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EDITORIAL

ChatGPT: To cite or not to cite?

Kasun Bandara Ekanayake

Soon after its first release by OpenAI in November 2022, the artificial intelligence (AI) chatbot ChatGPT (Generative Pre-trained Transformer) went viral, attracting millions of users all over the world within days¹. It was described as a trained model which can interact in a conversational way, answering follow-up questions, admitting its mistakes, challenging incorrect premises and rejecting inappropriate requests. However, the occasional generation of plausibly-sounding, but inaccurate or biased information and limited knowledge on events after 2021 were listed as its limitations².

All hell broke loose among the scientific community when ChatGPT was cited as authors in several publications, ranging from a chatbot's perspective on the use of Rapamycin in the context of Pascal's Wager, to use of AI in nursing education³⁻⁶. Several reputed publishers such as Science, Elsevier and Springer responded promptly; updating their editorial policies stating that the program cannot be listed as an author. One of their main arguments against the use of the chatbot was the fact that an author is accountable for their contribution to the work and ChatGPT is unable to do so. They further elaborated that AI tools can be used to improve the readability and language of the work, but not to replace key functions that are performed by the authors, and also, any use of such tools should be declared^{7,8}.

The International Committee of Medical Journal Editors (ICMJE) has, also, updated its authorship criteria in response to this problem at hand. When a manuscript is submitted to a journal, the authors should disclose whether they used any AI-assisted technologies when formulating the submitted

work. If such tools were used, the authors are required to indicate the extent they were used, in both the cover letter and the submitted work. However, AI-tools such as ChatGPT should not be listed as authors because they are not responsible for the accuracy, integrity, and originality of the work and the human authors are responsible for any AI-assisted work. ICMJE further instructs that the authors should review the work carefully as AI can generate authoritative-sounding output that can be incorrect, incomplete, or biased. Furthermore, AI-tools should not be listed as co-authors nor cited as an author in references⁹.

However there are ways that ChatGPT can contribute to the quality of scientific publications. Producing quality abstracts, providing structure and coherence to the content, improving language and writing style, and facilitating collaboration among multiple authors of different backgrounds and expertise, are some of the useful attributes of AI tools that would enhance the scholarly output of the academia¹⁰.

Although AI tools such as ChatGPT are unlikely to be cited as authors in scientific publications in the near future, one day this fluent but flaky⁷ chat box of a child could evolve into a sane adult speaker. That day might be closer than we think. For the time being, the Sri Lanka Journal of Forensic Medicine, Science & Law would follow the steps laid down by the giants in the publishing arena.

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RESEARCH ARTICLE

ANTHROPOMETRIC STUDY OF FACIAL AND NASAL INDICES OF THE AKAN ETHNIC POPULATION OF GHANA

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ABSTRACT

Introduction: Facial anthropometry is required in many medical and dental disciplines, particularly for prosthodontists, orthodontists, plastic surgeons, maxillofacial surgeons, and forensic medicine experts. An individual's facial shape is a reflection of their race, age, and gender. The present study aimed at determining the facial and nasal indices among the Akan ethnic group in Kumasi, Ghana.

Methodology: A total of 307 (182 males and 125 females) Akan adult volunteers between the age of 18 - 30 years were recruited for the study. Standard procedures were used to obtain the necessary facial and nasal measurements for generating the appropriate indices. A p-value of 0.05 or less was judged statistically significant.

Results: In males, the facial index ranged from 75.28 to 117.90, while in females it ranged from 76.58 to 97.87. The nasal index ranged from 52.0 to 115.3 in males and 52.0 to 105.7 in females. There were significant differences between males and females in all facial parameters utilized to calculate facial and nasal indices. The facial index, but not the nasal index, differed significantly between Akan males and females. Mesoprosopic was the most prevalent face type in both male and female Akan populations, whereas mesorrhine was the most common nose type.

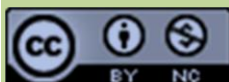
Conclusion: The findings of this study can be used as a reference to improve the outcome of cosmetic and reconstructive facial surgery and rhinoplasty, as well as for medico-legal purposes in the Akan people of Ghana.

Keywords: Akan; Anthropometry; Facial index; Ghana; Nasal index

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INTRODUCTION

Understanding and analyzing facial parameters is essential in a variety of medical and dental specialties, particularly for prosthodontists, orthodontists, plastic surgeons, and maxillofacial surgeons^{1,2}. Facial anthropometric data is also useful in the development of personal protective equipment and forensic medicine³. The dimensions of the face differ greatly between races due to genetic, environmental, dietary, and climatic influences¹⁻⁶. The majority of people desire to maintain their core ethnic characteristics while undergoing cosmetic enhancement. Because of this, applying Caucasian standards to other ethnic groups could lead to dissonant face proportions. Therefore,

facial anthropometry data must be established for each population^{1,4,6}.

We conducted this study utilizing facial anthropometric data to document and provide baseline data of facial and nasal indices since according to our knowledge no such study has been conducted among Akans in Kumasi, Ghana. The finding will benefit craniofacial surgeons given Ghana's booming cosmetic surgery market.

METHODOLOGY

This study was a cross-sectional study involving 307 persons with Akan ancestry up to the second generation Akans (182 males and 125 females). To reduce the possible effect of ageing on facial measurements, participants between 18 to 30 years of age were recruited. This study excluded pregnant women, those with craniofacial injuries, facial scars, visible tumours or oedema, and those who have had facial fractures or surgery.

All standard anthropometric measurements of the face were taken in the Frankfurt plane with participants sitting comfortably on a chair. A spreading calliper (GPM 107, North America) was used to measure the face, and a digital Shahe Vernier calliper (IP54 Shanghai, China) was used to measure the nose. It was ensured that the participants were neither smiling nor laughing when taking the measurements. After each subject, the callipers were cleaned with cotton wool and methylated spirit. The measurements were taken to the nearest 0.01 mm using the following landmarks⁷:

- **Nasion (n):** A depression at the root of the nose that overlies the junction of nasofrontal and internasal sutures.
- **Gnathion (gn):** The lowest point on the lower border of the mandible in the midline
- **Zygion (zy):** The most prominent point on the zygomatic arch
- **Subnasale (sn):** The midpoint of the angle at the columella base where the lower border of the nasal septum and the surface of the upper lip meet
- **Alare (al):** The most lateral point on each alar contour

The facial height (n-gn) was measured as the linear distance between the nasion to gnathion whereas the facial width (zy-zy) was measured as the linear distance between the right and left zygion. The facial index (FI) was calculated by dividing facial height and facial width and multiplying by 100. Table 1 shows the types of faces and their designated values of facial indices using Banister's classification. The nasal height (n-sn) was measured from the nasion to the subnasale whereas the nasal width (al-al) was measured as the maximum distance between the right and left alare. The nasal index (NI) was calculated by dividing nasal width and nasal height and multiplying by 100. The type of nose and their corresponding nasal indices according to the Martin and Saller classification are shown in Table 1.

Table 1: Classification of the human nose and face based on nasal and facial indices

Type of Nose	Nasal Index	Type of Face	Facial Index
Hyperleptorrhine	40.0 – 54.9	Hypereuryprosopic	≤ 79.9
Leptorrhine	55.0 – 69.9	Euryprosopic	80.0 – 84.9
Mesorrhine	70.0 – 84.9	Mesoprosopic	85.0 – 89.9
Platyrrhine	85.0 – 99.9	Leptoprosopic	90.0 – 94.9
Hyperplatyrrhine	≥ 100.0	Hyperleptoprosopic	≥ 95.0

The Committee for Human Research, Publication, and Ethics at the School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, approved the study with the approval number CHRPE/AP/397/21, following the Helsinki Declaration. Informed consent was obtained from all participants involved in the study.

Statistical analysis was done using IBM Statistical Package for Social Sciences software (SPSS 24.00 version, Inc. Chicago, IL, U.S.A). The data were presented as means and standard deviations. Data normality was checked using the one-sample Kolmogorov–Smirnov test and Shapiro–Wilk test. An independent samples t-test was used to compare the mean differences between the sexes. The level of statistical significance was determined at a p-value of less than 0.05.

RESULTS

The Kolmogorov-Smirnov test revealed that the data acquired in both groups were distributed normally. We observed excellent intraobserver repeatability with intraclass correlation coefficients (ICCs) ranging from 0.90 to 0.96 in all the measurements. Table 2 shows the descriptive statistics of the measurements of the nose and nasal indices. The nasal width of males was statistically significantly wider than females [$t(305) = 3.837$, 95%CI (0.83-2.57), $p < 0.001$]. The nasal height of males was similarly greater than females and this was statistically significant [$t(305) = 4.250$, 95%CI (0.86 - 2.35), $p < 0.001$].

The mean nasal index of males and females were 82.61 ± 11.80 and 81.53 ± 9.85 respectively. The difference was not statistically significant ($p = 0.400$). The mean difference between the facial width of males and females, 6.65, 95% CI [5.07 – 8.22] was statistically significant, $t(305) = 8.306$, $p < 0.001$. Also, there was a significant difference in facial height between males and females, $t(305) = 3.272$, $p < 0.001$. There was a significant difference in the mean facial index of males (89.89 ± 7.07) and females (86.99 ± 4.92), $t(305) = 3.972$, $p < 0.001$ (Table 2).

