**ORIGINAL ARTICLE**

# Knowledge, Attitude, and Practices for internal quality control in medical laboratory specialists in Kassala City, Eastern Sudan

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**Abstract**

Background: The term "internal quality control" (IQC) describes all of the steps taken by lab staff to improve performance, tools, chemicals, and operational processes in order to ensure the accuracy of the results. Objective: The study aimed to assess knowledge, attitude and practices for internal quality control in medical laboratory specialist in kassala city, kassala state, Sudan. Methods: This cross-sectional study, which involved 100 individuals from specific health centers, was conducted in Kassala City, Kassala State, Sudan. Surveys were used to gather data, and SPSS version (22) which was used for analysis and findings was displayed in tables. Results: In Sudan's Kassala State, the study was conducted in Kassala City. Out of 100 participants from the government and private laboratory health sectors, the overall results indicate that respondents had a positive attitude toward internal quality control (91%), a positive knowledge side (65%), and an overall practice score of 55.3%. Conclusion: Significant gaps in laboratory staff members' internal quality control knowledge, attitudes, and practices that could have an impact on test result accuracy and patient care. Lack of formal training and insufficient understanding of IQC procedures were shown to be the main causes of these deficiencies.

**Keywords:** Internal Quality Control, Medical Laboratory Specialist, Sudan, KAP and Accurate laboratory results.

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## INTRODUCTION

In clinical chemistry labs, quality control (QC) is crucial to ensure the precision, reliability, and rapidity of test results, all of which are vital for patient diagnosis, care, and treatment. The significance of quality control has grown with the increasing complexity of laboratory tests and the integration of advanced technologies. Accurate laboratory results are vital for effective clinical decision-making, and even minor errors can lead to significant consequences for patient care. Therefore, maintaining stringent quality control measures is imperative to uphold the integrity of laboratory operations (1). A range of procedures intended to track and enhance the analytical performance of laboratory tests are included in quality control. Implementing internal quality control (IQC) procedures, taking part in external quality assessment (EQA) applications, and adhering to regulatory standards are some examples of these practices. To recognize, address, and prevent errors in the laboratory context, each of these elements is essential (2). A crucial component of laboratory testing that guarantees precision, dependability, and consistency of test results is internal quality control, or IQC. To detect any deviations that can compromise the accuracy of laboratory results, IQC protocols are designed to monitor the daily performance of analytical techniques (3). Since its goal is to identify and correct errors in the laboratory process before they have an impact on patient care, IQC is an essential part of laboratory quality assurance. In order to perform IQC, control materials are used and examined in addition to patient samples. By simulating patient samples while maintaining known analyte concentrations, these controls enable labs to compare test findings to predetermined benchmarks (4). Labs can identify variations from expected performance and take prompt corrective action to ensure that the tests stay within acceptable levels of accuracy and precision by routinely analyzing control results (5). Efficient IQC programs are essential for reducing analytical errors and raising the general level of confidence in lab findings. Regular quality inspections help laboratories fulfill regulatory requirements and accrediting standards, such as those set forth by the International Organization for Standardization (ISO) and the Clinical and Laboratory Standards Institute (CLSI) (6). Strong IQC procedures are also essential for preserving the validity of test results, which are frequently utilized in patient care and clinical decision-making.

## MATERIALS AND METHODS

### Study design

This cross-sectional study, which involved 100 participants from both public and private laboratories, looked at the knowledge, attitudes, and practices of medical laboratory specialists at healthcare facilities employing Internal Quality Control (IQC) for clinical laboratory testing. All medical laboratory specialist who worked for the selected healthcare institution in Kassala City, Kassala State, Sudan, during the study period were included in the laboratories that determined the study's sample size.

### Analysis of data and collection

Questions with a scientific purpose were used to gather data. The data was entered, cleaned, and analyzed using SPSS 22 software. Descriptive statistics were computed for most of the study variables. The data were displayed using frequency distribution tables.

### Ethical clearance

The following people were granted ethical clearance since the research complied with the ethical consideration standards:

- The University of Gezira has granted both technical and ethical permission.

