Lactate and ammonia after 150m sprint in 200m and 400m track and field athletes

Pakzad-Mayer, Y., Chan, Y.-S., Jang, J.-T.

National Taiwan Sport University, Taoyuan

Taiwan

Abstract

Introduction: Most of Taiwan's 200m and 400m track and field athletes focus on a training based on a 150 m interval training. During this distance athlete can increase and keep their speed. So it is a useful method to train speed. During the last 20 years studies analyzed the behavior of NH_3 and lactate during exercise using different study designs. On this basis the following research was done to examine if NH_3 and lactate measurements can be used to examine athlete's anaerobic capacity. Additionally, repetition training was chosen to observe whether the rest period does influence the NH_3 outcome.

Methods: Ten track and field male subjects age 17.00±1.325 volunteered to participate in this study. Each subject had to do a 5x150m max repetition training after a 30 minutes warm up. During repetitions a 5 minutes resting period was granted. La, NH_3 was measured at rest and after the 5^{th} repetition. During each repetition the speed was measured.

Results: Lactate rose from 1.31±0.33 mmol/l at rest (R) to 18.79±3.81 mmol/l after the 5^{th} repetition (5x). The amount of NH_3 (µmol/l) rose from 31.60±16.03 (µmol/l) in (R) to 168.60±52.31 (µmol/l) in (5x). The speed steadily decreased on each stage from 8.38±0.60 (m/s) at the first repetition (1x) to 7.67±0.56 (m/s) at the last (5x). There was a linear relationship between NH_3 and lactate output during training (r = 0,77). The p value was significant (p=0,016).

Discussion: Many studies have shown that with increasing intensity the NH_3 value increases as well. This was interpreted as a matter of used muscle fibres. At higher workload more fast twitch fibres are recruited and hence, this results in a larger amount of NH_3 due to the activation of the AMP deaminase. On the other hand the glyconeogenesis might also be responsible for the increase of NH_3. Since ATP will be used up within the first 10s, 200m and 400m runners have to generate the energy by using proteins. Previous studies have found a correlation between NH_3 and lactate in high intensity tests. A 150m running distance, however, has not been analyzed yet. The finding of this study confirm that a correlation between this two parameters exist during max workload. If NH_3 value after 150m sprint can be used as a predictor of 200m and 400m sprinters needs further studies.

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Introduction

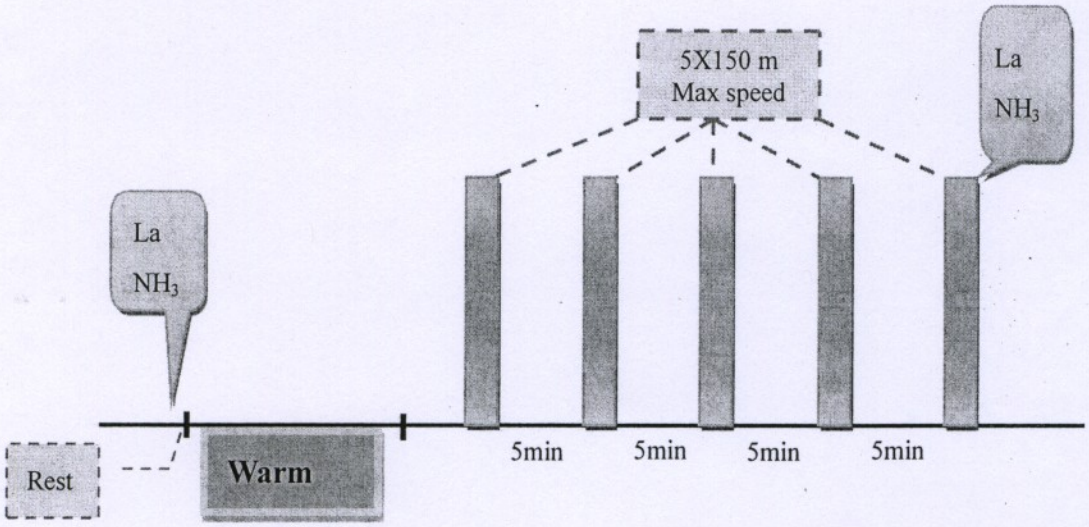
Every athletes' dream is to be the best in his or her field. So the training mode is very important. Most of Taiwan's 200m and 400m track and field athletes focus on a training based on a 150m interval training. During this distance athlete can increase and keep their speed. While a longer distance of 200m or 400m sprints result in a loss of speed. So the 150m sprint is a useful method to train speed. During the last 20 years studies analyzed the behavior of NH_3 and lactate during exercise using different study designs. Itho, H. and Ohkuwa, T. (1991) for example suggest that the peak value of ammonia appears within the first 15 seconds of exercise. On this basis the following research was done to examine if NH_3 and lactate measurements can be used to examine athlete's anaerobic capacity. Additionally, repetition training was chosen to observe whether the rest period does influence the NH_3 outcome.

