Research Article

Knowledge, attitude, and awareness of DNA fingerprinting among college students

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ABSTRACT

Background: In recent years, a study of human genetics has grown exponentially. With this scientific field and its accompanying techniques, a scientist has been able to determine the difference between individuals using DNA fingerprints. British Geneticist, Dr. Alec Jeffrey developed a powerful tool for use in forensic science popularly known as DNA fingerprinting. DNA fingerprinting can be used to establish the identity of unidentified decomposed human remains. DNA fingerprinting can also be used to determine relatedness among humans, relatedness among ancient population, studying about breeding in endangered species, thereby aiding in breeding programs in zoological parks, etc. **Aim:** this study aims to evaluate the knowledge, attitude, and awareness of DNA fingerprinting among college students. **Materials and Methods:** A cross-sectional survey by means of a self-administered questionnaire was conducted. Questionnaire was distributed to 100 students of Saveetha Dental College and Hospitals. Questionnaire consisted of three parts which are used to characterize pediatricians knowledge (seven questions), awareness (seven questions), and attitude toward DNA fingerprinting and its applications (three questions), etc. **Results:** The results were reported by summarizing responses of the respondents to each of the 17 questions in the questionnaire. Among the respondents, 46% of them were female respondents and 54% of them were male respondents. The response toward knowledge of the development of DNA fingerprinting, 46.2% quoted for Alec Jeffrey, 15.4% of the respondents quoted for James Grick, 19% of the respondents quoted for Khorana, and 19.2% of the respondents quoted for James Watson. Results for agreement toward mini-satellites is short non-coding repetitive sequence present throughout the chromosomes, 54% of the respondents do not agree with the statement and remaining of the respondents (46%) agreed with the statement while response toward the statement that DNA technique used to demonstrate the similarity between different animal species with reference to some specific protein coding in DNA sequence, majority of the respondent, 30.8% of them quoted for phyto blot, 38.5% quoted for garden blot, and 7.7% for plant profiling. **Conclusion:** Based on the results of this study, it may be concluded that there is a lack of proper awareness and knowledge of DNA fingerprinting techniques and its applications among dental students. Students should be well informed about its applications in various genetic fields by conducting some educational programs. To accomplish this objective, DNA fingerprinting topics in the medical curriculum and dental curriculum so that physician and dentist can impart their greater role. Regular education programs can be conducted. Articles in the medical journals DNA fingerprinting and applications can be published. Many workshops can be conducted.

KEY WORDS: Awareness, DNA fingerprinting, Enzymatic amplification, Respondents, Students

INTRODUCTION

In recent years, a study of human genetics has grown exponentially. With this scientific field and its accompanying techniques, a scientist has been able to determine difference between individuals using DNA fingerprints. British Geneticist, Dr. Alec Jeffrey developed a powerful tool for use in forensic science popularly known as DNA fingerprinting.[1] DNA fingerprinting is described as the determination of bonds on the part of DNA strand with chromosomes, which is genetically determined and capable of being related to other men bear of the same family. In terms of statistical terms, specificity of DNA fingerprinting is greater than blood groups.[2] Dr. Jeffrey created the ability to perform human identity tests by developing a technique to examine the length variation of these DNA repeat sequences. In forensic setting, the first use of DNA fingerprinting was done in 1986. In living organisms, DNA is a linear, double-stranded molecule, with the two strands hydrogen-bonded together and twisted to form a double helix found in the nucleus

