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(RESEARCH ARTICLE)

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Verification of the Analytical Performance of the Serum Lipoprotein (a) Assay on the Abbott Alinity ci®: Experience of the Biochemistry Laboratory at Mohammed VI University Hospital of Oujda

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Abstract

The verification of analytical methods, as required by the ISO 15189 standard, allows for the evaluation and comparison of a method's performance against predefined analytical objectives. This study focuses on verifying the assay of Lipoprotein (a) on the Abbott® Alinity analyzer, contributing to accreditation and quality improvement in the laboratory.

The assay was performed using immunoturbidimetry. The evaluation of analytical performance (repeatability and intermediate precision) was conducted using two quality control levels, with results analyzed via BYG Informatique software. The obtained results show satisfactory repeatability with CV1 = 1.16% and CV2 = 0.44%. Intra-laboratory reproducibility is also satisfactory, with CV1 = 2.16% and CV2 = 1.29%, in line with the manufacturer's specifications.

Keywords: Serum Lipoprotein (a); Analytical performance; Repeatability; Reproducibility; Alinity CI analyzer

1. Introduction

Lipoprotein (a) [Lp(a)] plays a causal role in the development of cardiovascular diseases, including coronary artery disease, peripheral artery disease, and aortic syndromes. High concentrations of Lp(a), present in 15-20% of the population, are associated with a 2- to 3-fold increased risk for these conditions. Although Lp(a) levels vary among ethnic groups, its impact on cardiovascular risk appears to be universal. Accurate measurement of Lp(a) requires validated and standardized tests, and randomized clinical trials are essential to confirm its causal role and evaluate the benefits of novel therapies designed to lower its levels (1). The aim of our study was to evaluate the analytical performance of Lp(a) measurement using an immunoturbidimetric method with the Abbott Alinity ci® system, in accordance with the criteria of Domain A of the guidelines for method verification and validation in medical biology.

1.1. Reminder on Lp(a)

Lp(a) is a proatherogenic and prothrombotic lipoprotein composed of a lipid core resembling that of LDL and a specific glycoprotein, apolipoprotein(a), covalently linked to ApoB-100 by a disulfide bond. Its unique structure, characterized by repeated domains called kringles, gives it a strong homology to plasminogen, allowing it to interfere with coagulation and fibrinolysis. By transporting oxidized phospholipids (OxPLs), Lp(a) contributes to vascular inflammation and the development of atherosclerotic plaques. It also plays a role in smooth muscle cell proliferation by inhibiting TGF-β activation (2). Unlike LDL cholesterol, Lp(a) levels are primarily determined by genetic factors and are not significantly

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influenced by diet or lifestyle. High concentrations are an independent risk factor for atherosclerosis and cardiovascular diseases.

While its physiological role remains unclear, it may contribute to wound healing and cholesterol transport to injury sites. Its involvement in aortic valve calcification and potentially in type 2 diabetes is also suggested, although the evidence remains limited. Identifying individuals with high levels could enable better prevention by targeting other modifiable cardiovascular risk factors (3).

1.2. Principle of the assay method

The Alinity c Lp(a) reagent consists of a suspension of uniform-sized latex polystyrene particles coated with anti-human lipoprotein (a) IgG. When a sample containing lipoprotein (a) is mixed with the reagent, agglutination occurs, which can be measured by turbidimetry (3).

2. Material and methods

This prospective study, conducted over a 30-day period at the biochemistry laboratory of the Mohammed VI University Hospital Center, aimed to evaluate the reproducibility and repeatability of Lp(a) measurements.

The study was conducted in two phases: the first phase consisted of daily Lp(a) controls at two concentration levels (low and high) to assess reproducibility and ensure results consistency. The samples were divided into two groups based on their concentration. In the second phase, samples covering a broad concentration range were collected, categorized into three groups, and analyzed with 30 replicates per sample to assess repeatability. The analysis was performed using the Lp(a) reagent kit on the Alinity ci® system.

The analyses followed the recommendations of the COFRAC GTA 04 accreditation technical guide. Data processing and statistical analysis were conducted using the BYG EVM module, linking the Alinity ci® to the iLab software for result validation. Coefficient of variation (CV) values were compared to the manufacturer's declared criteria, as no CV reference values were available in the SFBC (Société Française de Biologie Clinique) and RICOS (Reference Institute for Clinical and Laboratory Sciences) databases. The results of this study are presented in the following sections.