- The General Administration of Laboratories and Blood Bank, Kassala State has granted ethical approval.
- The study followed ethical standards: Informed consent was obtained, confidentiality was protected through secure data handling, and potential bias from the author's dual affiliations was disclosed. No financial compensation was provided to participants, whose voluntary involvement is acknowledged.

## RESULTS

The purpose of this study was to gather data on medical laboratory personnel' knowledge, attitudes, and behaviors about IQC in Kassala city, Kassala state, Sudan. One hundred people from government and private laboratories in Kassala city, Kassala state, Sudan, participated in the study. Respondents' sociodemographic findings by gender showed that 76% of study participants were men and 24% were women, with 48% of participants being in the 20–30 age group, 32% being in the 31–40 age group, 12% being in the 41–50 age group, and 8% being over the 51–60 age groups. According to the highest education level 8% had diploma, 44% with bachelor, 40% with master's degree and 8% with Doctorate. The study shows that 52% were laboratory technicians, 32% laboratory manager, 4% Quality assurance officer, 4% research scientist and 8% other, general Staff with experience less than one year 16%, 1 to 3 years 36%,4-7 years was 24% and 8-10 years was 24% (Table 1).

The fact that (52%) of the participants have not received training on IQC methods. The majority of respondents (60%) claimed that there were no IQC protocols in place at their place of employment, while only (40%) reported they had one. Most respondents (64%) accurately said that the main goal of IQC is to keep an eye on the dependability of test results. Nonetheless, a sizable percentage (32%) was unclear, and (4%) believed it served a different purpose (e.g., to protect patient privacy). The majority (88%) accurately identified that ensuring the correctness of laboratory results is the main goal of IQC. There is potential for improvement in comprehension of the significance of IQC in laboratory settings, nevertheless, as indicated by the (12%) who were ignorant of this basic goal. IQC should be carried out every day, according to more than half (56%) of respondents. There is variation in perceptions of the optimal frequency of IQC measurements, though, since (44%) believe it can be carried out less regularly (weekly, monthly, or only when problems develop). The majority (92%) agreed that personnel competency and training have a significant impact on IQC's efficacy. It's possible that the (8%) who think that no factors influence IQC are unaware of how difficult it is to uphold laboratory quality standards (Table 2).

A substantial majority of participants (80%) strongly agreed that IQC is necessary to achieve trustworthy laboratory results, with all participants (100%) holding this view. The vast majority (88%) believe that IQC is crucial for patient safety, and the remaining (12%) share this opinion. Most respondents (88%) believe that the time spent on IQC procedures is required and warranted, demonstrating an understanding of its significance in upholding high standards of quality. Nevertheless, (12%) believe that these processes can occasionally be overly time-consuming. A sizable majority (88%) accurately state that assuring the correctness of laboratory results is the main goal of IQC. The fact that (12%) of employees are ignorant of this goal. The responses reveal differing opinions on how effective the present IQC procedures are, a sizable percentage (28%) are neutral, and (8%) believe they are ineffective, despite (64%) (which combines the terms "very effective" and "somewhat effective") having a good opinion of their efficacy. Every participant (100%) showed a great desire to improve their knowledge and abilities by expressing support for more training on IQC procedures (Table 3).

In order to guarantee consistent quality in laboratory tests, just (32%) of responders engage in IQC procedures daily. Nonetheless, noteworthy 40% of respondents either infrequently or never engage in IQC activities. When a QC error occurs, most staff (60%) choose to re-do the test, which is a typical first reaction. Standard operating procedures (SOPs), a more thorough method of handling QC issues, are followed by another (32%). Nonetheless, a tiny percentage either disregard minor mistakes (4%), or report them to a supervisor (4%). Noteworthy (48%) of the respondents are unfamiliar with the procedures for recording IQC results, compared to slightly more than half (52%) who are. Of the responders, just (40%) calibrate and repair their equipment on a regular basis, and (44%) do so only infrequently. The remaining sixteen percent don't engage in any of these activities. Over half (52%) of respondents rarely or never review IQC results with colleagues, despite (32%) doing so frequently (Table 4).