Table 2: Descriptive statistics of facial and nasal indices among the Akan Population

	Male			Female				
	Min.	Max	Mean \pm SD	Min.	Max	Mean \pm SD	T	p
n-gn	91.89	139.68	117.07 ± 7.03	91.32	124.60	110.42 ± 6.69	8.306	< 0.001
zy-zy	99.16	156.34	130.81 ± 10.31	102.69	151.02	127.18 ± 8.33	3.272	< 0.001
FI	75.28	117.90	89.89 ± 7.07	76.58	97.87	86.99 ± 4.92	3.972	< 0.001
al-al	24.31	45.76	36.29 ± 4.05	23.85	42.69	34.59 ± 3.45	3.837	< 0.001
n-sn	32.47	53.21	44.24 ± 3.38	33.27	50.67	42.64 ± 3.05	4.250	< 0.001
NI	52.0	115.3	82.61 ± 11.80	52.0	105.7	81.53 ± 9.85	0.843	0.400

al-al: nasal width; n-sn: nasal height; NI: nasal index; n – gn: facial height; zy-zy: facial width; FI: Facial index

Table 3: Distribution of Facial and Nasal Types among Akans in Ghana

Facial Types	Female		Male		Pooled	
	N	%	N	%	N	%
Hypereuryprosopic	11	8.8	17	9.3	28	9.1
Euryprosopic	31	24.8	27	14.8	58	18.9
Mesoprosopic	51	40.8	51	28.0	102	33.2
Leptoprosopic	26	20.8	44	24.2	70	22.8
Hyperleptoprosopic	6	4.8	43	23.6	49	16.0
<i>Nasal type</i>						
Hyperleptorrhine	1	8.0	1	0.5	2	7
Leptorrhine	15	12.0	26	14.3	41	13.4
Mesorrhine	60	48.0	76	41.8	136	44.3
Platyrrhine	46	36.8	69	37.9	115	37.5
Hyperplatyrrhine	3	2.4	10	5.5	13	4.2

N = number of observations; % = percentages

Table 4: Comparison of facial indices with other published studies

Study	Sex	Facial index	Facial type
Present study	M = 182	89.89 ± 7.07	Mesoprosopic
	F = 125	86.99 ± 4.92	Mesoprosopic
Sisaalas (Ghana) ⁸	M = 88	102.11	Hyperleptoprosopic
	F = 97	104.25	Hyperleptoprosopic
Dagaabas (Ghana) ⁸	M = 91	99.70	Hyperleptoprosopic
	F = 111	98.29	Hyperleptoprosopic
Akan people (Ghana) ⁹	M = 50	97.21 ± 12.70	Hyperleptoprosopic
	F = 50	95.82 ± 12.49	Hyperleptoprosopic
Andhra Pradesh population (South Indian) ¹⁰	M = 65	91.5 ± 0.5	Leptoprosopic
	F = 65	88.1 ± 0.3	Leptoprosopic
Tehran (Iran) ¹¹	M = 100	101.26 ± 6.05	Hyperleptoprosopic
	F = 100	90.24 ± 7.60	Leptoprosopic
Malay (Malaysia) ¹²	M = 40	90.85 ± 8.38	Leptoprosopic
	F = 41	85.86 ± 5.69	Mesoprosopic
Haryana (Northern India) ¹³	M = 150	87.17 ± 5.63	Mesoprosopic
	F = 150	85.90 ± 5.53	Mesoprosopic
Turkish ¹⁴	M = 470	84.31 ± 5.6	Mesoprosopic
	F = 533	85.25 ± 5.48	Mesoprosopic

Table 5: Comparison of Nasal indices with other published studies

Study	Sex	Nasal index	Nasal type
Present study	M = 182	82.61 ± 11.80	Mesorrhine
	F = 125	81.53 ± 9.85	Mesorrhine
Ekowe indigenes (Nigeria) ¹⁵	M = 179	110.64 ± 12.52	Hyperplatyrrhine
	F = 121	112.89 ± 14.43	Hyperplatyrrhine
Tharu and Mongoloid (Nepal) ¹⁶	M = 250	74.60 ± 3.10	Mesorrhine
	F = 250	75.90 ± 5.10	Mesorrhine
Northern Tehran (Iran) ¹⁷	M = 100	69 ± 8	Leptorrhine
	F = 100	66 ± 8	Leptorrhine
South Indian population ¹⁸	M = 100	67.05 ± 9.53	Leptorrhine
	F = 103	64.84 ± 9.52	Leptorrhine
Igbo (Southern Nigeria) ¹⁹	M = 490	95.9 ± 9.8	Platyrrhine
	F = 260	90.8 ± 9.9	Platyrrhine
Yoruba (Southern Nigeria) ¹⁹	M = 443	90.0 ± 8.1	Platyrrhine
	F = 307	88.1 ± 8.3	Platyrrhine
Ijaw (Southern Nigeria) ¹⁹	M = 100	98.6 ± 9.7	Platyrrhine
	F = 100	94.2 ± 9.6	Platyrrhine
Caucasians ¹	M	65.50	Leptorrhine
	F	64.20	Leptorrhine
Bini (Nigeria) ²⁰	M	99.13 ± 9.26	Platyrrhine
	F	99.27 ± 11.67	Platyrrhine

DISCUSSION

The present study used anthropometry of the face and nose to determine the prosopic or facial and nasal indices of the Akan people. Akans make up over 47.5% of Ghana's population, making them the largest ethnic group²¹. Twelve groups make up this tribe: Akuapim, Akyem, Akwamu, Ahanta, Safwi, Nzema, Asante, Fante, Agona, Wasssa, Bono, and Kwahu. There is a shared cultural background and language among the residents of these subdivisions (Twi). Almost the entire forest and coastal areas of Ghana's south and west banks of the Black Volta River are occupied by the Akan people. The Akans are believed to have migrated from the Sahel to Africa's western coast.

Human facial anthropometry has always been an intriguing subject for anatomists, anthropologists, and plastic surgeons. An individual's facial shape is a reflection of their race, age, and gender^{1,2}. Facial morphology has applications in a variety of fields, including facial aesthetics, forensic identification, and reconstructive surgery¹². According to this study, the facial height for Akan females ranged between 91.32-124.60 mm and for Akan males 91.89-139.68 mm. The female and male facial breadth ranged between 102.69-151.02 mm and 99.16-156.34 mm, respectively. In general, all-female values were lower than those of males ($p < 0.001$). Hence, males (89.89 ± 7.07) had higher facial indices than females (86.99 ± 4.92) and this was statistically significant ($p < 0.001$). Evidence of sexual dimorphism in facial indices has been reported by several researchers in the literature. This may be due to the high testosterone-to-estrogen ratio in males which results in the difference in facial shape between the two sexes⁸⁻¹⁴.

In the study population, both males and females had mesoprosopic faces as the predominant face type. Hyperleptoprosopic (4.8%) and hypereuryprosopic (9.3%) facial types had the lowest distribution in females and males, respectively. In contrast, the hyperleptoprosopic face type was predominant in the Sisaala and Dagaaba tribes of Ghana's Upper West Region⁸. Surprisingly, hyperleptoprosopic face type was predominant in both sexes among the Akan people of the Assin District in the Central Region⁹. The least frequent facial type in their study was mesoprosopic, which accounted for 2% of males and 4% of females⁹. We believe the observed disparities may be attributed to the small sample size (50 males and 50 females) and greater age range of 20 to 58 years. Again, they did not indicate how the participants' tribe was ascertained. Males and females with leptoprosopic face types were

found in various populations such as Andhra Pradesh¹⁰ and Malay¹². Among 100 male and 100 female medical students at Tehran University of Medical Sciences, the dominant face type for males was hyperleptoprosopic, whereas for females it was leptoprosopic¹¹. Our study was however indirectly in agreement with the Haryana¹³ and Turkish¹⁴ populations.

The human nose is a conspicuous facial feature. It is also one of the most obvious variations when analyzing ethnic and racial distinctions^{1,8}. This study appears to be the first nose-type study in Ghana. Akan males and females had a nasal height range of 32.47-53.21 mm and 33.27-50.67 mm, respectively. The ranges for male and female nasal width were 24.31-45.76 mm and 23.85-42.69 mm, respectively. The values for the females were significantly lower than the males ($p < 0.001$). However, there was no statistically significant difference ($p = 0.400$) between the nasal indices of males and females (82.61 ± 11.80 vs. 81.53 ± 9.85). This agrees with a study by Eboh²⁰ among Bini Adolescents in Edo State, Nigeria. But it is contradictory to the findings of several other studies in the literature that had reported sexual dimorphism in the nasal index.