3. Results

3.1. Reproducibility results

The reproducibility test, also known as intermediate precision, assesses the impact of factors such as time, reagent lots, operators, and calibration on the results of a single sample. The results showed acceptable coefficient of variation at two levels (CV1 = 2.16% and CV2 = 1.29%), in line with the manufacturer's specifications. These results are visually presented on Levey-Jennings charts (Figures 1 and 2). The reproducibility CV values remain below the acceptable limit according to the manufacturer's specifications (Table 1).

Table 1 Reproducibility results for Lp(a) levels with comparison to the manufacturer's declared criteria (with an expansion coefficient k = 1.211)

Level of IQC	Number of Values	Mean (g/l)	Standard Deviation	Coefficient of Variation CV (%)	The manufacturer's specified CV (%)
Low	30	19.89	0.430	2.16	2,7
High	30	49.70	0.643	1,29	2,7

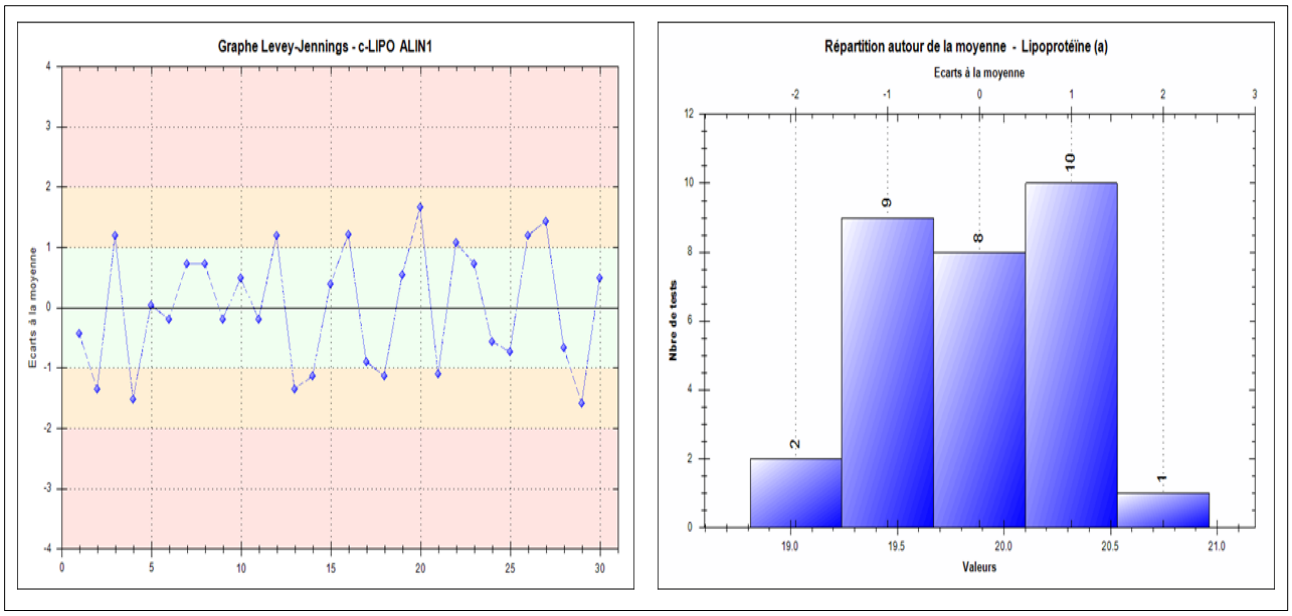

Figure 1 Low Level of Reproducibility: Levey Jennings graph and the distribution around the mean – Lp(a).