## DISCUSSION

As with internal quality control, laboratory quality control is essential to patient care because it helps prevent missed diagnoses and incorrect prescription medicine selections (7). It is generally known that having enough knowledge, attitudes, and practices across the IQC scope increases employee satisfaction and ensures the dependability of results (8). According to the current study, 52% of respondents were not aware of the methods for documenting IQC results, and only 48% of respondents had formal training in IQC procedures. This reveals a significant knowledge gap among lab staff, which could affect test results' precision and consistency (9). Errors in test data and decreased diagnosis accuracy were associated with this knowledge deficit (10). To close this knowledge gap, the study underlined the necessity of better training and ongoing professional growth. The need for better training and ongoing professional development in laboratories, particularly around Internal Quality Control (IQC), is widely acknowledged in the scientific community. The absence of structured IQC training has been identified as a key issue affecting the accuracy and reliability of laboratory results. This gap is particularly critical in resource-limited settings, where access to formal training programs is often restricted (11). In many situations, the lack of formal IQC training is a recurring issue. This implies that in order to provide laboratory personnel with the skills and knowledge necessary to ensure the accuracy of laboratory results, better education and capacity-building initiatives are needed globally. Time restrictions and a lack of resources were blamed for this disparity (12). Positive attitudes and the actual application of quality control procedures differ significantly, even though the significance of IQC is widely acknowledged. The data reveals a strong positive attitude toward the importance of IQC in ensuring reliable lab results and patient safety. There is room for improvement in current protocols, as a significant portion of respondents are either neutral or dissatisfied with their effectiveness. The unanimous desire for further training suggests an openness to continuous improvement in IQC practices. This implies that even when there is a high level of awareness, obstacles such a lack of time, finances, or training may prevent regular practice (13). According to the results of IQC Practices, just 32% of respondents participate in IQC activities every day, while 40% do so infrequently or never. Furthermore, a critical component of quality control regularly calibrating and maintaining laboratory equipment was only performed by 40%, regular calibration and preventive maintenance of laboratory equipment are crucial for ensuring accurate test results and maintaining high-quality laboratory standards (14). Patient outcomes were impacted by the frequent inaccuracies in test findings caused by this

irregular procedure (15). Addressing these gaps requires a focus on strengthening infrastructure, implementing standard protocols, and ensuring regular equipment maintenance. The study found that 48% of respondents were unfamiliar with documentation protocols and 52% rarely reviewed IQC results with colleagues, which could lead to missed opportunities for quality improvement and this lack of documentation was associated with a higher prevalence of diagnostic errors (16). The study underlined the necessity of regular audits and talks as part of a cooperative approach to quality improvement. The problem of insufficient documentation and peer review is not specific to the context of the current study. It is a pervasive issue that has an impact on the general standard of laboratory services. Laboratory quality assurance can be significantly improved by encouraging collaborative reviews and improving documentation procedures (17).

## CONCLUSION

The study identifies important gaps in laboratory staff members' knowledge, attitudes, and practice around Internal Quality Control (IQC), which might affect test result accuracy and, eventually, patient care. These shortcomings were determined to be largely caused by inadequate knowledge of IQC methods and a lack of formal training. Furthermore, even though IQC is widely recognized to be important, documentation and practical application procedures are frequently uneven, which results in lost chances for ongoing quality improvement.

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**Table (1): Sociodemographic traits of medical laboratory employees employed by specific governmental and private laboratories:**

| Sociodemographic Data | Range | Frequency | Percent |
|---|---|---|---|
| **Gender** | Male | 76 | **76.0** |
| | Female | 24 | **24.0** |
| **Age** | 20 - 30Years | 48 | **48.0** |
| | 31 - 40Years | 32 | **32.0** |
| | 41 - 50Years | 12 | **12.0** |
| | 51 - 60Years | 8 | **8.0** |
| **Highest Educational Qualification** | Diploma | 8 | **8.0** |
| | Bachelor Degree | 44 | **44.0** |
| | Master Degree | 40 | **40.0** |
| | Doctorate/PhD | 8 | **8.0** |
| **Role in Laboratory** | Laboratory Technician | 52 | **52.0** |
| | Laboratory Manager | 32 | **32.0** |
| | Quality Assurance Officer | 4 | **4.0** |
| | Research Scientist | 4 | **4.0** |
| | Other | 8 | **8.0** |
| **Years of Experience in Laboratory Work** | Less than 1Year | 16 | **16.0** |
| | 1 - 3Years | 36 | **36.0** |
| | 4 - 7Years | 24 | **24.0** |
| | 8 - 10Years | 24 | **24.0** |
| | Total | 100 | **100.0** |