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1) DNA FINGERPRINTING was developed by
   a) Francis Grick
   b) Khorana
   c) Alec Jeffrey
   d) James Watson
2) The technique to distinguish the individual based on their DNA fingerprint patterns is called
   a) DNA fingerprinting
   b) DNA profiling
   c) Molecular fingerprinting
   d) All of these
3) DNA fingerprinting relies on
   a) Difference in patterns of genes between individuals
   b) Difference in order of genes between individuals
   c) Difference in junk DNA patterns between individuals
   d) All of these
4) Mini satellites are short Non coding repetitive sequences present thoroughout the chromosomes. True/False
5) Each individual has unique DNA fingerprinting as individuals differ in
   a) No of mini satellites on chromosomes
   b) Location of mini satellites on chromosomes
   c) Size of mini satellites on chromosomes
   d) All of these
6) Correct procedure in DNA fingerprinting
   a) DNA isolation - PCR amplification- Electrophoresis- Southern blotting – auto radiography-analysis of DNA print pattern.
   b) DNA isolation - restriction digestion - PCR amplification- Electrophoresis- Southern blotting – auto radiography-analysis of DNA print pattern.
   c) DNA isolation - PCR amplification- restriction digestion - Electrophoresis- Southern blotting – auto radiography-analysis of DNA print pattern.
   d) DNA isolation - restriction digestion - PCR amplification- Southern blotting –electrophoresis -auto radiography-analysis of DNA print pattern.
7) DNA profiling is used
   a) In Forensic studies and in cases of disputed parentage
   b) In pedigree analysis and to study migration pattern
   c) To confirm cell line identity
   d) All of these
8) DNA profiling technique to demonstrate the similarity between different animal species with reference to some specific protein coding DNA sequence is called
   a) Zoo blot
   b) Phylogenetic blot
   c) Animal profiling
   d) Animal blot
9) DNA profiling technique to demonstrate the similarity between different animal species with reference to some specific protein coding DNA sequence is called
   a) Phytoblot
   b) Garden blot
   c) Plant profiling
   d) All of these
10) Which tissue sample is used for DNA fingerprinting
   a) Hair
   b) Skin
   c) Blood
   d) Any of the above
11) DNA fingerprinting can be done on any body secretions
   a) True b) False
12) VNTR refers to Variable Numbers of Tandem Repeats
   a) True b) False
13) RFLP refers to Restriction Fragment Length Polymorphisms
   a) True b) False

Figure 1: Questionnaire

of the cell. DNA chromosomes contain associated proteins called histones that organize DNA in its native configuration. Genes are located in specific regions of chromosomes called genetic loci.[3] Genetic polymorphism is the variation of different alleles on a single genetic locus. A population may have multiple allies at a given locus and this genetic polymorphism is the molecular basis of DNA sequencing.[4] Although over 99% of the DNA sequences in the human genome are identical between individuals, a small number of sequence differences are used to distinguish all humans. Those different sequences are usually targeted for identity testing. The techniques that are applied in identity testing are DNA fingerprinting, DNA profiling, and DNA typing.[5] Although there are some technical differences between these tests, the terms have been used interchangeably. Biological fluid such as blood, semen, vaginal fluids, hair roots, skin, and stains serves as sources of DNA extract.[6] Methods of DNA fingerprinting include restriction fragment length polymorphism (RFLP) and polymerase chain reaction (PCR). Basis of RFLP is that the three-dimensional structure of restriction enzymes allows them to attach themselves to a double-stranded DNA molecule and slide along the helix until they recognize a specific sequence of base pairs which signal the enzymes to stop gliding.[7] On the other hand, PCR is an enzymatic amplification of small fragments of DNA segments. DNA polymerase enzymes use the single-stranded DNA as template for the synthesis of a new complementary strand and also require a small section of double-stranded DNA to initiate this synthesis.[8] To the best of our knowledge, only few studies have reported to evaluate knowledge, attitude, and awareness of DNA fingerprinting among college students. Hence, in this study, we made an attempt to determine the knowledge of DNA fingerprinting, its technique, application in various fields of genetics among college students, and also their attitude and willingness to attend DNA fingerprinting raining and workshop.

MATERIALS AND METHODS

A cross-sectional survey by means of a self-administered questionnaire was conducted. Questionnaire was distributed to around 100 students of Saveetha Dental College and Hospitals. Questionnaire consisted of three parts which are used to characterize dental students' knowledge (five questions), attitudes (five questions), practices (five questions), and barriers related to DNA fingerprinting techniques, sampling methods, application in various fields (two questions), etc. The questionnaire of this survey study was framed based on the previous validated surveys. Sociodemographics included the respondents' age, gender, and year of study. Questionnaire converted topics on mini-satellites in DNA fingerprinting, RFLP, pedigree analysis, variable number of tandem repeats (VNTR), etc. Filled questionnaire was collected and analyzed. The data were entered into Microsoft Excel, and descriptive analysis was done. The result was represented in charts.