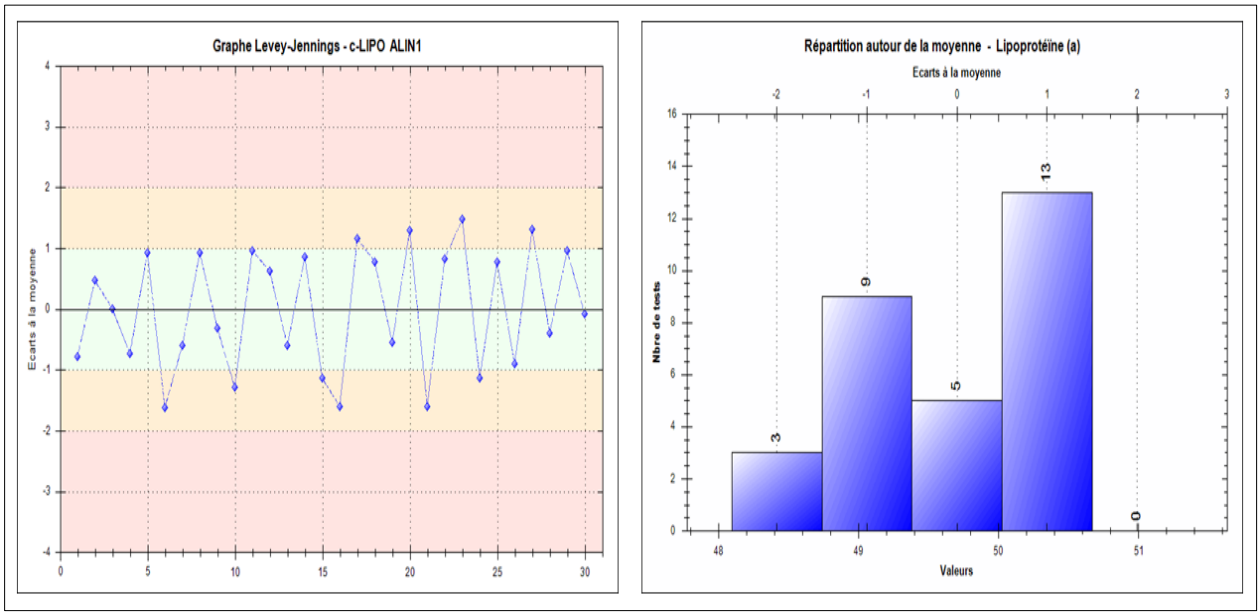

Figure 2 High Level of Reproducibility: Levey Jennings graph and the distribution around the mean – Lp(a)

3.2. Repeatability results

Repeatability was assessed by repeatedly analyzing the same sample under identical conditions (operator, reagent, calibration, and instrument), yielding satisfactory results for Lp(a) (CV1 = 1.16% and CV2 = 0.44%) at two concentration levels. The results are illustrated on the Levey-Jennings charts (Fig. 4 and Fig. 5). The repeatability CV values remain below the acceptable limit according to the manufacturer's specifications (Table 2).

Table 2 Repeatability results for Lp(a) levels with comparison to the manufacturer's declared criteria (with an expansion coefficient k = 1.211)

Level of IQC	Number of Values	Mean (g/l)	Standard Deviation	Coefficient of Variation CV (%)	The manufacturer's specified CV (%)
Low	30	20.28	0.235	1,16	2,7
High	30	49.47	0.215	0,44	2,7

