

Physiological Comparative Analysis of Snowboard Deck in Snowboarders

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Abstract. The purpose of this study is to examine and verify the effectiveness of the materials through physiological comparison. Blood lactate concentrations and energy metabolic variables were measured from the targeted snowboarders. Five slope-style snowboarders participated in the experiment. Each subject performed three runs with each “B”, “S” and “Y” deck. Blood samples were collected twice from the finger-tip at rest and immediately after each run. Portable wireless gas analyzer and Polar heart rate monitor was used in order to analyze the energy metabolic variables i.e. heart rate (HR), oxygen uptake (VO₂), metabolic equivalent (MET) and total energy consumption (TEE), at rest as well as during the run. The result obtained showed increased blood lactate concentration as well as higher oxygen uptake (VO₂) at the point of Lactate Threshold (LT) when performing runs by installing “B” and “Y” decks than “S”.

Keywords: Snowboard Deck, Blood Lactate Concentration, Energy Metabolic Variables.

1 Introduction

As Korea is hosting next 2018 Winter Olympics, domestic technology based products can contribute to develop the winter sports industry not only in Korea but also internationally further increasing our technological competitiveness [9]. In a previous study conducted [2] on six male athletes, degree of muscle glycogen was much more increased during exercise on snow than in the laboratory. Furthermore, rapid accumulation of lactic acid by fatigue on snow was also reported by [3]. Thus, these researches pointed out that performing experiment regarding the blood lactate concentration and energy metabolism in the field will be much more important on

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indicating the energy consumption than in laboratory condition. Based on these facts, the study aims to provide evaluation data for examining and verifying the effectiveness of the materials through physiological comparison and analysis of the new prototype snowboard deck with the existing equipments.

2 Methods

Five male Slope-style currently enrolled in the Korea Snowboard Association were chosen as subjects. The test took place in the advanced Slope-style course (420m in length with average pitch of 20° to maximum pitch of 30°) at “W” Snowpark, Gangwondo Korea. A twin tip freestyle snowboard deck constructed by “B” Co. was compared with the existing two products from “S” and “Y” company each. Subjects’ blood samples were collected at rest. Second blood samples were collected immediately after completing the run from the finger- tip. Before conducting each run subjects were given resting period on a chair for 3-5 minutes. The collected samples were analyzed by injecting into a lactate analyzer (Biosen C-line sport, EKF Diagnostic, Germany). Portable Gas Analyzer (K4b2 CosMed, Italy) and Polar Heart Rate Monitor was used to obtain Heart rate (HR), oxygen uptake (VO₂), metabolic equivalent (MET), total energy expenditure (TEE) in real time

3 Results

Increased blood lactate concentration was observed in all three deck than at rest (1.84±.32mmol/L). In particular, blood lactate concentration installing “B” (2.71±.67mmol/L) and “Y” (2.42±1.02mmol/L) decks was much higher in comparison to “S” (2.33±.59mmol/L) deck. When installing “B”, “S” and “Y” decks, heart rate (HR) was higher in the state of VO₂max (134.75±24.25bpm, 125.25±22.19 bpm, 135.75±27.24bpm) than at rest (79.00±4.16bpm, 77.25±6.40bpm, 78.75±6.40bpm) and at the state of lactate threshold (94.00±6.27bpm, 92.50±3.00bpm, 106.50±17.29bpm). VO₂ and MET were much higher in the state of lactate threshold (LT) (5.37±.76, 4.41±1.24, 5.73±1.18) than at rest (8.07±2.86ml/kg/min, 6.84±2.56ml/kg/min, 5.54±1.31ml/kg/min, 2.31±.81, 1.96±.73, 1.58±.38). Furthermore, VO₂ and MET appeared highest at state of VO₂max (37.20±4.76ml/kg/min, 38.51±3.49ml/kg/min, 39.78±3.24ml/kg/min, 10.63±1.36, 11.00±1.00, 11.36±.93) than in the state of lactate threshold (LT). Oxygen intake was increased when installing “B” (18.80±2.64ml/kg/min) and “Y” (20.06±4.11ml/kg/min) decks than performing runs on “S” (12.70±3.68ml/kg/min) deck in the state of the lactate threshold (LT). Also when installing “B” and “Y” decks, TEE was much higher in the state of lactate threshold (LT) (14.12±7.11kcal, 11.30±2.74kcal) and VO₂max (18.04±7.29kcal, 17.13±2.14kcal) than at rest. In case of “S” deck, it was much higher in the state of lactate threshold (LT) (11.39±3.22kcal) than at rest and it was much higher in the state of VO₂max (18.77±7.50kcal) than in the state of lactate threshold (LT).