The size and shape of the nose are influenced by climatic factors, with cold and dry climates favouring narrowing and moist and warm climates favouring expanding or broad noses¹. The platyrrhine nose types are often seen in African populations and associated with hot moist climates, whereas leptorrhine nose types are typically seen in European populations and associated with cold dry climates. Because Asia has an intermediate climate, mesorrhine noses are more common^{20, 22}. Although studies by Oladipo et al.¹⁹ among the Igbo, Yoruba, and Ijaw in Southern Nigeria and Eboh²⁰ among Bini Adolescents in Edo State, Nigeria support this assertion, it appears that this is not the case in the Akan population since the mesorrhine or medium nose was the most prevalent nose type among Akan males (41.8%) and females (48.0%). According to the literature, not all Africans are platyrrhine²³. The commonest nose type among the 200 participants of the Hausa ethnic group of northwestern Nigeria was mesorrhine (60%) followed by leptorrhine (37.5%), and platyrrhine (2.5%)²³. Oladipo et al.²⁴ reported nasal indices of 86.38 (platyrrhine) and 81.86 (mesorrhine) among the Andonis and Okrikas of Rivers State, Nigeria. The predominant nose type noted in this study is similar to the findings in the Tharu and Mongoloid populations in Nepal¹⁶.

The hyperleptorrhine or long narrow nose was observed as the predominant type for the Ekowe indigenes, Nigeria¹⁵. Leptorrhine or moderately narrow nose was prevalent for the Northern Tehran, Iran¹⁷, and South Indian populations¹⁸. Most Caucasians are leptorrhine having nasal indices ranging from 55.0 to 69.9¹. The variations in facial and nasal indices between and within populations may be attributed to environmental, dietary, geographical, and racial factors^{1,8-23}. The findings, therefore, affirm population variance in facial anthropometry. A potential limitation is that the normal values of facial and nasal indices obtained in the Akan population may not be generalizable to all Ghanaians.

CONCLUSION

The present study has provided normative data on facial and nasal indices of the Akan ethnic group which has not been investigated previously. The Akan ethnic group can be classified under mesorrhine nose and mesoprosopic face types. This finding suggests that genetics and ethnicity can greatly influence nasal and facial characteristics between and within populations. The findings of this study can be used as a reference to improve the outcome of cosmetic and reconstructive facial surgery and rhinoplasty, as well as person identification in forensic medicine.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

ETHICAL ISSUES

The Committee for Human Research, Publication, and Ethics at the School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, approved the study with the approval number CHRPE/AP/397/21, following the Helsinki Declaration. Informed consent was obtained from all participants involved in the study.

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None

AUTHOR CONTRIBUTIONS

NDK: Conceptualization, data acquisition, writing the manuscript, editing and reviewing the manuscript, approval of the final manuscript; **AK:** Conceptualization, data analysis, writing the manuscript, approval of the final manuscript; **JT:** Conceptualization, writing the manuscript, approval of the final manuscript; **TKD:** Conceptualization, data analysis, editing and reviewing of manuscript, approval of the final manuscript; **CSA:** Conceptualization, editing and reviewing of manuscript, approval of the final manuscript.

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RESEARCH ARTICLE

A PROSPECTIVE STUDY ON THE SEXUAL VICTIMIZATION OF ADOLESCENT FEMALES BY ROMANTIC PARTNERS AND THE RELATIONSHIP TO THE AGE GAP BETWEEN THE PARTNERS

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ABSTRACT

Introduction: According to statistics, 70% of reported rape cases had happened with the willingness of the female partner, where the law enforcement authorities have charged as the victim is below 16 years. This study evaluated the sexual victimization of such females by their partners in relation to the age gap between the couple.

Methodology: This is a descriptive study of 63 female victims of sexual assault aged 12 to 16 years, presented to the National Hospital Kandy during a one-year period. The sample was divided into three groups according to the age gap between the victim and perpetrator (P1; 0 to 5.9 years, P2; 6 to 11.9 years and P3; 12 to 18 years)

Results: The age gap of the couples ranged from 1.8 to 17.7 years, with a mean of 9.5 years and 49% belonging to P2. The percentage of couples engaging in sexual relations with penile penetration was higher with an increasing age gap. In P1, 71% had willingly engaged in sexual activity, while it was only 45% and 44% in P2 and P3 respectively. Furthermore, in P3, 30% of the victims had allowed the alleged sexual act following intimidation, but it was not observed in P1. This study revealed that within a month of courtship sexual activity had occurred in 55% of cases in P3 while it was 32% in P2 and, only 21% in P1. In P3, 11% had engaged in sexual activity on the first encounter, whereas it was not observed in P1 and P2.

Conclusion: With the increasing age gap, the vulnerability to sexual victimization of female adolescents by partners is more prevalent. Therefore, considering the age gap between partners may be more justifiable than adhering to a fixed age of consent to prosecute and punish in cases of sexual assault of adolescent females. Hence, it is evident that the application of the "Romeo and Juliet exemption" to the Sri Lankan setup is timely and justifiable.

Keywords: Age gap; Female adolescent; Sexual victimization; Statutory rape

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INTRODUCTION

Adolescence is the physical and psychological transitional stage where a child becomes an adult, occurring from puberty to legal adulthood. Among girls, the first signs of puberty emerge as early as 8 to 13 years, with an average of 11 years¹. The age of puberty of a male with spermatogenesis ranges from 13.5 to 13.7 years¹. However, the onset of legal adulthood is considered as 18 years². With the rapid psychological and physical changes occurring during

this period, they tend to have romantic relationships with heterosexual partners, and experience and explore sexual feelings³. Involvement in sexual relations at lower ages should be averted, because it may end up with grave life-long physical, psychological and cultural negative outcomes, such as teenage pregnancies, sexually transmitted diseases, long-term gynaecological complications and several psychiatric illnesses⁴. Strategies adopted to minimize sexual relations at lower ages are focused on the elimination of risk factors with proper sexual and reproductive health education. Another effective strategy is the enforcement of the law against the perpetrator.

According to the literature and jurisdiction of the country, a sexual relationship with a female below a certain defined age is considered a crime, irrespective of the female partner's consent or willingness⁵. The minimum age for consent for sexual relationships varies from country to country. Some countries consider the age as sixteen years, while others set it somewhere between 11 and 21 years of age based on the presumption that under this age the female does not have the capacity to give a valid consent⁶.

In terms of section 363(e) of the Penal Code of Sri Lanka, sexual intercourse with a female less than 16 years is considered rape, irrespective of her consent. The punishment is specified in 364(1) as a term of imprisonment not less than 7 years and not exceeding 20 years. However, according to section 365(2)(b) of the penal code of Sri Lanka, if the perpetrator is less than 18 years, and intercourse has been with the consent of a person under 16 years, the court may impose a sentence of less than 7 years⁷.

According to data from the Department of Police Sri Lanka, 1977 rape cases have been reported during the year 2021. Out of that 1377 cases (70 %) were statutory rapes which had happened with the consent of the female partner⁸.

However, law enforcement authorities must investigate and prosecute all alleged consensual statutory rapes as sexual offences, irrespective of the romantic relationship and emotional intimacy between the couple⁹. The main purpose of the law against statutory rape is to protect children from sexual exploitation by adults¹⁰. To overcome this kind of prosecution, certain countries have amended their laws regarding statutory rape. Some countries have proposed to lower the age of consent while some have introduced special provisions known as

“close-in-age exemption” or “Romeo and Juliet exemption”^{11,12}.

The close-in-age exemption prevents the sexual act that occurred between individuals with a few years of age difference from being considered a criminal offence¹². The law applies only when; 1) the female has reached a certain age, which can vary from country to country and range from 14 to 16 years, 2) with a narrow age difference between the couple, ranging from two to four years, 3) the act being consensual¹³. There are scientific justifications for the close-in-age exemption because studies revealed the wider age gaps cause more sexual victimization with higher unwanted sexual behaviours (without the willingness of the female partner), and less use of protection against pregnancy and sexually transmitted infections (STIs)¹⁴. The Law Commission of Sri Lanka discussed the application of the close-in-age exemption to Sri Lanka in 2014 but has not yet been recommended for application¹⁵. There are no published studies in Sri Lanka on the sexual victimization of female adolescents by their dating or romantic partner in relation to the age gap. This study is designed to fulfil this lacuna of knowledge in this area.

Furthermore, this study aims to assess the most serious sexual assault, the use of protection against STI and pregnancy, the willingness of the victim for sexual activity, and the intimacy of the relationship in relation to the age gap between partners.

METHODOLOGY

National Hospital Kandy (NHK), Sri Lanka is the main referral hospital for medico-legal opinions and treatments for victims of sexual violence in the Kandy district. The study population was 12 to 16-year-old females who were referred to the NHK for medico-legal opinion with a history of sexual assault. We have selected only the victims who verbally confirmed that the alleged accusers were their boyfriends or lovers.

As the study was based on the history given by victim, diagnosed victims with psychiatric illnesses and mentally retarded individuals were excluded. Those cases where the clinical forensic examination findings were incompatible with the given history, were excluded. Cases where the age of the victim or the accused could not be confirmed with a valid document (e.g., National identity card, birth certificate), were also excluded.

Data collection was done from April 2019 to the end of February 2020, after obtaining ethical clearance from the Ethics Review Committee of NHK (THK/ERC/21/2019). The participants were examined for medico-legal purposes by forensic practitioners attached to NHK who took the sole responsibility of examination and reporting to police/court. Victims were interviewed after receiving the written informed consent from the legal guardian and the assent from the victim. The interview was carried out only in the presence of a female chaperone based on pro-forma. During the study period, 63 victims were interviewed. Collected data were entered and analysed in Microsoft Excel worksheets.

