunders, 2008) and the reduction in training load (tapering) just before a major competition (Mujika & Padilla, 2003; Bosquet, Montpetit, Arvisais, & Mujika, 2007; Pyne et al., 2009) are effective methods to improve athletes' sport performance. The more that training can mimic the physiological demands and conditions of competition, the greater will be the performance improvement that can be expected (Rhea et al., 2006). Coaches should model training sessions so that their duration and the amount of recovery time more closely mimic game situations (Rhea et al., 2006). When conditions of competition are specific, adequate preparation is necessary (Gore et al., 2008).

Because of the specific conditions of LAOGC 2011, our two subjects had to adjust their preparation programmes to optimize their performance in the main competition. This process involved a combination of four days of competition modelling followed by six days of tapering. Applying this kind of programme allowed the subjects to achieve their best sport performance (at LAOGC 2011) of their individual careers. Four days of competition modelling not only allowed them to simulate the competition conditions, but also to simulate the practice round. The scoring average over the four days of competition modelling was 87.25 strokes for subject A and 86.25 for subject B. The scoring average (A, 86.67; B, 85.33) of the first three days (1–3) of competition modelling was 0.66 strokes (A) and 1.34 strokes (B) less than the scoring average (A, 87.33; B, 86.67) of the last three days (2–4) of competition modelling. The results showed that the fourth day of play could worsen sport performance, which implies that three days of play without a practice round may be more suitable for our subjects than four days of play with the practice round held on the first day. It is for this reason that our subjects did not participate in the practice round one day before LAOGC 2011. Their practice round was played three days before LAOGC 2011, in the tapering stage.

The locomotion and physiological demands of subjects (recorded during the four days of competition modelling) were in line with the findings of other studies. A single round of golf can last from 2.5 to 6 h (Smith, 2010); the distance covered is generally less than 10 km (Kobriger, Smith, Hollman, & Smith, 2006; Zunzer, von Duvillard, Tschakert, Mangus, & Hofmann, 2013). The HR response range is reported as 100–120 beats·min^{-1} (McKay et al., 1997; Burkett & von Heijne-Fisher, 1998; Stauch, Lui, Giesler, & Lehmann, 1999); the range for total energy expenditure is 960–1954 kcal and that for energy expenditure is 6.0–11.8 kcal·min^{-1} (Smith, 2010). Our additionally findings suggest, that playing golf did not have a positive training effect on the subjects' aerobic fitness (1.2–1.3 – recovery zone). In considering the player's optimization from a multidisciplinary perspective, the role of physiology should be seen as equally important as other contributing factors (Smith, 2010). Therefore, young golfers should be advised to include aerobic training sessions in their training programmes with the aim of improving sport performance.

Subjects' sport performance indicators recorded over the four-day period of competition modelling and the three-day period of LAOGC 2011 revealed that subjects' long-game skills (DA, GIR) were at a higher level than their short-game skills (scrambling; putts per GIR; putts per round). In the future, it is necessary for junior golfers to improve their short-game skills because indicators describing these skills have the strongest correlations with scoring average (Hellström, 2009 a).

Because neither subject undertook any physical conditioning during the golf season, only the technical training loads were decreased in the tapering stage. Subjects decreased training frequency (25%) and volume (16.67%) in the

practice areas, and frequency (33.33%) of playing rounds of golf in the tapering stage compared with their annual training programme, while the intensity of training sessions in the practice areas and of playing rounds of golf was the same as previously. This mode of reduction of training load is not in line with recommendations for effective tapering, where the general guidelines indicate a 2–3-week period incorporating a 40–60% reduction in training volume following a progressive non-linear format, maintaining training intensity, and a modest (if any) reduction (~20%) in training frequency (Mujika & Padilla, 2003; Bosquet el al., 2007; Pyne et al., 2009). However, these recommendations are for endurance sports athletes and relate to physical training loads. The expected mean improvement in individual performance time with an effective taper is 2–3%, ranging from 0 to 6% in trained athletes (Mujika & Padilla, 2003).

A combination of four days of competition modelling and six days of tapering allowed our junior golfers to improve their sport performance: the scoring average at LAOGC 2011 was 6.02% (A) and 3.77% (B) lower than for the four days of competition modelling. These results might be determined by the key indicators of sport performance in golf (Hellström, 2009 a): the green in regulation percentage was 8.33% (A) and 6.95% (B) higher at LAOGC 2011 compared with that in the competition modelling stage. The scrambling percentage was also 7.34% (A) higher at LAOGC 2011. Furthermore, subject A recorded two putts per round and subject B 1.5 putts per round fewer at LAOGC 2011 compared with the competition modelling stage. However, the driving accuracy percentage was 4.48% (A) and 5.13% (B) lower at LAOGC 2011 compared with the competition modelling stage.

Comparative analysis of different cases showed different effects on sport performance (scoring average) at LAOGC 2011. Both models (1–3 days and 2–4 days of competition modelling) also indicated an improvement in sport performance. The scoring average at LAOGC 2011 was 6.1% (A) and 4.23% (B) lower compared with that for the last three days of competition modelling, while the scoring average at LAOGC 2011 was 5.39% (A) and 2.73% (B) lower compared with that for the first three days of competition modelling. The decision not to play a practice round one day before LAOGC 2011 was correct (Mujika & Padilla, 2003; Pyne et al., 2009); this is confirmed by the scores for the third day, which were worse compared with those for the first and second days for both subjects at LAOGC 2011, and by the results of the competition modelling stage with the practice round held on the first day.