**Table (2): Knowledge of medical laboratory personnel on Internal Quality Control:**

| Knowledge | Range | Frequency | Percent |
|---|---|---|---|
| Have you received training in Internal Quality Control procedures? | Yes | 48 | 48.0 |
| | No | 52 | 52.0 |
| Is there a protocol for IQC in you work area? | Yes | 40 | 40.0 |
| | No | 60 | 60.0 |
| Which of the following best describes IQC in a laboratory setting? | It monitors the reliability of test results | 64 | 64.0 |
| | It ensures patient confidentiality | 4 | 4.0 |
| | I am not sure | 32 | 32.0 |
| What is the primary purpose of IQC? | To ensure accuracy of laboratory results | 88 | 88.0 |
| | I don't know | 12 | 12.0 |
| How frequently should IQC be performed in the lab? | Daily | 56 | 56.0 |
| | Weekly | 20 | 20.0 |
| | Monthly | 20 | 20.0 |
| | When there is an issue | 4 | 4.0 |
| Which of the following factors can affect the effectiveness of IQC? | Staff training and competence | 92 | 92.0 |
| | None of the above | 8 | 8.0 |
| | Total | 100 | 100.0 |

**Table (3): Attitude of medical laboratory personnel on Internal Quality Control:**

| | | Frequency | Percent |
|---|---|---|---|
| Do you believe that IQC is essential for reliable laboratory results? | Strongly Agree | 80 | 80.0 |
| | Agree | 20 | 20.0 |
| How do you view the role of IQC in patient safety? | Extremely Important | 88 | 88.0 |
| | Important | 12 | 12.0 |
| What is your opinion on the time spent on IQC procedures? | Necessary and well-justified | 88 | 88.0 |
| | Sometimes too long | 12 | 12.0 |
| What is the primary purpose of IQC? | To ensure accuracy of laboratory results | 88 | 88.0 |
| | I don't know | 12 | 12.0 |
| | Yes, very effective | 32 | 32.0 |

| | | | |
|---|---|---|---|
| Do you feel that the current IQC protocols in your lab are effective? | Somewhat effective | 32 | 32.0 |
| | Neutral | 28 | 28.0 |
| | Not effective | 8 | 8.0 |
| Would you support additional training on IQC practices if available? | Yes | 100 | 100.0 |

**Table (4): Practice of medical laboratory personnel on Internal Quality Control:**

| | | Frequency | Percent |
|---|---|---|---|
| How often do you personally participate in IQC activities in your lab? | Daily | 32 | 32.0 |
| | Weekly | 20 | 20.0 |
| | Monthly | 8 | 8.0 |
| | Rarely/Never | 40 | 40.0 |
| When you encounter a QC error, what is your usual response? | Repeat the test | 60 | 60.0 |
| | Report to the supervisor | 4 | 4.0 |
| | Ignore if it seems minor | 4 | 4.0 |
| | Follow standard operating procedures (SOPs) | 32 | 32.0 |
| Are you familiar with the protocols for recording and documenting IQC results? | Yes | 52 | 52.0 |
| | No | 48 | 48.0 |
| | Total | 100 | 100.0 |
| Do you regularly calibrate and maintain equipment as part of IQC? | Yes | 40 | 40.0 |
| | No | 16 | 16.0 |
| | Occasionally | 44 | 44.0 |
| How often do you review IQC results with other lab personnel? | Daily | 32 | 32.0 |
| | Weekly | 12 | 12.0 |
| | Monthly | 4 | 4.0 |
| | Rarely/Never | 52 | 52.0 |
| | Total | 100 | 100.0 |