RESULTS

1. Age distribution among female partners and their alleged romantic partners

In our study population, all the males were older than their female partners. The age gaps of the couples ranged from 1.8 to 17.7 years, with a mean of 9.5 years. This study population was divided into three groups according to the age gap between the female and their male partner. The close age gap (P1) was zero to 5.9 years, the intermediate age gap (P2) was 6 years to 11.9 years and the advanced age gap (P3) was 12 years to 18 years. There were 22%

(n=14) of females in P1, 49% (n=31) in P2 and 29% (n=18) in P3.

2. Type of sexual assault

When analysing the most serious sexual assault among the study subjects, alleged penovaginal intercourse had the highest frequency (n=26, 41%) followed by alleged inter-crural intercourse. The distribution of alleged sexual assaults in relation to the age gap is shown in Table 1.

(N.B. Penovaginal intercourse was considered as the most serious as having a risk of pregnancy as well as transmission of sexually transmitted infections. Anal or oral penetration was considered the second most serious assault, as carrying a risk of transmitting sexually transmitted infections. Inter-crural penetration was considered the next serious assault and other sexual offences including fondling and kissing were considered as least serious. (Penovaginal intercourse > oral or anal > inter-crural > fondling and kissing))

Table 1: Sexual offence against romantic partners, in relation to the age gap

Group based on age gap	Type of alleged sexual assault						Total alleged sexual assaults with penile penetration n (%)
	Fondling and kissing n (%)	Sexual assault with penile penetration				Penovaginal intercourse n (%)	
		Inter-crural intercourse n (%)	Uncertain (vaginal or inter-crural) n (%)	Anal intercourse n (%)	Oral intercourse (fellatio) n (%)		
P1	04 (29)	01 (7)	02 (14)	00	00	07 (50)	10 (71)
P2	02 (6)	09 (29)	05 (16)	01 (3)	01 (3)	13 (42)	29 (94)
P3	01 (6)	03 (17)	04 (22)	02 (11)	02 (11)	06 (33)	17 (94)
Total	07	13	11	03	03	26	

3. Assessment of female partner's willingness for a sexual relationship

3.1 Female partner's assent to sexual relations

In P1, 43% (n=06) of females stated that their male partner asked about their willingness for the sexual act prior to the incident. It was 51% (n=16) in the P2 and 22% (n=04) in P3.

3.2 Reasons for allowing the alleged sexual act

In the P1, 71% (n=10) of females engaged in sexual relations willingly while it was 45% (n=14) in the P2 and 44% (n=08) in the P3.

Those who unwillingly allowed the alleged sexual acts were interviewed to identify the reason for allowing the act to proceed. In P1, 75% (n=3) of females had allowed the alleged act due to fear of losing the relationship. However, only 41% and 40 % had allowed the alleged act in P2 and P3 respectively due to fear of losing the relationship. In P2 and P3, females allowed the alleged sexual act to proceed due to death threats made by the male

partner against the victim or her family members or threats of revealing personal material (photos and messages) to the public. However, it was not observed in P1. Only one case was observed in the P2 where the male partner had intoxicated her prior to the act. The reasons for allowing the alleged sexual act in relation to the age gap are elaborated in Table 2.

Table 2: Reasons for allowing the alleged sexual act, in relation to the age gap

Population according to the age gap	Reasons for allowing the alleged sexual acts				
	Physical force to victim n (%)	Fear of losing the relationship n (%)	Threat to death of victim or family member n (%)	Other threats (Revealing personal material to society n (%)	Intoxication n (%)
P1	01 (25)	03 (75)	00 (00)	00 (00)	00 (00)
P2	05 (29)	07 (41)	01 (06)	03 (18)	01 (06)
P3	03 (30)	04 (40)	01(10)	02 (20)	00 (00)

4. Use of protection against pregnancy and sexually transmitted infections (STI), in relation to the age gap between the partners

All females (n=63) who were at risk of pregnancy/STIs were interviewed on the use of protection. Further details are illustrated in Fig.1.

All females who had used protection (n=12) were victims of alleged penovaginal intercourse. In 58% of cases the male partner had used condoms. 33% of females had used emergency contraceptive pills and 8% had used oral contraceptive pills (OCP). It was observed that 54% victims of penovaginal intercourse had not used any form of protection.

In P1, 71% of females had used some form of protection, whereas it was 38% in P2 and only 33% in P3.

5. Duration of the relationship, frequency of meet-ups, method of communication and elopement

5.1 Duration of the romantic relationship

The duration of the romantic relationship at the time of the alleged most serious sexual assault was analysed in relation to the age gap between the couple and is shown in Fig.2. In P1 50% (n=7) of females had alleged sexual relations one year from the onset of the romantic relationship and it was 32% (n=10) in P2 and 11% (n=2) in P3. Further, within a month of the courtship 55% of females in P3 had engaged in sexual activity. It was 32 % in P2 and, 21% in P1. In P1 7% (n=1) of females had alleged sexual relations during the 1st week after the onset of the romantic relationship and it was 10% (n=3) in P2 and 11% (n=2) in P3.

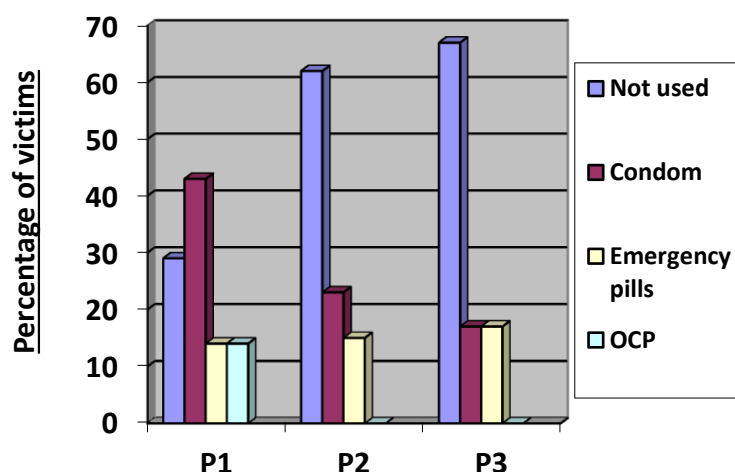


Fig 1: Use of protection against pregnancy and STI in relation to the age gap

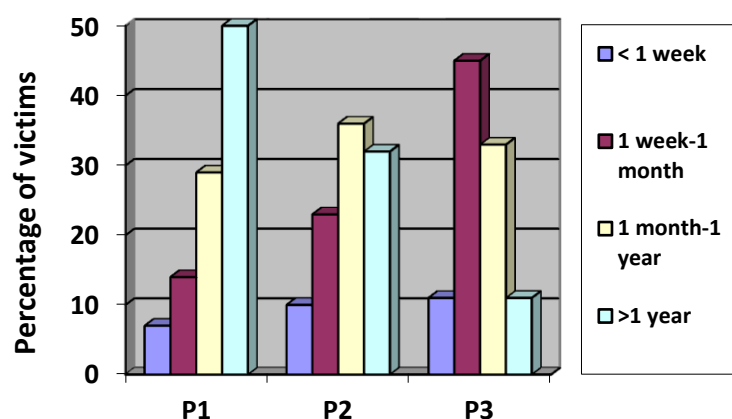


Fig. 2: Duration of romantic relation at the time of the alleged most serious sexual assault in relation to the age gap between the partners

5.2 Frequency of meet-ups

In P1 and P2, all the females had physically met their partners previously at least once prior to the sexual act. In P3, 11% of females had sexual relations with their partners on their first physical encounter. The frequency of meetings according to the age gap is demonstrated in Table 3.

Table 3: Frequency of meet-ups of partners according to the age gap

Population according to the age gap	Frequency of meet-ups of partners				
	Previously not met n (%)	Once per 4 weeks n (%)	Once per 2-3 weeks n (%)	1-3 times per week n (%)	4-7 times per week n (%)
P1	00 (00)	01 (7)	04 (29)	04 (29)	05 (35)
P2	00 (00)	07 (23)	12 (39)	11 (35)	01 (03)
P3	02 (11)	03 (17)	09 (50)	04 (22)	00 (00)

5.3 Methods and frequency of communication during the relationship

In P1 and P3, all females have communicated with the male partners using phones, social media or other methods (letters and messages through friends) before the alleged offence. In P2, 97% had communicated with the alleged partner before the alleged sexual act. The frequency of communication using phones, social media or other methods used by partners is summarized in Table 4.

Table 4: Frequency of communication

Population according to the age gap	Frequency of communication				
	Not communicated n (%)	1-2 times per 7 days n (%)	3- 6 times per 7 days n (%)	1-2 times per day n (%)	>3 times per day n (%)
P1	00 (00)	05 (36)	02 (14)	04 (29)	03 (21)
P2	01 (03)	06 (19)	08 (26)	11 (35)	05 (16)
P3	00 (00)	02 (11)	07 (39)	08 (44)	01 (06)

5.4 Elopement

A history of elopement was given by 57%, 52% and 17% in P1, P2 and P3 respectively.