Purpose: Examine NH_3 and lactate outcome and their relationship to analyze athlete's anaerobic capacity.

Methods

Subjects and Experimental Design

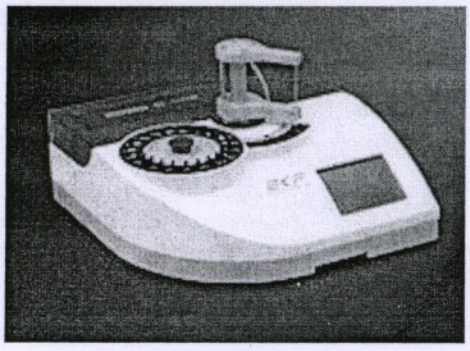
Ten track and field male subjects age 17.00±1.325 volunteered to participate in this study. Each subject had to do a 5x150m max repetition training after a 30 minutes warm up. During repetitions a 5 minutes resting period was granted. La, NH_3 was measured at rest and after the 5^{th} repetition. During each repetition the speed was measured. Graph 1 shows the test procedure.



Graph 1: Test procedure

Instruments

Lactate was measures with a Biosen C-line from EKF Diagnostic (graph 2). NH3 measurements were done with a blood ammonia meter from Arkray model PocketChem PA 4130 (graph 3).



Graph 2: Biosen C-line

Graph 3: PocketChem from Arkray PA 4130

Statistics

The Pearson product-moment correlation was used to determine the relationship between ammonia and blood lactate.

Result

At rest blood lactate and ammonia were measured and at the end of the intermittent training. Lactate rose from 1.31±0.33 mmol/l at rest (R) to 18.79±3.81 mmol/l after the 5th repetition (5x). The amount of ammonia NH_3 (µmol/l) rose from 31.60±16.03 (µmol/l) in at rest (R) to 168.60±52.31 (µmol/l) after the 5th repetition (5x). Figure 1 shows both the increase in ammonia and blood lactate after the 5th repetition.

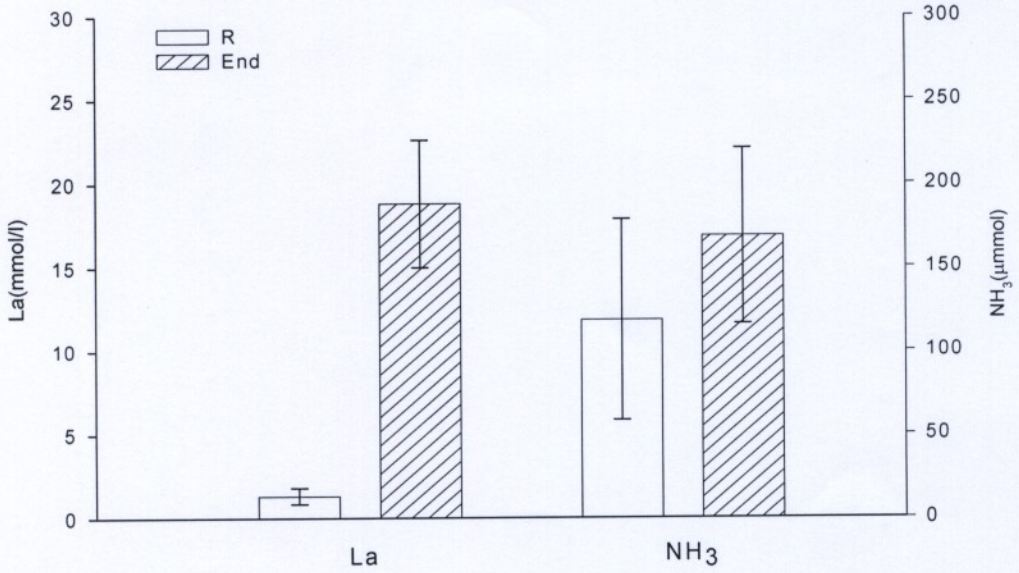


Figure 1: ammonia and blood lactate before and after the test

The speed on the other hand steadily decreased on each stage. It decreased from 8.38±0.60 (m/s) at the first repetition (1x) to 7.67±0.56 (m/s) at the last (5x) (see Figure 2).

