

Case Report

DNA Identification of Human Remains in Disaster Victim Identification (DVI): An Identification of Burned Girls Students in Tanzania

Fidelis Charles Bugoye*, Elias Zakaria Mulima*, David Luhende Elias, Fidelis Saimon Segumba, Leticia Nchagwa Waitara

Directorate of Forensic Science and DNA Services, Government Chemist Laboratory Authority, Dar es Salaam, Tanzania

Email address:

fidelis.bugoye@gcla.go.tz (F. C. Bugoye), bugoye81@yahoo.co.uk (F. C. Bugoye), elias.mulima@gcla.go.tz (E. Z. Mulima), eliamlima@yahoo.com (E. Z. Mulima)

*Corresponding author

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Abstract: The Government Chemist Laboratory Authority (GCLA) in Tanzania is the only institution offering DNA testing in solving various human identification challenges using Human DNA technology. Globally, forensic DNA typing has undeniably been a useful tool employed in cases such as criminal investigation, missing persons and parentage testing. In Tanzania, the indispensable need for Human DNA technology in human identification was greatly emphasized in August 2009 following the inferno at Idodi secondary school in Iringa region whereby the fire burnt and razed a girl's dormitory to the ground killing twelve girls student while leaving twenty students severely wounded. The cause of the fire was later determined to have been due to a lit candle by a student aiming to study late into the night even after the power generator had been switched off. DNA typing of 15 autosomal Short Tandem Repeat markers using ABI 3100 Genetic Analyser was performed on samples collected from the recovered deceased bodies and their relatives. Successful human identification was achieved for all twelve recovered bodies and their reunification with their respective families. Therefore, the Idodi gruesome incident marked both an icon in scientific approach towards the utilization of DNA technology for disaster victim identification and usefulness of experts' collaborations from different disciplines in mass fatalities and human identification in Tanzania.

Keywords: DNA, DVI, Forensic, Idodi, STRs, GCLA, Tanzania

1. Introduction

DNA typing analysis is integral to missing person and disaster victims identification cases [1-2]. It's an important tool for supporting legal procedures, administration and humanitarian reasons [2]. This paper describes the response and contribution of Government Chemist Laboratory Authority (GCLA) in Disaster victim identification using DNA technology in Tanzania with particular reference to GCLA's - Forensic DNA Laboratory's contribution to Disaster Victim Identification for the August 2009 fire accident at Idodi Secondary School in Iringa whereby 12 girls students

lost their lives while 20 were severely injured. Although Tanzania had experienced several mass disasters in the past, the Idodi fire accident marked the first known attempt where DNA technology in disaster victim Identification. The authors recognize the identification of the 12 students of Idodi fire accident accelerated various strategic mechanisms for resource mobilisation, investments and effective provisions and utilization of Human DNA services in Tanzania. Therefore, since enactment of the Human DNA Regulation Act, No. 8 of 2009 increased the numbers of unknown victims of mass fatalities identified using DNA typing analysis as per HDNA regulation Act, section 25 (2d).

In August 2009, a girl's dormitory of Idodi Secondary

School which housed 460 students with single exit door was completely burnt down. Following scientific investigations carried out by fire and rescue responders, it was then realized the fire had been initiated by candle light which was used by a student who had decided to study late into the night even after the school's generator had been switched off. Unfortunately, the girl fell asleep leaving the lit candle unattended which resulted in the unstoppable chain of events of the mosquito net catching fire that spread on to the bed sheets, mattress and eventually the entire dormitory. Fortunately, even though the dormitory was completely burnt 428 of the 460 students managed to escape while 20 were severely injured and 12 students sadly lost their lives. After the fire was extinguished twelve completely charred bodies were recovered, along with some body parts detached.

The bodies and other remains were taken by an ambulance to Iringa Regional Hospital purposely for forensic investigation and identification procedures which involved a team pathologists and DNA experts who jointly worked as a team while adhering to the country's disaster victim identification procedures. The recovered bodies were severely burnt and could not be recognized by physical features, for that reason, highly polymorphic short tandem repeat (STR) loci or microsatellites were used for identification because of their high power of discrimination and ease of analysis [3] in matching of the body parts [2]. Since there was no reference DNA profiles or an established Human DNA Database for comparison, relatives of the victims [1] were contacted, consented and DNA samples were collected [2] as per section 25 (2d) of HDNA Regulation Act, 2009. Reference samples obtained were either the victims' mother, father brothers or sisters. Successful DNA profiles generated used 15 Autosomal STRs Loci of Identifier Amplification Kits (AB). The Autosomal STRs DNA typing analysis made possible comparison to establish the identity of all the body remains found at the burnt dormitory.

2. Material and Methods

2.1. Sample Collection

2.1.1. Victims Samples

Post-mortem examination of the twelve completely burned body remains were carried out at Iringa Regional Hospital and given identification number prior to DNA sample collection. DNA samples of 5g soft tissues were collected from deep muscles as surface muscle were charred and may have been contaminated through contact with DNA from other bodies [4]. Each collected DNA sample was sterile packed in respective dry and labelled envelopes before being transported [5] to GCLA forensic DNA laboratory in Dar Es Salaam for DNA analysis.