DISCUSSION

The study identified 63 female victims aged between 12.6 to 15.8 years. The mean age of the victims was 14 years. It was observed that the number of victimized females increased with advancing age (6% of victims were in the 12 to 12.9 years group and 51% of victims were in the 15 to 16 years group). A study done by Finkelhor et al. showed the same pattern where the incidence of female victimization increased with advancing age¹⁶. In addition, a study done in the USA by Reppucci et al¹⁷. involving 206

adolescent females ranging from 12 to 16 years revealed the average age of the victim as 14.5 years. This closely reflects the average age of our study population. Also, studies done in India by Tamuli et al.¹⁸ Hasan et al.¹⁹, Sarkar et al.²⁰, Bhardwal et al.²¹ and Islaml et al.²² reflect a similarity to the results of our study where the mean age of victims was around 13-16 years. The average age of the alleged perpetrators was 24 years in our study with 59% between the ages of 22 to 29.9 years. However, Reppucci et al. in their study observed the male partner's average age as 16.2 years. This is relatively lower than the average age of male partners in our study population¹⁷.

The age gap between the couples in our study population ranged from 1.8 to 17.7 years, with a mean of 9.5 years. In addition, 78% of alleged male partners were at least 6 years older than their female partners. A study by Hill et al. indicated that females who experienced abuse had higher odds of having a partner who was 5 or more years older, which closely reflects the results of our study²³. However, according to Reppucci et al.¹⁷ the percentage of male partners who were four or more years older than the females was only 14%. This reflects that the age gap is broader in our study population compared to the US study. Higginson explained the reason as, older male partners were sought with the belief that they can provide financial security, and emotional stability and possess greater sexual knowledge, experience and/or other resources compared to younger men²⁴.

The study revealed that the percentage of alleged penovaginal intercourse was highest (50%) in P1, with a reduction in the frequency with the increasing age gap (42% in P2 and 33% in P3). However, a study on statutory rape in the USA by Bieri et al.²⁵ has revealed that with the increasing age gap between the victim and offender odds of a statutory rape incident increased. Similarly, Oudekerk et al.¹⁴ revealed that the wider the age gap between partners, the more likely they were to engage in sex. Further, a study done by Barter et al.²⁶ showed the same pattern where the incidence of female victimization increased with advancing age. Thus, an above-described decreasing percentage of penovaginal intercourse with an increasing age gap demonstrated in our study population is controversial to some of the literature.

However, the percentage of couples engaging in sexual relations with penile penetration (penovaginal intercourse, anal, oral, inter-crural, uncertain whether inter-crural or vaginal) increased with the increasing age gap. This indicates that the

percentage of sexual offences against the order of nature (unnatural offences) increases with the increasing age gap between the partners. This observation is indirectly supported by the statement; "More sexual victimization with increasing age gap" described by Reppucci et al.¹⁷ This is further supported by Bieri's finding of increased sexual aggression incidents with increasing age difference²⁵. Also, the percentage of least serious sexual assaults such as fondling was observed to be higher in the close age gap group (29%) compared to the advanced gap group (6%). This again indicates that victimization is less when the age gap is less.

These results revealed that only 22% of male partners have verbally asked about the willingness of the female partner to have sexual relationships in the P3. However, a relatively high percentage of male partners in both P1 and P2 (43% and 51% respectively) have asked about the female partner's willingness before the act. These findings were not described in previous studies. However, these results indicate less consideration of the female partner's willingness in the advanced age gap group, which is compatible with the findings of studies described below.

The results revealed that most females (71%) in P1 have engaged in sexual relations willingly, while it was a lower percentage (44%) in P3. Favouring our results, studies by Bieri et al. proved that with the increasing age gap between victims and offenders, a higher incidence of statutory rape incidents has been noted involving forcible sex crimes²⁵. Reppucci et al, also described that wider age gaps were associated with a higher incidence of unwanted sexual behaviour according to their study¹⁷.

Percentages of sexual acts done by physical force ranged between 25%-30% in all three groups. However, obtaining consent by fear and intimidation was highest (30%) in P3 and consenting due to fear of losing the relationship was highest (75%) in P1. No studies in the literature described how male partners convinced or intimidated the female partner to engage in the sexual act. However, the highest percentage of threats made by the male partner in P3 is compatible with the finding of a high frequency of sexual violence with advancing the age gap in the literature.

In our study population, the percentage of use of contraception decreases with increasing age gap. These findings are also consistent with the findings of Oudekerk et al.¹⁴ and Higginson²⁴.

Sexual relations in the early period of a romantic relationship suggest a high possibility of sexual exploitation rather than having an intimate relationship.—This study revealed that within a month of courtship sexual activity had occurred in 55% of cases in P3 while it was 32 % in P2 and, only 21% in P1. In P1 50% of females had alleged sexual relations more than one year from the onset of their romantic relationship, while it was only 11% o in P3. These findings suggest that couples with advanced age gaps were more likely to have sexual relationships in the early period of their romantic relations compared to couples with a close age gap. This might be a result of sexual exploitation by older male partners, rather than an intimate relationship. This relationship is also not described in previous studies in the literature.

Several scales are described in the literature to assess a couple's intimacy. The Miller Social Intimacy Scale (MSIS), which consists of 17 questions scored on a 10-point Likert scale is the commonly used scale to assess intimacy of a couple²⁷. They used the willingness to spend time with their partner as a measure to assess their intimacy. However, the current situation has changed because of the freely available modern electronic communication methods, such as mobile phones and social media. A study by Vadysinghe et al.²⁸ on modes of communication in cases of sexual assault in Sri Lanka based on 62 victims of sexual assault, revealed that only 44% had direct verbal communication with the assailant. Mobile phones were used in combination with other forms of communication in 47% of cases, whereas only mobile phones as the method of communication was used by 16%. Only 3% had communicated with letters. Therefore, we used both frequency of physical meet-ups and other methods of communication as a tool to assess intimacy.

Surprisingly, results showed that 11% of couples in the P3 had sexual relationships in their first meeting. However, none of the females in P1 and P2 had engaged in sexual relationships on their first meeting. In addition, no females had met their male partner more than four times per week in the advanced age gap group. However, in P1 5% of females had met their partners more than 4 times per week. These findings suggest a more intimate relationship in the close age gap group than the advanced age gap group.

A relatively high percentage of victims in P1 (36%) had communicated less than two times per week. However, a relatively higher percentage of victims in P2 and P3 (35% and 44%) had communicated one to

two times per day. These findings indicate couples with a wider age gap are more likely to communicate using phones and social media, while couples with a closer age gap are more likely to meet each other in person. This is further indicative of a higher level of intimacy in the close age gap group. These findings are also not described in previous literature. In our study, most females in P1 (57%) had sexual relations after eloping, whereas it was 52% in P2. However, the majority of females in P3 had engaged in sexual relations without a history of eloping. A study done on reasons to elope in the Anuradhapura district in Sri Lanka revealed the commonest reason as parental disapproval of the love affair (56%)²⁹. This indicates that the partners who had eloped were more interested in having a long-term responsible relationship rather than the need for sexual exploitation³⁰. Elopement of a couple with an adolescent female raises awareness among the parents, community as well as police regarding possible sexual relationships. Therefore, in the case of eloping, the male partner has to bear more responsibility, as there is a high possibility of being penalized by legal authorities compared to those who had sexual relations without eloping. Therefore, we can assume those who elope, despite the disadvantages, maybe having a more intimate relationship. This observation has not been described previously in the literature.

CONCLUSION AND RECOMMENDATION

Adolescent females were more vulnerable to sexual victimization in multiple aspects when the age gap between the partners increases. This indicates consideration of the age gap between partners is more justifiable than the fixed age of consent to prosecute cases of sexual assault of adolescent females. Further, consideration of the age gap is important to mitigate the punishments against the close-age male partner. Thus, the legal basis of close-in-age exemption or Romeo and Juliet exemption applies to our population. However, multicentre similar studies are recommended to have comprehensive insight into this area.

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CONFLICTS OF INTEREST

No potential conflicts of interest were reported by the authors.

ETHICAL ISSUES

Ethical clearance for this study was granted by the Research and Ethical Review Committee of National Hospital, Kandy, Sri Lanka (THK/ERC/21/2019). Subjects were interviewed after obtaining written informed consent from the legal guardian and assent from the victim.

SOURCES OF SUPPORT

None.

AUTHOR CONTRIBUTIONS

RMSBG: Conceptualization, data acquisition, writing the manuscript, editing and reviewing the manuscript, approval of the final manuscript; **ANV:** Supervising, editing and reviewing the manuscript, approval of the final manuscript; **MS:** Supervising, editing and reviewing the manuscript, approval of the final manuscript; **AMRMA:** editing and reviewing the manuscript, approval of the final manuscript.

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RESEARCH ARTICLE

CIRCUMSTANCES OF FATAL ROAD TRAFFIC ACCIDENTS AMONG ADOLESCENTS IN A METRO CITY OF INDIA

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ABSTRACT

Road Traffic Accident (RTA) is an important public health problem globally in all age groups, particularly among adolescents. RTA is one of the leading causes of death in India. The long-term impact of RTA among adolescents is serious in society in terms of economy, disease burden, and future productivity.

This study attempts to find out the circumstances of fatal road traffic accidents among adolescents in a metro city in India.