4 Discussion and Conclusion

Different researches [7] [8] have mentioned about the use of “Lactic acid” as a reference value for improving the performance of athletes, analyzing the effectiveness of training, a degree for excessive training as well as to control the exercise intensity [5]. According to the results obtained from the study, higher blood concentration was observed in “B” and “Y” decks than “S”. It is considered that these results are indicators that represent the mobilization capabilities of the lactic acid system during energy metabolic process which appeared due to depletion of energy sources as well as due to the increase in fatigue substance concentrations in the peripheral muscles through the performed activity. When snowboarding, high lactate levels are caused in part by occlusion during continuous isometric contractions which results in restriction of blood flow of vastus lateralis [11]. According to the result obtained from this study, the oxygen uptake when installing “B” and “Y” decks were much higher than when installing “S” deck at the state of lactate threshold. On the other hand, the MET of snowboard athletes are reported to be 7-11 [3] whereas, the MET of our subjects was 10- 11 level at the state of VO₂max proves the intensity of the experiment performed.

References

1. Andersen, R. E., & Montgomery, D. L., Physiology of alpine skiing. Sports Medicine (1988), pp.210-221.
2. Blomstrand, E., & Essén-Gustavsson, B., Influence of reduced muscle temperature on metabolism type I and type II human muscle fibers during intensive exercise. Acta Physiologica Scandinavica (1987), pp. 569-574.
3. Castellani, J. W., & Young, A. J., Health and performance challenges during sports training and competition in cold weather. British Journal of Sports Medicine (2012), pp. 788-791.
4. Koh, Y. S., & Jeong, I. G., Portable metabolic measurement system accurately measure metabolic variables during sub-and maximal exercise. Journal of Sports and Leisure Studies (2007), pp. 833-842.
5. Juel, C., Klarskov, C., Nielsen, J. J., Krstrup, P., Mohr, M., & Bangsbo, J., Effect of high-intensity intermittent training on lactate and H iron release from human skeletal muscle. American Journal of Physiology, Endocrinology and Metabolism (2004), pp. 245-251.
6. Jung Young-Hak, The Effects Of Acute Stretching And Kinesio-Taping In Isokinetic Muscle Strength In Snowboarders. Postgraduate thesis, Graduate School of Korea National University of Education, Korea (2009).
7. Langran, M., & Selvaraj, S., Increased injury risk among first-day skiers, snowboarders, and skiboarders. American Journal of Sports Medicine (2004), pp. 96-103.
8. Meyers, M. C., Laurent, C. M. Jr., Higgins, R. W., & Skelly, W. A., Downhill ski injuries in children and adolescents. Sports Medicine (2007), pp. 485-499.
9. Park, H. Y., Cho, T. S., & Mun, S. H., The effect on satisfaction and buying behavior according to product attribute of snowboard deck. Journal of Sports and Leisure Studies (2012), pp. 63-75.
10. Suh, Chae-Moon, Effect of ski and snow-board sport on beta-endorphin and norepinephrine secretion. The Korean Journal of Sport (2012), pp. 225-237.

- 11.Szmedra, L., Im, J., Nioka, S., Chance, B., & Rundell, K. W., Hemoglobin/myoglobin oxygen desaturation during alpine skiing. *Medicine and Science in Sports and Exercise* (2001), pp.232-236.