Short communication

RELIABILITY OF LACTATE SCOUT PORTABLE ANALYZER IN AGILITY DOGS DURING MULTIPLE MEASUREMENTS

BELIĆ Maja[1], RADIN Lada[2], BRKLJAČA BOTTEGARO Nika[3], BEER LJUBIĆ Blanka[4], BENIĆ Marijan[5], STANIN Damir[6], VRBANAC Zoran[6*]

[1]Department of Pathophysiology, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia; [2]Department of Physiology and Radiobiology, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia; [3]Surgery, Orthopedics and Ophthalmology Clinic, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia; [4]Internal Diseases Clinic, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia; [5]Sanatio Ltd., Bolnička cesta 34c, Zagreb, Croatia; [6]Department of Radiology, Ultrasound Diagnostic and Physical Therapy, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

The aim of this study was to evaluate the reliability of multiple measurements with Lactate Scout portable analyzer in dogs during treadmill exercise. Ten Border collies were involved in the study and blood samples were taken before, three times during and twice after the treadmill exercise. Lactate concentration was measured in duplicate, by Scout portable analyzer and the reference biochemical analyzer in the laboratory, and the obtained values were compared. There was a high and positive correlation between these two methods (r=0.96, p=0.003). The Lactate Scout analyzer reveals a high degree of agreement with the laboratory method and therefore can be valid for use in research of veterinary sports medicine and emergency veterinary medicine where multiple measurements of lactate concentrations are often needed.

Key words: exercise, dogs, hand held analyzer, lactate

Lactate concentration in the blood increases during physical exercise of certain intensity and can be measured using different methods. By measuring the lactate concentration we can determine the lactate threshold (i.e. anaerobic threshold) which indicates the maximum intensity of the working load at which the accumulation of lactic acid exceeds the capabilities of its degradation [1]. In human sports medicine blood lactate analysis is performed routinely in practice as it serves as an indicator of training adaptation and correlates well with endurance exercise [2] and therefore helps in evaluating optimal exercise intensity [3]. For the same reason blood lactate concentration is measured in sports animals, mostly dogs and horses [4-7]. Since lactate concentration correlates with the total oxygen debt, the magnitude of hypoperfusion

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*Corresponding author: e-mail: zoran.vrbanac@vef.hr

and the severity of shock, it is also used to assess the seriousness and prognosis of several medical and surgical critical conditions [8-10].

Blood lactate concentration can be measured by two methods: in the laboratory using the standard biochemical analyzers with commercial enzymatic kits and by hand-held portable lactate analyzers. The main advantage of portable analyzers is simple handling and rapid acquisition of the results which is why this device is routinely used in hospitals and human sports medicine. Despite their very practical purpose, the portable analyzers are not as commonly used in veterinary as in human practice. Nevertheless their use in dogs and horses sports activities, such as agility, could shorten the time of data processing and give us the needed results on the spot i.e. in field conditions. Moreover the portable analyzers could be more practical to use during some critical interventions [11,12]. The latest studies showed the introduction of the lactate pocket analyzer in ovine medicine [13].

Lactate Scout (LS, SensLab GmbH, Germany) is a pocket-sized blood lactate analyzer for lactate measurements which provides lactate readings within ten seconds and requires only a 0.5 µl of sample i.e. one droplet of blood is sufficient for measurement and it can be taken either from the superficial vein (fingertip) or the ear capillaries. Although a more practical and rapid way of taking blood samples in field conditions is from the ear capillary, in our study we used the blood droplet obtained from the vein catheter since we already had it placed there for the laboratory blood analysis. The analyzer has been designed to be used 'in the field' and operates on temperatures from 5-45°C and in up to 85% humidity. A wide measurement range of 0.5-25 mmol/L covers the typical values of different species. An in-built compensation for hematocrit allows accurate measurements even at high (>50%) or low (<35%) hematocrit levels.

There are many studies on the evaluation of portable lactate analyzers in human and veterinary sports medicine but most of them were undertaken to assess the accuracy and reliability of the Lactate Pro analyzer or some other hand held lactate analyzers beside Lactate Scout analyzer [2,9,12,14,15]. However, all the mentioned studies were conducted during rest i.e. clinical examination, when dogs are usually calm and possible technical errors are minimized (blood clotting in an intravenous line, sudden weather change, low battery of the device, etc.).

The aim of our study was to assess the reliability of Lactate Scout analyzer for multiple measurements of lactate concentration in the same subject, as it would be performed in the field during training, when repeated measurements are preferable in order to accurately determine the lactate threshold. Therefore we used a homogenous group of agility dogs and compared lactate values gained by multiple measurements on Scout portable analyzer and the data obtained in the laboratory conditions by commercial kit. The study was approved by the Ethics Committee of Faculty of Veterinary Medicine, University of Zagreb.