This is an observational descriptive cross-sectional study, conducted at an autopsy center in Kolkata, India for a period of one year. Data were obtained from reports of post-mortem examinations and police inquests of fatal road traffic accidents in adolescents, reported to the institute. The data was compiled in Microsoft Excel and analysed by using a simple table.

The total number of RTA deaths among adolescents during the study period was 45, with 91% of them male and 9% female. The most common offending vehicle in RTA deaths was a motorized two-wheeler (71%). 91% of the deceased were riders while 9% were pillion riders. 59% of them were below the age (18 years) of obtaining a valid driving license. The majority had collided with stationary objects during the RTA and died due to head injury (52%).

Keywords: Adolescent; Fatal; Rider; Road traffic accident; Two-wheelers

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INTRODUCTION

Road Traffic Accident (RTA) is a serious public health problem worldwide. The “Study Global Burden of Disease” commenced by the World Health Organization, Harvard University, and World Bank, forecasted that the world’s third biggest cause of death and disability would be due to traffic accidents by the year 2020¹⁻³. Nowadays injuries and deaths occurring from road traffic crashes are unacceptably high. The current trend indicates that this situation will continue in the near future⁴. The lives lost due to road traffic accidents kept on

increasing to reach as high as 1.35 million in 2016⁴. The situation is not distributed uniformly over the globe. In low-income countries, RTA is the 7th leading cause of death, while in lower and upper-middle-income countries, it ranks 10th. But in high-income countries, RTA does not rank in the top 10 leading causes of death⁵. If we investigate the deaths among adolescents worldwide, we find that in 2019 alone, RTAs claimed nearly 100,000 lives in the adolescent age group (10-19 years). Many of the deceased were pedestrians, cyclists, or users of motorized two-wheeler⁶. Iran has the highest rate of road accidents in the world⁷, whereas China is in the second highest position in the world². In India, one person dies every 6 minutes, and 10 are injured at the same time frame². India leads in the number of deaths due to RTA followed by China and US among 199 countries reported in the World Road Statistics, 2018⁴. As per the WHO Global Report on Road Safety⁴, India accounts for almost 11% of the accident-related deaths in the World. In India during the year 2019, nearly 30% of the victims of RTA were of the age of 25 years and below⁸. In their report on Adolescent and young adult health, WHO advocates the necessity of advising young drivers on safe driving. They also suggest strict enforcement of laws against driving under the influence of alcohol and drugs among all age groups⁶. People in the adolescent age group are the most potentially productive segment of the society and their loss is costly. For every individual killed in RTA, many others are requiring long treatment and rehabilitation leading to a serious loss of productivity. In this perspective “Circumstances of fatal road traffic accidents among adolescents in a metro city of India” has been planned and executed in the Department of Forensic and State Medicine, Institute of Post Graduate Medical Education and Research (IPGME&R), Kolkata, West Bengal, India.

METHODOLOGY

This was an observational descriptive cross-sectional study, with institution-based data collection. The study was conducted at the autopsy center of the Department of Forensic and State Medicine, Institute of Post Graduate Medical Education and Research (IPGME&R), Kolkata, West Bengal, India, during a period of one year (1st January 2021 to 31st December 2021). The research activity included obtaining permission, anonymous data collection, compilation, analysis, and write-up. The study population consisted of adolescents who died due to road traffic accidents as reported in the autopsy center of IPGME&R, Kolkata. The sample size was a complete enumeration. During the study period, a total of 2686 post-mortem examinations were

conducted in this autopsy center. Among them, 143 deceased were in the adolescent age group, of which 45 were fatally injured in RTA. They constituted the population of this study. The percentage prevalence of fatal RTA in India among the 10-19 years age group (adolescent age group as per WHO) is not available. This made it difficult to calculate the sample size. Therefore, complete enumeration was done.

IPGME&R, Kolkata is an apex hospital providing tertiary-level health care. There is no territorial demarcation for referral service to this hospital. So, the population served by the apex hospital cannot be defined.

Ethical clearance was obtained from the competent authority after ensuring that the data collection would be anonymous, no photographs taken, or any data procured which could reveal the identity of the deceased.

Data was obtained from police inquests and post-mortem reports of the study population. The data was compiled in Microsoft Excel and analysed by using a simple table.

RESULTS

During the study period, post-mortem examinations of 143 deceased adolescents were conducted. As revealed on initial police inquiry, the manner of death among 45 of them i.e., 31%, was RTA followed by hanging and burns (15% each) and poisoning (10%). Among the 45 deceased adolescents who died due to RTA (study population), 91% were male subjects.

The vehicles involved in the fatal RTAs included in the study are demonstrated in Table 1.

Table 1: Vehicle involved in the RTA

Road-user category	Frequency	%
Users of two-wheelers	32	71
Bicyclist	6	13
Pedestrian	5	11
Users of four-wheelers	2	5
Total	45	100

Considering deaths involving two-wheelers, 91% were drivers, while 9% were pillion riders.

The minimum age to acquire a driving license for any motorized vehicle is 18 years in India. In this study population, 59% of the fatally injured adolescent

two-wheeler riders were below the legal age for getting a driving license (< 18 years).

The colliding surfaces during the fatal RTAs are demonstrated in Table 2.

Table 2: Colliding surfaces during the RTA

Object deceased collided with	Frequency	%
Stationary object	15	52
Four-wheeler	07	24
Motorized two-wheeler	03	10
Engine van*	03	10
Pedal bicycle	01	4
Total	29	100

*Engine van: Locally-built three-wheelers fitted with an engine without safety and pollution certification as well as license and registration number

The majority of vehicles had collided with a stationary object and in 94% of cases, the cause of death was the death due to head injury (Table 3).

Table 3: Distribution of injuries in RTA

Distribution of injuries	Frequency	%
Head Injury	42	94
Abdominopelvic injury	01	02
Vertebra and spinal cord injury	01	02
Fracture of long bone	01	02

DISCUSSION

WHO in their Global Status Report in Road Safety⁴, said that nowadays the foremost cause of death of children and young adults (5-29 years) is road traffic injury which is largely due to neglected road safety. This indicates a need for a shift in the current child health agenda. This relationship is even stronger when it focuses on motorcyclists who, since the age of 15, are already 85.5% of the victims, reaching 91% between 20 and 24 years⁹. In our study it was found that RTA is the leading cause of unnatural deaths among adolescents (31%), corroborating the findings of WHO.

Data from the U.S. Department of Transportation's Fatality Analysis Reporting System (FARS) reveals that about 2 of every 3 teenagers killed in crashes in 2019 were males¹⁰. Anantharaman and

Logaraj¹¹ accounted that most of the victims of RTA in Chennai were young males in the productive age group with a male-to-female ratio of 6:1. Government of India, Ministry of Road Transport and Highways Transport Research Wing New Delhi, reported in the year 2019 that 1,51,113 persons died due to RTA. Among them, 11168 (7.4%) were below 18 years of age and 77.5% of them were male. This high incidence of deaths among males was consistently found in India and its different states in the past years. In West Bengal, the state of India where the study was conducted, among the deceased of fatal RTAs, 67% were male and 33% were female¹². These findings agreed with our study (male 91%; female 9%).

The growing trend of RTA is significantly observed in countries experiencing rapid growth in population, urbanization, and motorization^{4,13}. According to the Government of India, Ministry of Road Transport & Highways Transport Research Wing⁸, among fatal RTAs 43.2% involved two-wheelers, 17.8% pedestrians, and only 13.6% involved other four-wheelers¹⁴. It was stated that motorized two-wheeler occupants meeting with RTAs were more common in the younger age groups in Haryana. On analysis of the type of vehicle, Anantharaman and Logaraj¹¹ showed that 43.02 % of the vehicles were light motor vehicles in Chennai. In West Bengal, 20.6% of the deceased of RTA were users of motorized two-wheelers¹². These studies positively reflect our observations.

In this study, the deaths from RTA involving motorized two-wheelers affect mostly drivers (91%) in comparison to the pillion riders (9%). In India as well as in West Bengal the legal age of obtaining a license for driving motorized vehicles (two-wheeler as well as four-wheeler) is 18 years. Here 9.9% of the drivers involved in RTA did not have a valid license⁸ but in our study among the adolescent age group, it was observed that 59% of the drivers of two-wheelers involved in fatal RTAs were below the legal age and did not have a valid driving license. Furthermore, in the remaining 41% of cases, sufficient data was not available to confirm whether they possessed a valid driving license or not.

In RTAs when the responsible vehicle is a two-wheeler, the victim/victim-vehicle is a pedestrian in 27% of cases and a bicycle in 22%, and a two-wheeler in 34% of cases. In our study when the responsible vehicle was a two-wheeler driven by an individual in the adolescent age group, the victim/victim-vehicle was noted to be a four-wheeler in 24% of cases and a two-wheeler in 10%, engine van in 10% and bicycle in 4% of cases. But, in

52% of the cases, the rider collided with a stationary object resulting in the death of the rider.