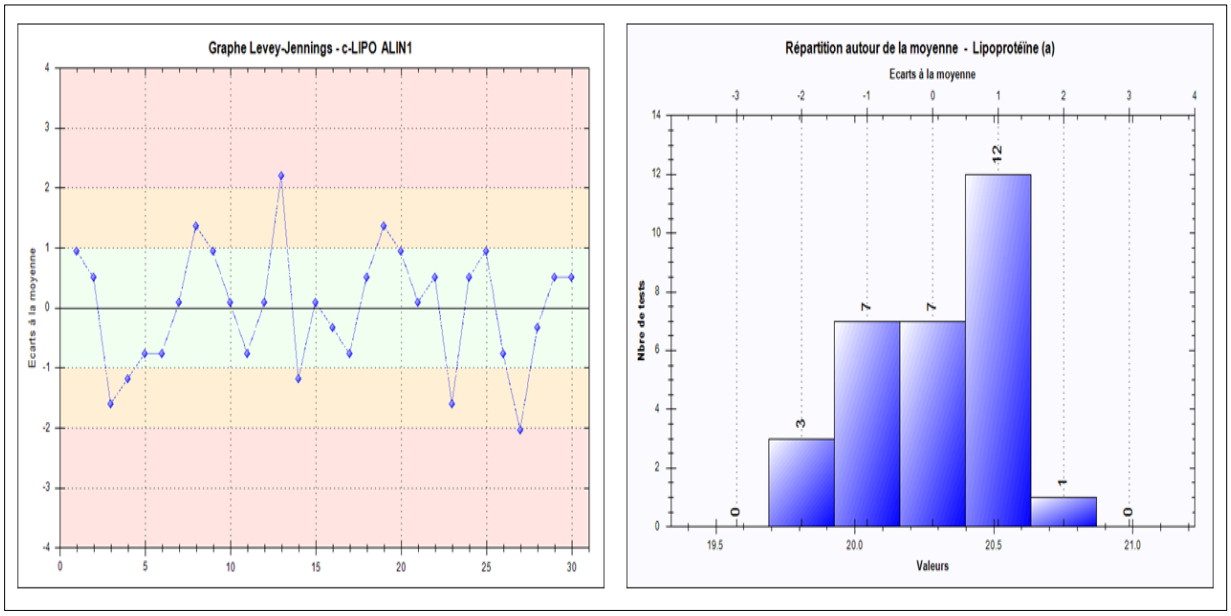

Figure 3 Low Level of Repeatability: Levey Jennings graph and the distribution around the mean – Lp(a)

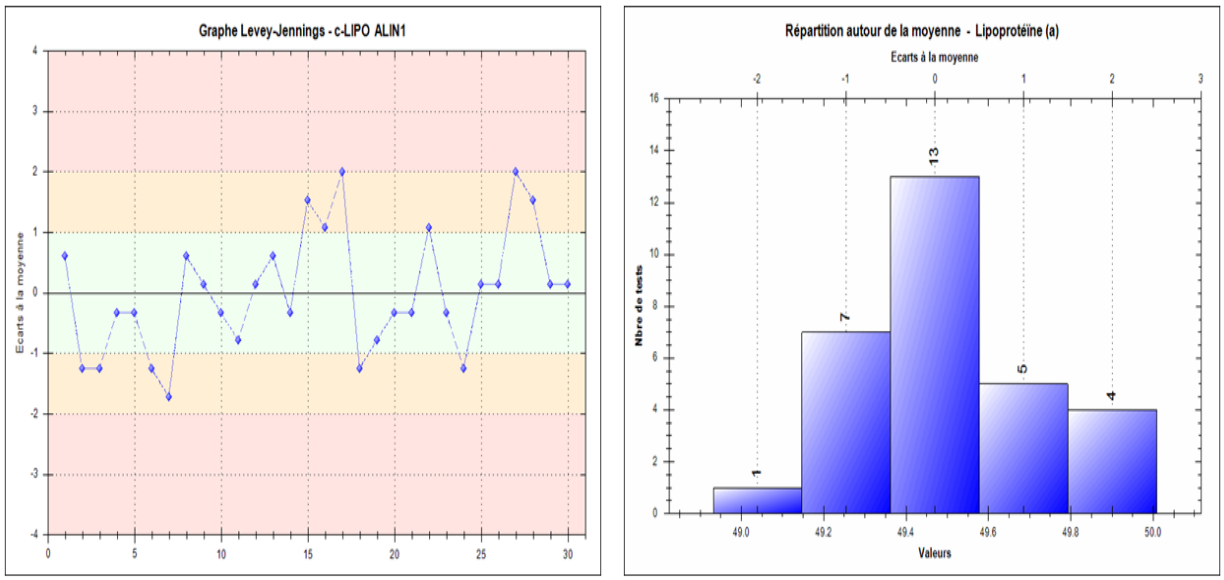

Figure 4 High Level of Repeatability: Levey Jennings graph and the distribution around the mean – Lp(a)

4. Discussion

Lp(a) is a genetically determined lipoprotein, with concentrations ranging from <1 mg/dL to >200 mg/dL. Approximately 20% of the population has high levels (>42 mg/dL). Concentrations are higher in individuals of African descent compared to those of European or Asian origin. High levels of lipoprotein (a) are associated with an increased risk of cardiovascular diseases, aortic valve stenosis, heart failure, and paradoxically, type 2 diabetes (1).