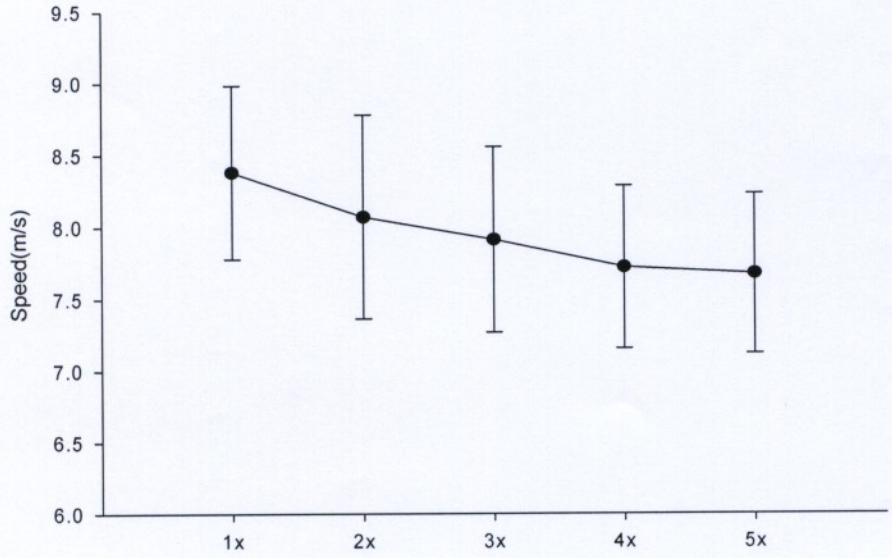
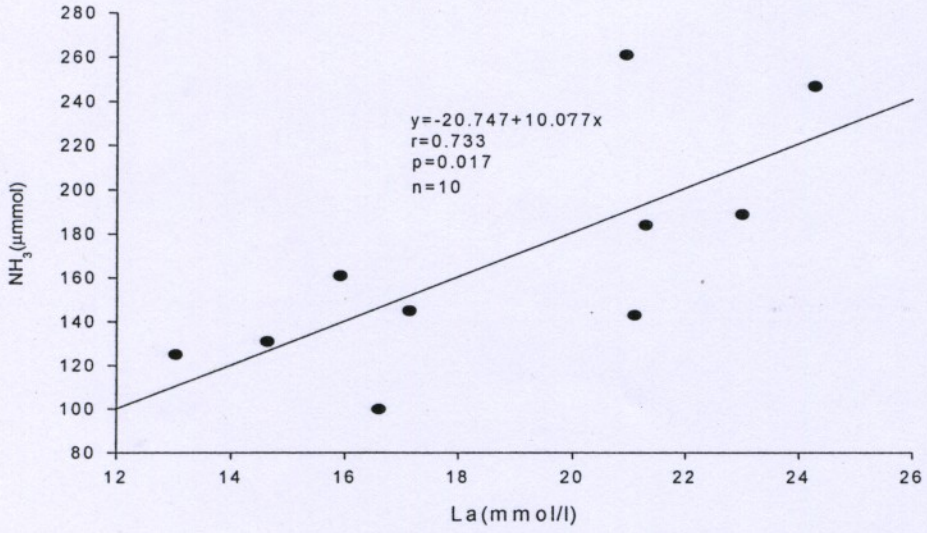


Figure 2: Speed 150m sprints on each repetition

Figure 3 shows that there was a linear relationship between NH_3 and blood lactate output during training (r = 0,73). The p value was significant (p=0,016).



Discussion

Many studies have shown that with increasing intensity the NH_3 value increases as well (see Urhaus, A. and Kindermann 1992). This increase was interpreted by Nazar K., Dobrzynski B., Lewicki R. (1992) as a matter of used muscle fibres. At higher workload more fast twitch fibres are recruited and hence, this results in a larger amount of NH_3 due to the activation of the AMP deaminase (see Schlicht, W. Naretz, W. Witt, D. and Rieckert, H 1990). On the other hand the glyconeogenesis might also be responsible for the increase of NH_3. Since ATP will be used up within the first 10s, 200m and 400m runners have to generate the energy by using proteins. The studies of Urhaus, A. and Kindermann, W.(1992), Nazar K., Dobrzynski B., Lewicki R. (1992) and Schlicht, W. Naretz, W. Witt, D. and Rieckert, H (1990) have found a correlation between NH_3 and lactate in high intensity tests. A 150m running distance, however, has not been analyzed yet. The finding of this study confirm that a correlation between these two parameters exist during max workload in outdoor conditions. Hageloch, W., Schneider, S. and Weicker, H. (1990) found out that a self-assessed sprinters had a higher ammonia outcome after 75m sprints than self-assessed middle distance runner. The 1000m distance, however, showed no different in the two groups. However, the distance and abilities of 200m and 400m sprinters are quite different from 75m and 1000m sprinters.

Conlusion

This study showed that after an interval training with 150m sprints, 200m and 400m runners ammonia rose as well as their blood lactate although a 5 minute break was granted. It also showed that the two parameters are related. Further studies have to be done to analyze whether an 200m and 400m athlete's physical performance can be

predicted by his or her NH_3 level after a 150m sprint. Furthermore, if NH_3 value after 150m sprint can be used as a predictor of 200m and 400m sprinters needs further studies.

Reference

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