Head injury is the major cause of death due to RTA by motorized two-wheeler users. The most important safety measure is a properly worn standard crash helmet. In this study, 94% of the two-wheeler riders died due to head injury. Alcohol and drug abuse is another major risk factor of RTA. Wearing crash helmets is mandatory for two-wheeler users and consumption of alcohol and drugs is completely prohibited during driving. In this study, data is not available on whether the deceased wore a crash helmet and whether they were under the influence of alcohol and drugs or not.

CONCLUSION

This study reveals that RTA is the major cause of unnatural deaths among adolescents in India. In this age group, the majority of RTA fatalities were males riding motorized two-wheelers and below the age (18 years) of obtaining a valid driving license. The majority of them had collided with a stationary object and died due to head injury.

Ministry of Transport and Road Safety, Govt of West Bengal has launched a road safety initiative "Safe Drive and Save Life". In this initiative, awareness weeks have been conducted at regular intervals involving people of all age groups. Refuelling pumps are instructed not to dispense fuel if the riders are not wearing helmets. Multiple strategies have been implemented, such as the capacity building of relevant personnel, institutional strengthening through procurement of road violation detection devices, conducting periodic examinations of roads through road safety audits, development of medical care facilities (well-equipped trauma care center), and procurement of ambulance with resuscitation facility. The effectiveness of these initiatives needs to be evaluated.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

ETHICAL ISSUES

Ethical clearance was obtained from the IPGME&R Research Oversight Committee, Institute of Post Graduate Medical Education & Research, Kolkata, India

SOURCES OF SUPPORT

None

AUTHOR CONTRIBUTIONS

ID: Acquisition and analysis of data for the work; **KB:** Development of content; **NB:** Data processing, compilation, and analysis; **DM:** Data processing, compilation, and analysis; **SC:** Interpretation, drafting, and revising the paper critically for important intellectual of data for the work.

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CASE REPORT

FORENSIC APPROACH TOWARDS CRIMINAL USE OF MERCURY IN DOMESTIC VIOLENCE

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ABSTRACT

The prevalence of criminal cases against women is not first-hand with statistical data from the National Crime Records Bureau in India proclaiming an even rise in cases of domestic violence. Despite numerous laws to protect women against various crimes including rape, sexual harassment, dowry death, etc., there is less respite from violence toward women in India. Indian society needs to stand up and address the existence of many socio-cultural reasons for crime against women apart from literacy to lower these crime statistics. Forensic experts play a pivotal role in the scientific examination of evidence to support the criminal justice system which in the end affects the lives of millions of female victims. A case of attempted domestic homicide is presented wherein a 21-year-old married female was poisoned with some unknown substance laced in her milk by her in-laws. This case is of interest to the scientific community as well as to persons working within the medical and judiciary fraternity.

Case history: A married woman aged 21 years alleged her in-laws including her husband of attempt to murder her by giving her milk laced with some unknown substance. She had severe vomiting after drinking milk where she noticed some shining materials in the vomitus. The vomitus and the gastric lavage were analyzed subsequently.

Methodology: Physical and Chemical Examinations including visual analysis and solubility, odour, etc were initially conducted on the exhibits (Gastric Lavage and Vomitus samples) and results were further confirmed by Atomic Absorption Spectrometry.

Results: An abnormally high level of mercury i.e. 9.88 ppm and 332.15 ppm were detected in Gastric lavage and vomitus respectively.

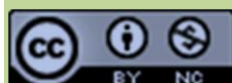
Conclusion: The various scientific investigations determined that the female had been poisoned by using mercury justifying the essential role of forensics in linking shreds of evidence scientifically.

Keywords: Atomic Absorption Spectrometry; Forensic Science; Homicide; Mercury; Poisoning

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INTRODUCTION

Crime against women in Indian society has spread its roots long and continues even to date in various measures. Violence is noticeable to Indian women in many forms like sexual harassment, dowry death, honour killing, and acid attack cases to name a few including female foeticide even before they are born¹. Although a culturally rich country like India holds its women on a high pedestal, unfortunately, the copious attempts to control crime against women have been futile. National Family Health Scheme (NFHS) findings underscore the extent and

severity of violence against women, where one-third of 30% of married Indian women suffer even today^{2,3}. National Commission for Women (NCW) registered a 2.5 times increase in domestic violence complaints during the pandemic lockdown^{4,5}. National Crime Records Bureau data for 2021 records 503 domestic violence cases, even though India has powerful laws like the Protection of Women from Domestic Violence Act, 2005 (PWDVA) and IPC section 498A to safeguard the women population^{6,7}. However, the bench of Honourable Justice Joseph Kurian and R F Nariman pointed out appropriately that “the perpetrators and abettors of domestic violence” include both genders⁸. However, the legal approaches to protect female victims have brought several changes in law from the Dowry Prohibition law of 1961 to The Criminal Law (Amendment) Act of 2013 but still, little success is seen in controlling the crime^{9,10}.

Domestic violence cases are brushed under the carpet unless it reaches the critical stage where the victim might suffer minor injuries and then garner courage for action. There is extensive literature pointing toward homicidal cases in domestic violence and its evidentiary challenges faced by enforcement agencies, forensic scientists, and the criminal justice system. Scientific evidence reported by Forensic Scientists plays an important role not only as expert admissibility in a court of law but also enables decision-makers to have a distinct vision to conclusions, eradicating inevitable misconceptions and incomprehensible contradictions regarding the victim, scene of crime evidence, and crime perpetrator.

Ancient Roman, Greek, and Indian civilizations had popular cosmetic and medical usage of mercury including the amalgamation of the tooth¹¹. History suggests the homicidal poisoning of kings, scientists, and literary geniuses¹². Heavy metal poisoning occurs mainly due to excessive exposure to toxic metals like Lead, mercury, arsenic, cadmium, and chromium that affect normal body functioning¹³⁻¹⁴. Therefore, mercury salts and compounds are considered threats as both are chronic and acute poisons¹⁵. Albers et al reported a rare but interesting homicidal case of fatal intoxication in a 40-year-old man caused by the injection of organic mercury, allegedly in an attack with a syringe fixed to the tip of an umbrella¹⁶. Hitosugi encountered on fascinating case of criminal mercury vapor poisoning by using grains of mercury in cigarettes which were inserted into a battery holder where the victim inhaled the vapor produced when the battery was heated¹⁷. Intoxication with mercury compounds is rare, conversely, there have been several reports of

homicidal, suicidal, and accidental intoxication of mercury across the world¹⁸⁻²⁵. Indian married women in use salt of mercury as a daily cosmetic (vermilion) due to its brilliant hue where this colour property of the cosmetic was used as trace evidence in another forensic case; however, its use with criminal intentions is limited²⁶.

The toxicity due to mercury poisoning is predominantly determined by the form, dose, and rate of mercury ingestion or inhalation¹². Symptoms are mostly non-specific in chronic poisoning but severe acute inflammatory reactions are found in cases of acute exposure²⁷⁻²⁸. Organic mercury leads to high damage to Central Nervous System while salts of inorganic mercury chiefly damage the digestive system lining and kidney with symptoms of tremors, gingivitis, abdominal pain, vomiting, and diarrhoea²⁹⁻³⁰ as a result of exposure. Mercury finds its use in many industrial processes as a component of batteries, thermometers, and Compact Fluorescent Lamps apart from its wide usage in medical therapeutic applications, thus exposure to this needs thoughtfulness^{15,16}. There exist many international laws and guidelines to prevent the misuse, overuse, or restriction of mercury-containing products³¹, however, mercury in various forms is still easily accessible. The identification of symptoms in mercury poisoning becomes important from a medico-legal view and its detection in biological samples from a forensic angle.

The case study presented here is an example of poisoning using mercury with detailed insight into the toxicological examination in the forensic laboratory when samples for case examination were limited. The article will benefit law enforcement officers, prosecutors, judges, and forensic experts examining domestic violence cases.

CASE HISTORY

A married woman aged 21 years alleged her in-laws including her husband of attempt to murder her by giving her milk laced with some unknown substance. She had severe vomiting after drinking milk where she noticed some shining materials in the vomitus. She obtained medical assistance and disclosed her troubled married life. Investigating agencies collected samples for chemical examination.

The seized samples by the investigating agency were received at Forensic Science Laboratory, Delhi for chemical examination in suitably packed and sealed condition. All the reagents and solvents used in the analysis were of analytical grade procured from

Sigma-Merck. All glassware used was purchased from Borosil.

The chemicals required were Copper strips, Dilute Nitric Acid (10 times or 1:10), Concentrated Hydrochloric Acid, and Methanol. The first sample analyzed was 7 ml from gastric lavage and the second sample analyzed was 5 ml of vomit.

Preliminary Chemical Examination Reinsch's Test³²:

This test is a screening method for metal analysis due to its rapid, sensitive, and reliable results in the forensic toxicological examination without extensive preliminary treatment. Washed with Dilute Nitric Acid and dried copper strips were placed in samples along with a blank sample. 2 ml of Concentrated Hydrochloric Acid (HCl) is added to 4.0 ml of each sample then and gently heated in a porcelain dish for about half an hour under the fume hood to burn out the materials and water portion. If the sample gets reduced add 1ml of water and concentrated HCl and carry on the process till only copper strips with residues are left. Copper strips were then washed with methanol and dried on filter paper.

Microscopic examination of the test copper strip was then carried out at 10x /0.25 on Leica DM 750 compound microscope.

