Portuguese Journal of Sport Sciences
11 (Suppl. 2), 2011

THE ANALYSIS OF RACE PACING IN ELITE COMPETITIVE LONG-DISTANCE SPEED SKATING

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The purpose of this study was to investigate the characteristics of racing pattern adopted by elite male speed skaters in official 5000m race. Twenty-four male skaters, who participated at the World Single Distances Speed Skating Championships 2008, were recorded using video camera (60Hz). The top group (top12 ranked skaters) was significantly faster than the 2nd group (13th to 24th ranked skaters) from 350m line to the finishing line ($p<0.001$~0.05). The variations of speed in curve sectors were smaller for the top group than the 2nd group (Lap2nd & 8th, $p<0.05$), and also smaller in straight sectors (Lap8th & 9th, $p<0.01$~0.05). These results suggest that it is important to adopt a "positive pacing strategy" and to distribute skating speed evenly as possible within each lap, especially not to decrease skating speed excessively in straight sectors at that time.

KEY WORDS: ice skating, competition, racing pattern, strategy, 5000m.

INTRODUCTION: It is known that there are several pacing strategies, which affect the performance in Long-distance speed skating. According to the previous studies, almost of elite male skaters observed during the competitive 5000m races adopted a similar strategy by starting fast before pace gradually declined throughout the duration of the race (Yuda et al., 2002, Thomas et al., 2010). This pacing pattern is called ”positive pacing strategy”. However, little attention has been given to the difference in skating speed at each curve and straight sectors during the whole race. The present study aimed to investigate the characteristics of racing pattern adopted by elite male speed skaters in official 5000m race.

METHODS: Twenty-four elite male speed skaters, who participated at the World Single Distance Speed Skating Championships in 2007/2008 season, were videotaped with two video cameras (60Hz) during the whole course of the men’s 5000m race. They were divided into two groups according to the final standings, the top group (top12 ranked skaters) and the 2nd group (13th-24th ranked skaters). The average speed and skating cycle frequency for six sectors (included two curves and four straights) were calculated at each lap based on the temporal data collected by the timer counter superimposed on the video images. The rate of decline (%) in skating speed was defined as “(1 - (time of Lap1st to 6th) / (time of Lap7th to 12th)) ×100” (Yuki et al., 1999, Yuda et al., 2002). The unpaired t-test was used to assess the significant differences between two variables for the both groups. The level of significance was set at α=0.05. Values are shown as mean ± SD.

RESULTS AND DISCUSSION: The mean total time of the top group was 6:29.93 ± 6.26 seconds (6:17.24 ~ 6:38.01) and that of the 2nd group was 6:43.80 ± 3.95 seconds (6:39.41 ~ 6:51.74) ($p<0.001$). Figure 1 shows the means skating speed at each sector during the whole race. The top group was significantly faster from 350m line to the finishing line than the 2nd group ($p<0.001$~0.05). The skaters of the both groups adopted a similar strategy by starting fast before pace gradually declined throughout the duration of the race so-called “positive pacing strategy”. These results were similar to previous studies (Yuda, et al.,2002, Thomas et al., 2010). The rate of decline in speed of the top group was significantly lower than the 2nd group (2.00 ± 1.98% vs. 3.88 ± 2.11%, $p<0.05$). The range of sector speeds at each lap of the top group were smaller than the 2nd group, and a significant difference was detected at Lap9th ($p<0.001$, Figure 2). All skaters accelerated in curve sectors and decelerated in

straight sectors. Figure 3 shows the variations of skating speed in curve and straight sector at each lap. The top group was smaller than the 2nd group in curve sectors (Lap2nd & 8th, $p<0.05$) and also in straight sectors (Lap8th , $p<0.05$; Lap9th, $p<0.01$). There were significant positive relationships between the variations of skating speed and the cycle frequency in curve sectors (Lap2nd, $p<0.05$), also in straight sectors (Lap5th, $p<0.01$; Lap9th to 11th, $p<0.05$).

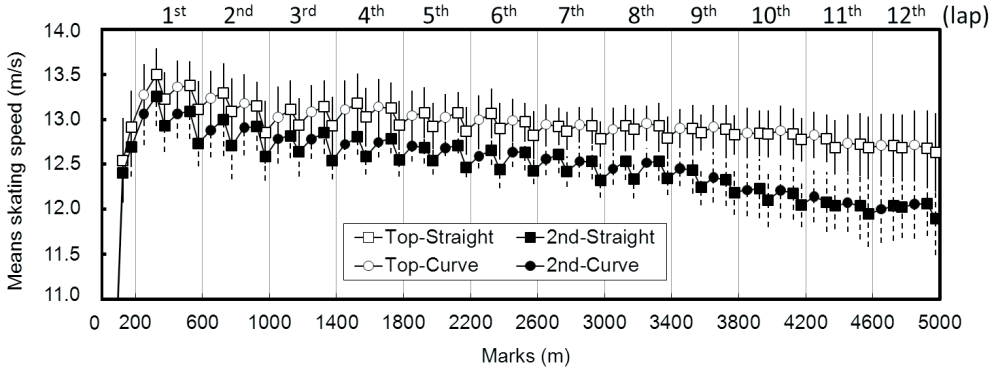

Figure 1: Means skating speed at each sector during the 5000m race.

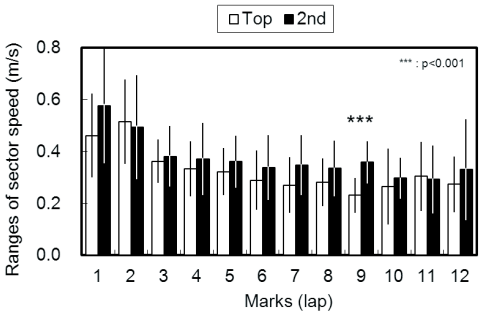

Figure 2: Ranges of sector speed within each lap during the 5000m race.

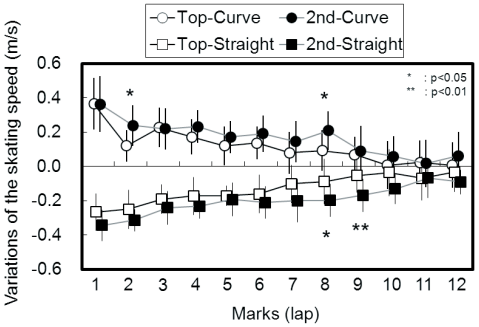

Figure 3: Variations of skating speed in curve and straight sector at each lap.

CONCLUSION: These results suggest that it is important to adopt a "positive pacing strategy" and to distribute skating speed evenly as possible within each lap, especially not to decrease skating speed excessively in straight sectors at that time.

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Acknowledgement
The data of this study were accumulated with the cooperation of the Japanese Olympic Committee and Coca-Cola (Japan) Co., Ltd. We sincerely express our gratitude to those people.