The verification of an analytical method is a crucial step in evaluating and quantifying the performance of an analytical process before its routine use (4). This process allows the laboratory to control its analytical methods, understand their limitations, and ensure the reliability, accuracy, and reproducibility of analytical results. It thus ensures the relevance of clinical interpretations, which are essential for diagnosis, patient monitoring, and therapeutic decision-making. Furthermore, it ensures compliance with regulatory and normative requirements, thereby enhancing the quality and safety of biological analyses (5). Article 7.3.2 of the ISO 15189:2022 standard specifies that the laboratory must establish a procedure for verifying examination methods before their use, to ensure that the performance defined by the manufacturer or method is actually met (6).

Lp(a) is one of the parameters measured in our laboratory using the automated Abbott Alinity® ci system. Several immunochemical techniques, such as ELISA, nephelometry, immunoturbidimetry, and lanthanide fluorescence immunoassays with dissociation, are commonly used to measure Lp(a) in human plasma or serum.

In the absence of reference CVs provided by professional societies such as SFBC or RICOS, we had to rely on external reference materials to assess and ensure the accuracy of the Lp(a) measurement method. In this context, the working group of the International Federation of Clinical Chemistry and Laboratory Medicine initiated a project to select a secondary reference material to standardize Lp(a) measurement, in order to reduce analytical issues related to variations between assay methods. The results of this project showed that reference materials offering the best analytical performance and optimal harmonization helped reduce the variation of results between test systems, although some adjustments are still necessary due to the size polymorphism of apolipoprotein (a). The adoption of such materials, traceable to an international standard, is therefore essential to ensure reliable and comparable results in Lp(a) measurement, especially in the absence of established local references (7).

Our study used the COFRAC SH GTA 04 guide to assess the precision of Lp(a) assays. Due to the absence of reference values for the coefficient of variation (CV) in SFBC (Société Française de Biologie Clinique) and RIQOS (Reference Institute for Clinical and Laboratory Sciences) databases, we compared the results obtained to the manufacturer's specifications. All CV values for the two levels of Lp(a) measurement, for both repeatability and intermediate precision, were below the values established by the manufacturer's declared criteria.

5. Conclusion

Globally, laboratories use techniques validated by the manufacturer. However, in accordance with the ISO 15189:2022 standards, these validated methods must be verified by an independent laboratory before being integrated into routine practice. This is also the case for Lp(a) measurement, which is one of the key parameters related to cardiovascular risk factors and requires method verification.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Kamstrup PR. Lipoprotein(a) and Cardiovascular Disease. Clin Chem. 8 janv 2021;67(1):154-66.

[2] Kostner KM, Marz W, Kostner GM. When should we measure lipoprotein (a)? Eur Heart J. 2 nov 2013;34(42):3268-76.

[3] Alinity ci®, Lp (a) Reagent Kit notice,B83317R01,B1R142.

[4] A. Vassault, A. Hulin, E. Chapuzet, J. Arnaud, C. Giroud. Verification/validation of the performances of analytical method. 2010;

[5] Vassault A, Grafmeyer D, de Graeve J, Cohen R, Beaudonnet A, Bienvenu J. [Quality specifications and allowable standards for validation of methods used in clinical biochemistry]. Ann Biol Clin (Paris). 1999;57(6):685-95.

[6] Richardson H. Medical Laboratories --- Requirements for Quality and Competence: An ISO Perspective. | EBSCOhost [Internet]. Vol. 83. 2002 [cité 18 févr 2025]. p. 333. Disponible sur: https://openurl.ebsco.com/contentitem/doi:10.1111%2Fj.1423-0410.2002.tb05329.x?sid=ebsco:plink:crawler&id=ebsco:doi:10.1111%2Fj.1423-0410.2002.tb05329.x

[7] Tate JR, Berg K, Couderc R, Dati F, Kostner GM, Marcovina SM, et al. International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) Standardization Project for the Measurement of Lipoprotein(a). Phase 2: selection and properties of a proposed secondary reference material for lipoprotein(a). Clin Chem Lab Med. oct 1999;37(10):949-58.