RESULTS

The results were reported by summarizing responses of the respondents to each of the 17 questions in the questionnaire [Figure 1]. Among the respondents, 46% of them were female respondents and 54% of them were male respondents [Figure 2]. Figure 3 shows response toward knowledge on the development of DNA fingerprinting, 46.2% quoted for Alec Jeffrey, 15.4% of the respondents quoted for James Grick, 19% of the respondents quoted for Khorana, and 19.2% of the respondents quoted for James Watson. Figure 4 shows that agreement toward mini-satellites is short non-coding repetitive sequence presents throughout the chromosomes, 54% of the respondents do not agree with the statement and remaining of the respondents (46%) agreed with the statement. Figure 5 shows response toward the statement that DNA technique used to demonstrate the similarity between different animal species with reference to some specific protein coding in DNA sequence, majority of the respondent, 30.8% of them quoted for phyto blot,

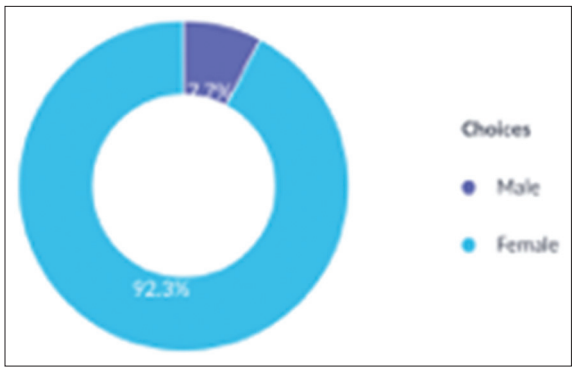

Figure 2: Number of respondents

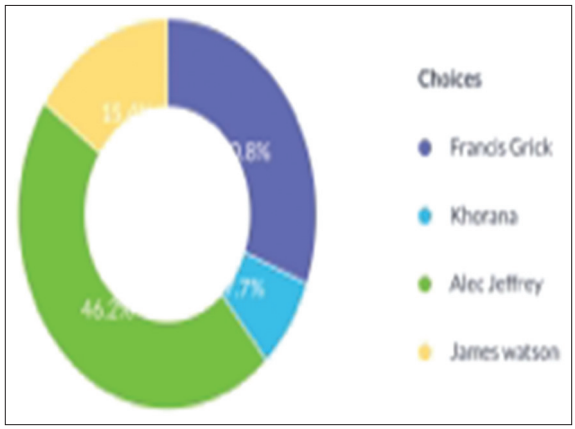

Figure 3: Response towards knowledge of DNA finger print

38.5% quoted for garden blot, 7.7% quoted for plant profiling, and remaining of the respondents (23.1%) quoted for all the options. Figure 6 shows response toward tissue sample used for DNA fingerprinting, 25% quoted for hair, 33.3% quoted for skin, 33.3% quoted for none of the above, and 8.3% quoted for blood. Figure 7 shows response toward agreement toward the statement that DNA fingerprinting can be done on any body secretions, 54% of the respondents agreed with the statement and 46% of the respondents do not agree with statement. Figure 8 shows response toward agreement with the statement that VNTR refers to variable number of tandem repeats, 84.6% of the respondents agreed with the statement and 15.4% of the respondents do not agree with the statement. Figure 9 shows response toward agreement with the statement that main role of PCR in DNA fingerprinting is amplification of target area using primer, 92.3% of the respondents agreed with the statement, and 7.7% does not agreed with statement.