There were ten healthy, agility active (training level master) Border collies enrolled in this study, 4 females and 6 males with a mean age (±SD) 3.7 (± 1.9) years and mean

body mass (±SD) 17.5 (± 3.1). All dogs were privately owned and were held as pet dogs. The dogs underwent clinical examination and were found to be healthy.

For a progressive exercise test a motorized calibrated treadmill (Fit Fur Life Ltd., Professional model, Surrey, Great Britain) was used. The dogs had three training sessions before final testing to get familiar with the treadmill, surroundings and research staff in order to minimize stress and achieve a well coordinated gait pattern for testing purposes. The training session consisted of several minutes running on the treadmill and then 2-3 minutes rest, repeated three times. The exercise test was performed in the morning and before it the dogs fasted for at least two hours while access to water was unlimited during the whole time of the exercise. Before beginning the exercise test on a treadmill, the intravenous catheter was placed in dogs' *v.cephalica antebrachii* and the first blood sample was taken. The staged incremental exercise protocol consisted of four series that included 3 minutes exercising and 1 minute pause. The first blood sample was taken 5 minutes before the exercise and the last 30 minutes after the exercise. Blood samples (0.5 ml) were also taken during each pause. There were 6 blood collections per each dog.

Blood samples for laboratory analysis were collected in vacutainer tubes with sodium oxalate and sodium fluoride (Terumo Europe N.V., Belgium) and immediately centrifuged at 3000 rpm for 10 minutes. Plasma was separated and delivered to the institutional reference laboratory where lactate concentration was measured on calibrated biochemical analyzer Olympus AU640 (Olympus, Japan) with a Beckman Coulter reagent kit (Beckman Coulter, Ireland). For direct lactate measurement with the Scout analyzer a single whole-blood droplet was used within few seconds of collection. The Lactate Scout analyzer contains reagent strips that can measure lactate in a range of 0.5-25 mmol/L.

Kolmogorov–Smirnov test was used for testing data for normality and equal variance while Student dependent t-test was used to reveal significant (p<0.05) differences between Scout and Lab lactate concentration data. To evaluate the correlation between the lactate values obtained by the Scout analyzer and the ones obtained by the Lab chemistry analyzer we used Pearson's Rank Order correlation and set statistical significance between values at $p < 0.05$. Bland and Altman's test was used to express the level of agreement between the two methods. Statistical analysis was performed using SigmaStat 3.0 for Windows (Jandel Corporation, San Rafael, CA, USA).

RESULTS AND DISCUSSION

The blood lactate concentrations measured with the Lactate Scout analyzer ranged from 0.6 to 2.6 mmol/L and the ones obtained in the laboratory 0.5 to 2.6 mmol/L. Student t-test between data from Scout analyzer and Lab analyzer indicated that there was no significant differences among these devices (p= 0.6). Pearson correlation revealed a high and positive correlation between lactate measured by the Scout analyzer

and by the Lab analyzer (r= 0.96, p= 0.003) (Figure 1). The level of agreement was determined over the range of 1.2 – 1.7 mmol/L and the mean difference between the Scout lactate and Lab lactate was 0.04 mmol/L with the limits of agreement of -0.08 to 0.17 mmol/L (Figure 2).
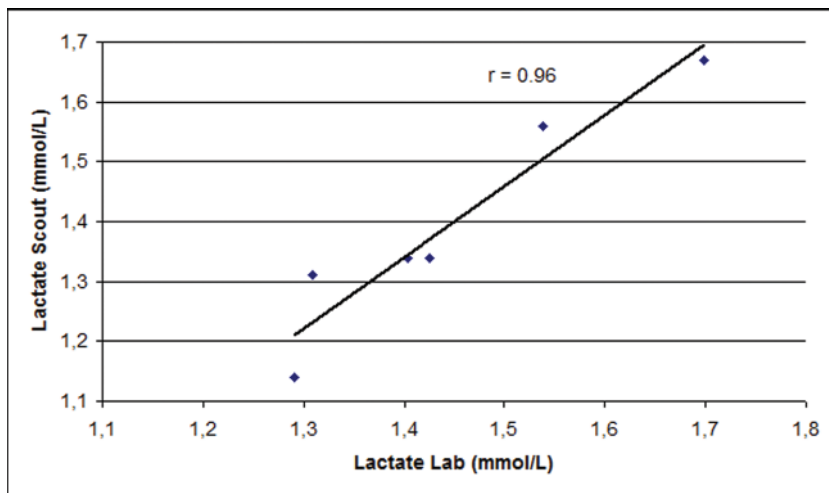