2.1.2 Relatives Samples

Buccal swab samples from parents and other relatives of each un-identified persons or unknown bodies were collected to obtain reference DNA profile for comparison however emphasis was but only father and mother collected reference

samples were submitted to GCLA forensic DNA laboratory for analysis [1].

2.2. DNA Extraction

DNA from the recovered samples of un-identified body remains were extracted using QiaAmp DNA Mini Kit [6] following manufacturer's instructions for tissue protocol. While buccal swab reference samples were extracted from parents and close relatives using Chelex DNA extraction protocol as reported elsewhere [7]

2.3. PCR Amplification

PCR amplification was performed using 1 - 3ng/ul of extracted genomic DNA according to the manufacturer's protocol for the AmpF/STR Identifier PCR kit using Gene Amp PCR System 9700 (Applied Biosystems). A total of 15 autosomal STRs which include CSF1PO, D13S317, D16S539, D18S51, D19S433, D21S11, D2S1338, D3S1358, D5S818, D7S820, D8S1179, FGA, TH01, TPOX and vWA and amelogenin, the sex-determining marker were typed [8]. The characteristics of 15 STRs loci used [11] are described in table 1 below.

Table 1. The characteristics of the 15 STR loci used.

Locus	Chromosome location	Repeat motif	Primer label
D8S1179	8q	TCTA	6-FAM
D21S11	21q11-21	TCTA	6-FAM
D7S820	7q11.21-22	GATA	6-FAM
CSF1PO	5q33.3-34	AGAT	6-FAM
D3S1358	3p	TCTA	VIC
TH01	11p15.5	AATG	VIC
D13S317	13q22-31	TATC	VIC
D16S539	16q24-qter	GATA	VIC
D2S1338	2q35-37.1	TGCC	VIC
D19S433	19q12-13.1	AAGG	NED
vWA	12p12-pter	TCTA	NED
TPOX	2p23-pter	AATG	NED
D18S51	18q21.3	AGAA	NED
D5S818	5q23.3-32	AGAT	PET
FGA	4q28	TTTC	PET

2.4. Capillary Electrophoresis

Capillary electrophoresis for fragment analysis was performed on ABI 3100 Genetic Analyser (AB). Fluorescently labelled DNA products were separated and detected using GeneScan Analysis Software version 3.1 and DNA data was analysed with Genotyper Analysis Software v 1.0 [10].

3. Results Evaluation

DNA profiling using STR makers was successfully carried out for all the twelve unidentified victims and relative samples. Using direct profile observation and comparisons [3], all body remains were identified using 15 autosomal STRs makers and established biological relationships with parents of unrecognisable students [8, 10]. The Probability of paternity of 99.99% were calculated to confirm all relationship as

presented in a table 2 below.

Table 2. Table representing sample ID's, their relationship and calculated Probability of paternity.

SN	Victim sample ID	SEX	Reference sample ID	SEX	Relationship with Victim
1	DV_1	Female	RS_16	Female	Mother
2	DV_2	Female	RS_8	Female	Mother
3	DV_3	Female	RS_11	Female	Mother
4	DV_4	Female	RS_9	Female	Mother
5	DV_5	Female	RS_1	Female	Mother
6	DV_6	Female	RS_4	Female	Mother
7	DV_7	Female	RS_10	Female	Mother
8	DV_8	Female	RS_22	Male	Father
9	DV_9	Female	RS_7	Female	Mother
10	DV_10	Female	RS_19	Female	Mother
11	DV_11	Female	RS_13	Male	Father
12	DV_12	Female	RS_3	Female	Mother

4. Discussion

Following a mass tragedy, in addition to rescue procedures and health related support to the survived victims, proper Identification of the dead and un known victims using coordinated approach initiated by experts from different Authorities is also imperative. It is not only necessary for emotional and humanitarian reasons but also for administrative and legal purposes [5, 7].

The coordinated collaboration of different experts from the earliest stages of post-mortem examinations and sample collection for DNA identification has proved to be the most effective approach which helps DNA experts to avoid sample mix-up and cross contamination which is one of the serious problem in disaster victim identification using DNA technology [2, 4]. In this case experts have learned and realized the contribution of forensic genetics and the essential teamwork of the victims' families allowed the identification of all recovered bodies that otherwise would not be easy to obtain relatives DNA reference samples necessary for accurate comparisons of the victim's recovered samples [2]. It should also be noted, in this reported Idodi case, there was no bodies identified using other materials such as photos, scars, and clothing as reported case in Bangladesh DNA identification [7], all other visual of recognition would have been useful in absence of DNA testing facilities in Tanzania. The achievement of DNA identification in the wounded incident of Idodi secondary schools in 2009 relieves the living family members and relatives of the victim from uncertainty, this facilitates the closure to the identification challenges [2] and resulted into dramatic increase in awareness, and utilization of human DNA typing analysis for parentage testing and forensic identification procedures in Tanzania.

Ethical Approval

This work and permission to publish have been approved by the Government Chemist Laboratory Authority (GCLA)-Tanzania.

Conflict of Interest

None.

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