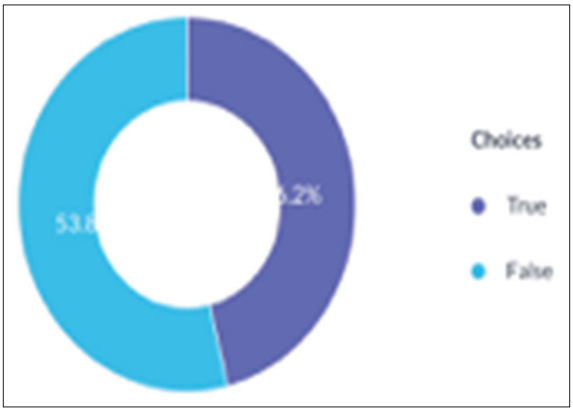

Figure 4: Response towards role of mini satellite in DNA finger print

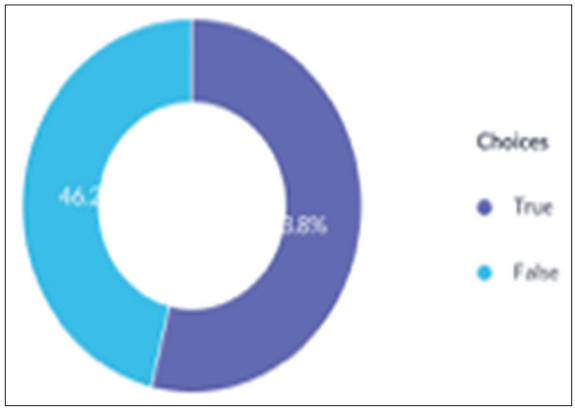

Figure 7: Response towards commonly used samples for DNA finger print

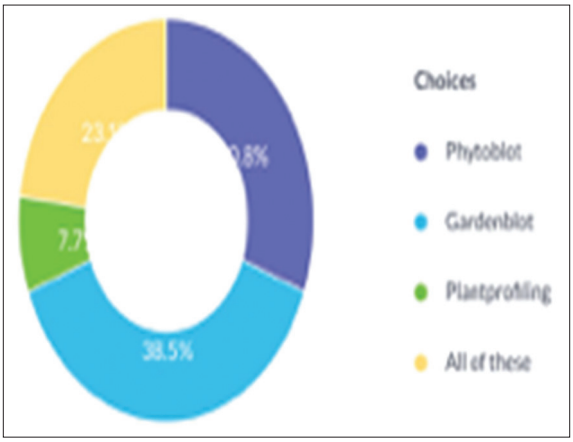

Figure 5: Agreement towards Various applications of DNA finger

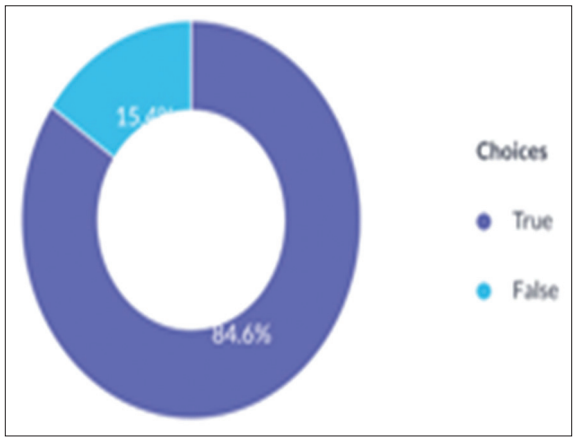

Figure 8: Role of VTRN in DNA finger print

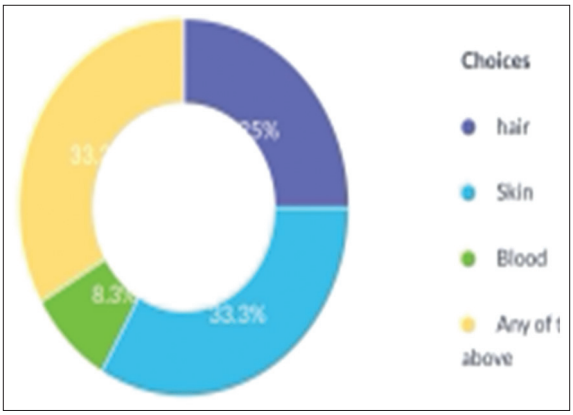

Figure 6: Response towards choice of DNA finger

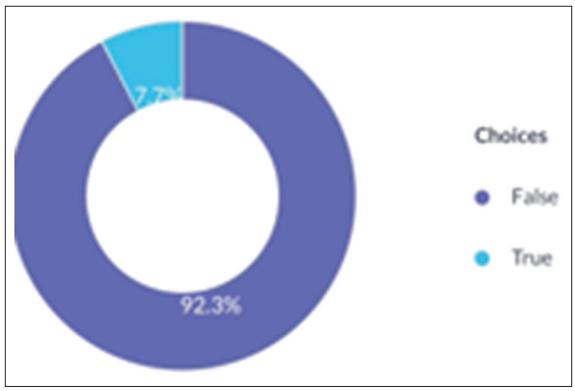

Figure 9: Role of DNA finger in cadaver

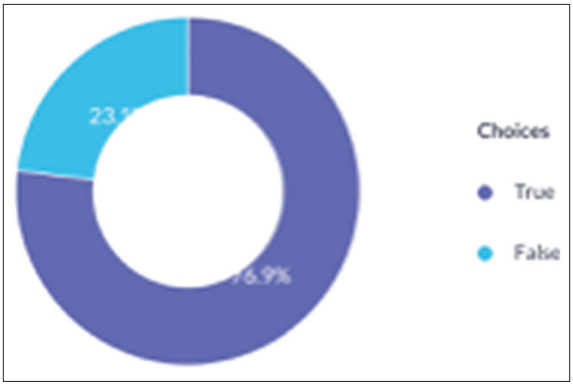

Figure 10: Agreement towards DNA finger print in forensic

Figure 9 shows response toward the statement that DNA fingerprinting not identify a person after his death, 76.9% agreed with the statement, and the remaining of the respondents (23.1%) does not agreed with the statement. Among the applications of DNA fingerprinting, majority of the respondents (64%) quoted that determining relatedness among humans is the most awarded application [Figure 10].

DISCUSSION

The use of DNA fingerprinting ranging from paternity testing, genetic testing, DNA ancestry services, or DNA genealogy has proven to be greatest assets in the history of science and a boon to forensic science. Therefore, knowing about DNA fingerprinting techniques, sampling methods and its application are of utmost importance among the students. In a study by Jefferey *et al*., it was reported that mini-satellites are regions of genome with non-coding, tandemly repeated sequences of about 100 bp. The number of mini-satellite in human genome has been estimated to be 1500/haploid genome. However, in this study, most of respondents do not support the statement that mini-satellites are short non-coding repetitive sequences present throughout the chromosomes. This indicates lack of knowledge of mini-satellites in DNA fingerprinting.[9] Furthermore, these mini-satellites contain loci that exhibit extreme polymorphism due to variation in the number of repeats called VNTR.[10] In this study, most of the respondents preferred skin as good source to yield optimal quantity of DNA for analysis.[11] According to Gill *et al*., hair roots with associated cellular material can be good sources of high-molecular-weight (HMW) DNA for RFLP analysis.[12] PCR techniques have been successful in typing single human hairs. Similarly, Higuchi *et al*. reported that amplification of DNA from hair of chimpanzees has permitted identification of subspecies using allele-specific probes.[13] In another study reported by Vigilant *et al*., mitochondrial DNA amplification of DNA from single hair roots has been used in human population genetic analysis.