CONCLUSIONS

The simulation of four days of competition modelling followed by six days of tapering including a practice round held three days before competition was effective in improving the sport performance of junior golfers in a three-day competition.

Further research is needed for detecting the effectiveness of competition modelling and tapering on sport performance in golf.

REFERENCES

Bosquet, L., Montpetit, J., Arvisais, D., & Mujika, I. (2007). Effects of tapering on performance: A meta-analysis. *Medicine and Science in Sports and Exercise*, 39(8), 1358–1365. PMID: 17762369 [PubMed – indexed for MEDLINE]

Burkett, L. N., & von Heijne-Fisher, U. (1998). Heart rate and calorie expenditure of golfers carrying their clubs and walking flat and hilly golf courses. *International Sports Journal*, 2(2), 78–85.

Draovitch, P., & Simpson, R. (2007). *Complete conditioning for golf*. Champaign, Illinois: Human Kinetics.

Gore, C. J., McSharry, P. E., Hewitt, A. J., & Saunders, P. U. (2008). Preparation for football competition at moderate to high altitude. *Scandinavian Journal of Medicine and Science in Sports*, 18(1), 85–95. doi: 10.1111/j.1600-0838.2008.00836.x

Hellström, J. (2009 a). Competitive elite golf. *Sports Medicine*, 39(9), 723–741. doi: 10.2165/11315200-000000000-00000

Hellström, J. (2009 b). Psychological hallmarks of skilled golfers. *Sports Medicine*, 39(10), 845–855. doi: 10.2165/11317760-000000000-00000

Kobriger, S. L., Smith, J., Hollman, J. H., & Smith, A. M. (2006). The contribution of golf to daily physical activity recommendations: how many steps does it take to complete a round of golf? *Mayo Clinic Proceedings (Mayo Foundation for Medical Education and Research)*, 81(8), 1041–1043. PMID: 16901027 [PubMed – indexed for MEDLINE]

McKay, J. M., Selig, S. E., Carlson, J. S., & Morris, T. (1997). Psychophysiological stress in elite golfers during practice and competition. *Australian Journal of Science and Medicine in Sport*, 29(2), 55–61. PMID: 9242979 [PubMed – indexed for MEDLINE]

Morya, E., Ranvaud, R., & Pinheiro, W. M. (2003). Dynamics of visual feedback in a laboratory simulation of a penalty kick. *Journal of Sports Sciences*, 21(2), 87–95. PMID: 12630788 [PubMed – indexed for MEDLINE]

Mujika, I. (2010). Intense training: The key to optimal performance before and during the taper. *Scandinavian Journal of Medicine and Science in Sports*, 20(2), 24–31. doi: 10.1111/j.1600-0838.2010.01189.x

Mujika, I., & Padilla, S. (2003). Scientific bases for precompetition tapering strategies. *Medicine and Science in Sports and Exercise*, 357, 1182–1187. PMID: 12840640 [PubMed – indexed for MEDLINE]

Nevill, A., Atkinson, G., & Hughes, M. (2008). Twenty-five years of sport performance research in the Journal of Sports Sciences. *Journal of Sports Sciences*, 26(4), 413–426. doi: 10.1080/02640410701714589

Perez-Turpin, J. A., Cortell-Tormo, J. M., Suarez-Llorca, C., Andreu-Cabrera, E., Llana-Belloch, S., & Perez-Soriano, P. (2009). Relationship between anthropometric parameters, physiological responses, routes and competition results in formula windsurfing. *Acta Kinesiologiae Universitatis Tartuensis*, 14, 95–110.

Pyne, D. B., Mujika, I., & Reilly, T. (2009). Peaking for optimal performance: Research limitations and future directions. *Journal of Sports Sciences*, 27(3), 195–202. doi: 10.1080/02640410802509136

Rhea, M. R., Hunter, R. L., & Hunter, T. J. (2006). Competition modeling of American football: Observational data and implications for high school, collegiate, and professional player conditioning. *Journal of Strength and Conditioning Research*, 20(1), 58–61. PMID: 16503692 [PubMed – indexed for MEDLINE]

Schempp, P., & Mattsson, P. (2005). *Golf: Steps to success*. Champaign, Illinois: Human Kinetics.

Smith, D. (2003). A framework for understanding the training process leading to elite performance. *Sports Medicine*, 33(15), 1103–1126. PMID: 14719980 [PubMed – indexed for MEDLINE]

Smith, M. (2010). The role of physiology in the development of golf performance. *Sports Medicine*, 40(8), 635–655. doi: 10.2165/11532920-000000000-00000

Stauch, M., Lui, Y., Giesler, M., & Lehmann, M. (1999). Physical activity levels during a round of golf on a hilly course. *Journal of Sports Medicine and Physical Fitness*, 39(4), 321–327. PMID: 10726433 [PubMed – indexed for MEDLINE]

Toubekis, A. G., Drosou, E., Gourgoulis, V., Thomaidis, S., Douda, H., & Tokmakidis, S. P. (2013). Competitive performance, training load and physiological responses during tapering in young swimmers. *Journal of Human Kinetics*, 38, 125–134. doi: 10.2478/hukin-2013-0052

Zunzer, S. C., von Duvillard, S. P., Tschakert, G., Mangus, B., & Hofmann, P. (2013). Energy expenditure and sex differences of golf playing. *Journal of Sports Sciences*, 31(10), 1045–1053. doi: 10.1080/02640414.2013.764465

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Corresponding author **Marius Zienius**
Lithuanian Sports University
Sporto str. 6, Kaunas LT-44221
Lithuania
Tel. +370 61346179
E-mail mariuszienius@yahoo.com