

# Blood gas analysis is not reliable for serum electrolytes and can lead to wrong clinical decisions

Blood gas analysis reliability for serum electrolytes

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## To the editor:

We've read the recent research paper of Karataş et al. which reported high correlation between blood gas analyzer (BGA) and laboratory autoanalyzer (LAA) measurements of electrolytes, hemoglobin and glucose and concluded that they could be used interchangeably in clinical situations, but we think that there is a deficiency in the statistical method of this study and the conclusion made accordingly is also incorrect [1].

When we accept one of the two laboratory test methods as a reference and want to evaluate the usability of the other method instead of the reference test, it is not enough to simply look at the correlation between the results of the two measurement methods. Although the correlation coefficient is very high, it cannot be concluded that the test results are compatible with each other. As an example, let's take a dataset and suppose that the K<sup>+</sup> value measured in LAA is 1.5 times higher than the K<sup>+</sup> value measured in BGA in each case. In such a situation, a perfect correlation between measurement methods will be detected (the Pearson correlation coefficient = 1,  $p < 0,001$ ). However, when we look at this dataset, we can evaluate a patient who is hypokalemic with 2,4 mmol/L according to the LAA result as normokalemic with 3,6 mmol/L according to the BGA result. If we look at the same dataset again, we accidentally begin the treatment of hyperkalemia in a patient whose K<sup>+</sup> value is measured as 4 mmol/L in LAA, which is within normal limits, if we rely on the results of BGA which will reveal K<sup>+</sup> value as 6 mmol/L. As can be seen from this example, when evaluating the reliability of the two test measurement results, it is wrong to make conclusions only by looking at the correlation coefficient. In this case, the test that should be preferred is the Bland-Altman analysis, and a compatibility assessment should be made along with the correlation [2].

In our study, which presented the highest number of cases related to BGA and LAA compatibility in the literature, 31060 patient data were examined and although moderate correlation was found for sodium and potassium, and strong correlation was found for hemoglobin, hematocrit and glucose, mean differences were not within acceptable limits for any test. Therefore, it has been concluded that blood gas analysis is not a completely reliable method, it is more appropriate to wait for biochemistry results instead of making early clinical decisions with blood gas analysis especially when the results and the patient's clinic is not compatible, and blood gas analysis can be used carefully as a decision-making tool only in patients who are hemodynamically unstable and when the test result is compatible with the patient's clinic [3].

As a result, we think that Karataş et al. made an erroneous conclusion due to statistical deficiency, and it was healthier to interpret the results of the study by making the Bland-Altman analysis.

## References

1. Karatas A, Canakci E. Can the clinician trust blood gas for serum electrolyte levels? *J Clin Anal Med.* 2019;10(2): 151-5.
2. Doğan NÖ. Bland-Altman analysis: A paradigm to understand correlation and agreement. *Turk J Emerg Med.* 2018;18(4):139-41.
3. Altunok İ, Aksel G, Eroğlu SE. Correlation between sodium, potassium, hemoglobin, hematocrit, and glucose values as measured by a laboratory autoanalyzer and a blood gas analyzer. *Am J Emerg Med.* 2019;37(6):1048-53.