[14] The high copy number of mitochondrial DNA even permits mtDNA amplification from hair shafts that have no associated cellular material.[15] In a study by Bar *et al*., it was reported that within a tissue type, there was an overall inverse relationship between DNA recovery and time since death, with degradation accelerated by increased temperature. The yield from the blood was good, this is attributed to the presence of clot that contains good quality DNA.[16] Healy found liver, spleen, cardiac muscle, and skeletal muscle to be poor sources of HMW DNA, diaphragm, lung and testes to be better, and skin, bone marrow, and bloodstains to be the best sources.[17] Haglund *et al*. reported that brain tissue seems to be one of the best sources of DNA, followed by muscle and blood, and then other internal organs. Liver is consistently a poor source of postmortem DNA. In this study, majority of the respondents agreed that DNA fingerprinting can be done on any body secretions.[18] This statement is supported in a study by Martin *et al*., in which it was reported that DNA typing can be done on any biological evidence. Enzymatic amplification of small segments of DNA is done by PCR technique.[19] This PCR technique is based on the principle of DNA replication. The starting point of DNA is specified by supplying an oligonucleotide primer that anneals to the template at a particular point. RFLP is a restriction enzyme that attaches to DNA molecules and slide along the helix until they recognize specific sequence of base pair which signals the enzyme to stop gliding. Holand *et al*. reported that DNA fingerprinting can be used to establish the identity of unidentified decomposed human remains. DNA fingerprinting can also be used to determine relatedness among humans, relatedness among ancient population, studying about breeding in endangered species, thereby aiding in breeding programs in zoological parks, etc.[20]

CONCLUSION

Based on the results of this study, it may be concluded that there is a lack of proper awareness and knowledge of DNA fingerprinting techniques and its applications among dental students. Students should be well informed about its applications in various genetic fields by conducting some educational programs. To accomplish this objective, DNA fingerprinting topics in the medical curriculum and dental curriculum so that physician and dentist can impart their greater role. Regular education programs can be conducted. Articles in the medical journals DNA fingerprinting and applications can be published. Many workshops can be conducted.

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