Figure 1. Correlation between mean lactate measured by the Scout analyzer and the Lab analyzer (r=0.96, p=0.003)
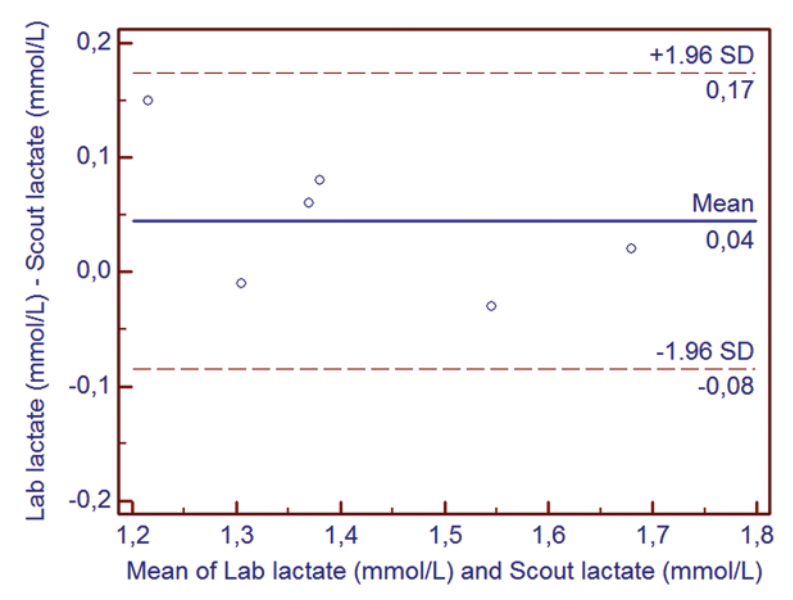

Figure 2. Bland Altman plot showing the limits of agreement for lactate measured by Scout analyzer and the Lab analyzer.

Although the range of measured lactate concentrations by the laboratory analyzer was slightly wider than by Scout analyzer, still there were no significant differences in

the results between these two measuring methods. Moreover, there was a positive and significant correlation between these methods. Some studies appeal to caution when interpreting higher lactate values (>5 mmol/L) with the Lactate Scout analyzer [2,9]. In our study, the maximum concentration was below that value (2.6 mmol/L) and therefore we consider our results to be reliable. A minor limitation of our study could be the fact that the blood samples were taken from the vein catheter and not the ear capillary as usual in field conditions, but since our goal was to examine the reliability of multiple measurements in the same subject, with 6 samples obtained from each animal, we believe blood sampling site is not of vital importance for this study.

This study was performed under controlled conditions; room temperature and humidity were the same for all tested subjects. The reliability of the pocket analyzer in field conditions where the mentioned parameters might vary extensively still remains to be investigated. Nevertheless, the positive correlation between the lactate values obtained by the laboratory and pocket analyzer confirms the accuracy of determining the lactate concentrations by multiple measurements which are often needed in sports and emergency veterinary medicine.

Authors' contributions

Maja B, LR and ZV have made conception, design and drafting of the manuscript, have been involved in acquisition of data, and performed the statistical analysis and interpretation of data. NBB and BBLj carried out the laboratory work, made substantial contributions to analysis of data and have revised manuscript critically for important intellectual content. Marijan B and DS have revised manuscript critically for important intellectual content. All authors have given final approval of the version to be published, agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy of integrity of any part the work are appropriately investigated and resolved. All authors read and approved the final manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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POUZDANOST ODREĐIVANJA KONCENTRACIJE LAKTATA TOKOM VIŠEKRATNOG MERENJA SA *LACTATE SCOUT* PORTABILNIM ANALIZATOROM KOD AGILNIH PASA

BELIĆ Maja, RADIN Lada, BRKLJAČA BOTTEGARO Nika, BEER LJUBIĆ Blanka, BENIĆ Marijan, STANIN Damir, VRBANAC Zoran

Ova studija ima za cilj da proceni pouzdanost određivanja koncentracije laktata tokom višekratnog merenja sa *Lactate Scout* portabilnim analizatorom kod pasa tokom treninga na pokretnoj traci. U ovu studiju je uključeno deset pasa rase border koli kod kojih su uzorci krvi sakupljani pre treninga, tri puta tokom i dva puta nakon treninga

na pokretnoj traci. Koncentracija laktata je uporedno određivana sa *Scout* portabilnim analizatorom i referentnim biohemijskim analizatorom u laboratoriji, nakon čega su dobijene vrednosti upoređivane, a sva merenja su urađena u duplikatima. Ustanovljena je visoka i pozitivna korelacija između ove dve metode (r=0,96, p=0,03). Rezultati dobijeni *Lactate Scout* analizatorom pokazuju visok stepen sličnosti sa rezultatima laboratorijske metode zbog čega se ova metoda može smatrati validnom za ispitivanja u sportskoj veterinarskoj medicini i urgentnoj veterinarskoj medicini, gde su višekratna određivanja koncentracije laktata često neophodna.