



A MINI-REVIEW OF CONVENTIONAL TECHNIQUES FOR THE ISOLATION OF DNA FROM BLOOD SAMPLES: A FORENSIC APPROACH

Forensic Science

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ABSTRACT

Forensic science is the best way of detecting crime reports which increases the responsibility of widespread appropriate domains (the law enforcement agency, advocates, law lords, inventors, investigators, administration ministries, and rule-makers). Generally, in sexual and psychological abuse crimes, women are largely affected. In forensic crime studies, the samples are collected from the exterior that includes handle doors, hair samples, footprints, etc, where blood is the major source of the crime report. These blood samples are either collected as dry or wet blood. Sequencing approaches for categorizing individuals that target the human DNA for application to forensic science and use in criminal investigations is in vogue. The purpose of this review is to focus on the scientific techniques for the isolation of DNA from blood samples which act as major evidence in sexual assault and other serious crimes.

KEYWORDS

Forensic, DNA isolation, biological evidence, Miller's method, PCR

INTRODUCTION

Forensic science and investigation play a major role in finding out the various crime reports. Forensics can even support law implementation establishments and the law lords in the resolution of lawbreaking by enabling the identification and apprehension of lawbreaking criminals. The use of forensic science encompasses a widespread collection of events extending from crime act signal gathering, emerging fact-finding strategies, creating investigative primes, complete dissimilar ranks of investigation, in which the different magnitudes of forensic science can extant several complications that influence its worth within the authorized system.¹ The frequent and recent examination by the magistrates was distinguishing in pleasing a wide-ranging concern to report the entire forensic science (i.e., from law breaking scene to law court) while undertaking the wide-ranging of applicable domains (the law enforcement agency, advocates, law lords, inventors, investigators, administration ministries and rule makers). Whereas the attention stood on England and Wales, central themes that arose out in an inquiry involved the non-existing of oversight, liability, and concern for forensic science². Forensic studies, involving mainly DNA examination, frequently encompasses inspiring examples produced by partial DNA degradation, the incidence of PCR inhibitors, low DNA quantities, blends of several contributors³. Most of the crimes are based on physical, sexual, and psychological abuse, nevertheless, women are predominantly affected⁴.

BLOOD SAMPLES AND DNA EXTRACTION

The extraction of biomolecules, DNA, RNA, and protein, is the utmost vital technique cast-off in molecular biology which is the initial point for downstream procedures and invention advances including diagnosis. Numerous procedures are available concerning DNA isolation from blood on enzymes and organic solvents for the high yield of DNA⁵. Friedrich Miescher in 1869, 1st isolated the DNA. He wished to resolve the essential philosophies of life, to regulate the biochemical composition of cells. He also tried to separate cells from lymph nodes⁶.

DNA is taken out from numerous biological models such as hair, blood, semen, saliva, skin cells, and several others and among them blood is versatile. Blood consumes as a fundamental part of biochemistry, hematology and clinical studies, and also forensic surveys⁵. The popularity of peripheral blood samples stands for white blood corpuscle, immunophenotyping, and diversity of microparticles⁷. Initially, Miescher observed the several categories of protein that brand up the leukocytes and showed that proteins are the chief mechanisms of the cell's cytoplasm. Throughout his assessments, Miescher observed that a material precipitated when acid was added and dissolved with alkaline. He was the first person to obtain the unpolished precipitate of DNA. He developed a new protocol to separate the cell nuclei from cytoplasm followed by DNA isolation. But this protocol was unsuccessful to harvest sufficient material for

future analysis. Again, he developed a second procedure to gain more measures of purified nuclein. This nuclein was further named 'nucleic acid' via his student, Richard Altman. The preliminary repetitive research laboratory procedures for DNA were developed from density gradient centrifugation. In 1958 Meselson and Stahl demonstrated the semi-conservative replication model of DNA by using this technique of Miescher. Later on, these procedures were solubles for chromosomal DNA, plasmid DNA, and other proteins. Meanwhile, Friedrich Miescher in 1869 successfully isolated DNA for the first time, and the preliminary DNA extraction settled from density gradient centrifugation approaches by Meselson and Stahl in 1958.

Sequencing methods for classifying individuals that target the human DNA which is been advanced for application to forensic science and use in criminal investigations. There are different types of the conventional method of isolating the DNA from blood. At present, many specialized procedures are undertaken for the extraction of DNA, RNA, or protein⁸. Phenol-chloroform method is the one of most common methods that include the interruption and lysis of the dye material, breakdown of cell machinery, and exclusion of impurities by organic solvents, where the DNA is recovered by alcohol and saline precipitation and succeeding rehydration. Instead of alcohol precipitating another procedure involves the purification of extracted DNA by the column-based method⁹. Another protocol to obtain the DNA from the blood by Miller's method⁹.

Commonly the blood is collected in either the EDTA or heparinized tube followed by DNA isolation. Other than these two procedures also, there are several protocols used in plasmid DNA isolation. In the case of forensic crime studies, the samples are collected from surfaces including handle doors, hair samples, footprints, etc¹⁰. The forensic samples are collected as dry and wet blood samples. Samples are collected as liquid blood. They are usually collected from blood ponds, from cloth, as well as gauze pad or sterile cotton cloth and also as dried blood originate on small substances, larger substances or on an article of clothing which has been accurately wrapped and labeled.

Nowadays research scientists estimate dried blood spots (DBS). These DBS samples are prepared with 80 µl of blood on Whatman filter paper or filter paper card which is left overnight, stored, and sealed in plastic bags at room temperature which lasts for 24 days¹¹. Similar procedures to detach DNA from DBS is the Chelex-100 method, TE buffer method, Methanol extraction method, and Phenol-Chloroform method. Chelex 100 is a chelating gum that has a high affinity for polyvalent metal ions like Mg 2+ which is technologically advanced for extraction of DNA from forensic samples. Here, the protocol is simple, quick, and no organic solvents are involved. On the other hand, methyl alcohol is comparatively inexpensive, and heaps of compounds melt in it, comparatively freely when likened to ethanol, without difficulty. Hence, methanol is used¹². Currently automating the nucleic

acid withdrawal procedure is possibly useful for several reasons counting to decrease working time, reduction of labor costs, increase worker protection in addition to that it provides a chance in growing reproducibility and quality of results⁶.

DISCUSSION

Influence Of Forensic Science

A calculating program must be well-known under a suitable governing figure to monitor and account for the influence and efficiency of forensic science in the legal system which will further ensure challenges and issues that are identified and resolved¹.

Forensic Science Education

To progress current grade programs into universally satisfactory standards, an authorization classical led by a forensic society (such as the FSSGH) or specialists should be adopted. The prospectus for this grading program must participate in close partnership and communication with consultants¹.

CONCLUSION

The capacity to gather and extract DNA from trace material or tiny fragments and produce statistics via sequencing skill has across-the-board applications for forensic use. The emphasis is on that moment to aim that what should be standardized to ensure reproducibility, sensitivity, and, eventually, accuracy. It is also reported that earlier studies using high-throughput sequencing highly influence the study design and marker gene choice, which is considered as an important significant impression for forensic use. A mounting field of investigation is fixated on performing human identification without using human DNA¹³, manipulating the microbial cross left behind by individuals in their environment.

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