Instrumental Analysis

Atomic Absorption Spectrometry (AAS)

The samples were further analyzed using AAS for the detection of Elemental Mercury. AAS is an excellent analytical technique for element analysis with good sensitivity to measure parts per billion of a gram in a sample. Varian makes AAS of the model - FS 220, which was used to measure the element Mercury at Wavelength (nm) -253.7 nm, lamp current 4mA, fuel acetylene, and slit width 0.5nm.

RESULTS

Silver shining deposits were observed on copper strips which suggest positive results for the presence of mercury in Sample 1 and Sample 2 (Fig. 1). When these strips were heated in the test tube, shiny silver deposits of mercury were observed on the walls of the test tube. These copper strips were seen under the microscope (Fig. 2); shiny mercury globules of mercury were evident. Fig. 3 illustrates black spherical globules of mercury of various sizes as, during sublimation, mercury comes in contact with sulfur in the air to form mercury sulfide.

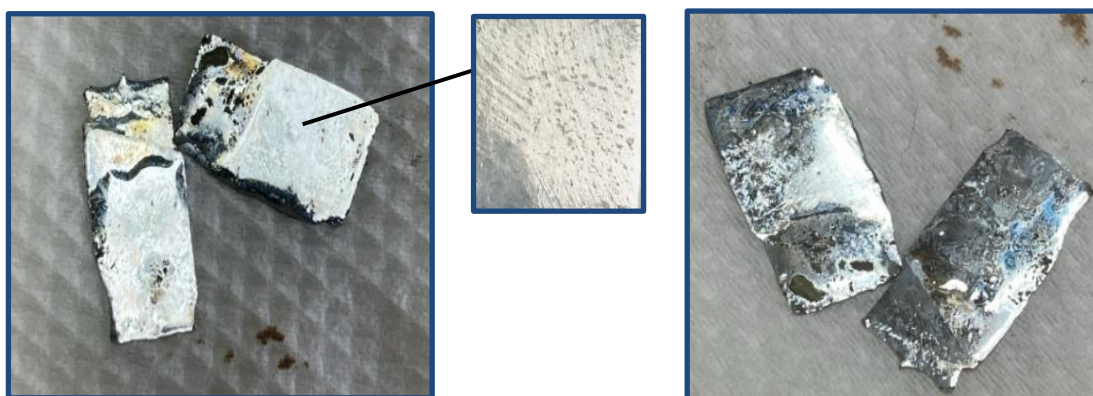


Fig. 1: Silvery shining deposits of mercury appear on the copper strip after Reinsch's test

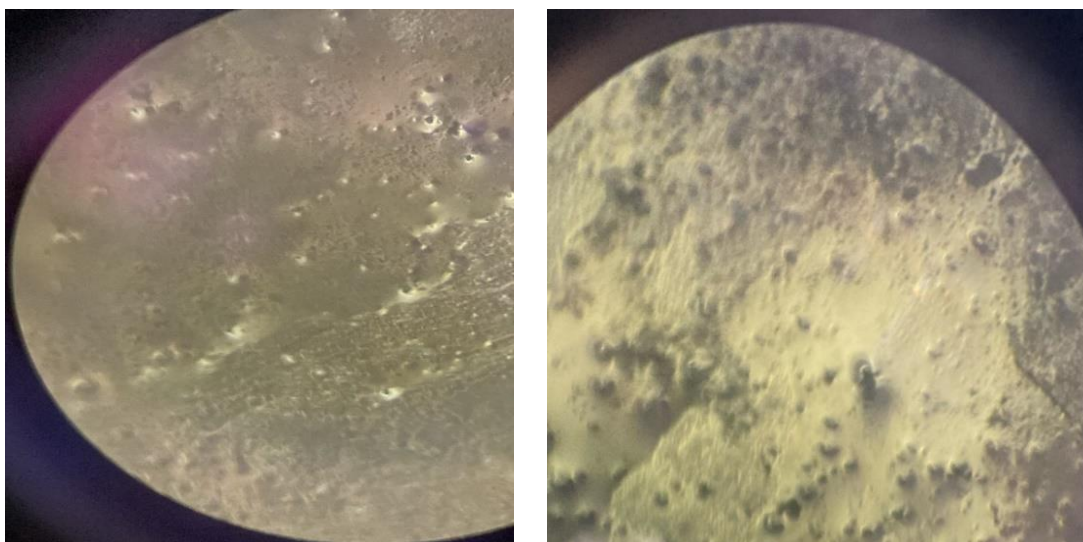


Fig. 2: Microscopic view of the copper strip after Reinsch's test



Fig. 3: Mercury sublimes to form black spherical globules of various sizes on a copper strip

	Sample ID	Hg: MVU Actual Conc.	Hg: MVU Actual Conc. Unit
1	6.21 (1) UNTREATED	-1.21	ppm
2	BLK1	-1.21	ppm
3	6.21 (1)	9.88	ppm
4	BLK2	-1.21	ppm
5	6.21 (2)	332.15	ppm
6	BLK3	-0.28	ppm

Fig. 4: Concentration of mercury detected in the samples during AAS analysis

The results of samples 1 and 2 were found to be 9.88 mg/ml and 332.15 mg/ml respectively establishing the fact that both samples had a high concentration of elemental Mercury when analysed in AAS. The various standard solution for mercury was prepared to range from 50, 100, 200, 400 and 600ppm for which the graph was plotted before running the samples.

Calibration Curve(Element:Hg:FlameCont C#:01)

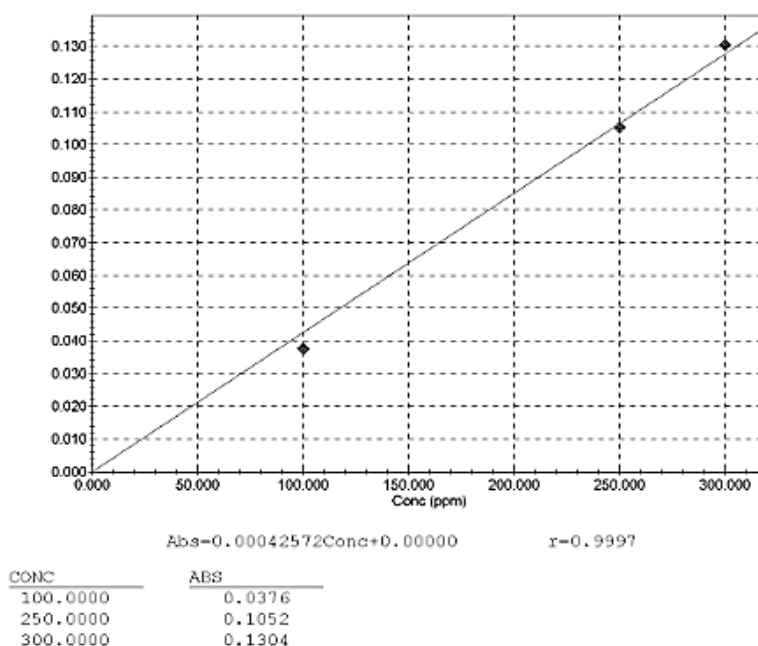


Fig. 5: Calibration curve of the quality control that was run during the quantitation of the mercury

DISCUSSION

A poison can be any substance that causes harmful effects when administered accidentally or in a homicidal manner to living organisms depending on exposure and dose. Homicidal poisoning in crime cases more than often results in fatal incidences where the most common factor is that the perpetrators of the crime had effortless access to poisonous substances either due to their occupation or available over the counter. Here also, large industrial belts of Delhi are engaged in numerous operational processes involving mercury and its compounds³³⁻³⁶ making it accessible to the public. The odorless character of mercury was utilized in this crime as it was easily mixed in milk without creating suspicion in the victim. Toxic ingestion has a corrosive effect on the digestive tract and thus increases the permeability of the gastrointestinal tract. In the bloodstream, it adheres to sulfhydryl groups on erythrocytes, cysteine, or glutathione to poison cellular function by altering the tertiary and quaternary structure of proteins by binding with sulfhydryl and selenohydryl groups²⁹. Thus, mercury has the potential to cause significant health issues through sequences of biochemical reactions in the human body. Within minutes of intoxication, the toxicokinetic action begins with wide distribution in

blood, liver, kidney, and muscles¹⁹. Interpretation of the effects of poison in the biological environment is a mandatory aspect of forensic toxicology. As the dose ingested is important for the poisoning effect to arise, it can be perceived in the said case that the victim was conscious and oriented when she approached for medical and police assistance. It is pertinent to mention here that vomiting through which most of the intoxicant was expelled out of the body played a vital part in her survival which can also be correlated with the amount of mercury detection as in Fig 4. The presence of mercury in vomitus and gastric lavage in such high amounts indicated poisoning of mercury as it is not an integral constituent of human body tissues and cells. So, the mere presence gives legal value proof beyond a reasonable doubt. Such type of mercury poisoning can often be misdiagnosed due to non-specific signs and symptoms to some extent due to lack of knowledge and expertise among investigating agencies or during initial medical documentation. Thus, the documentation of the case was necessary. The presence of mercury could also have been ascertained from the glass of milk even, if, timely seizures and chemical examination would have been conducted as mercury must have settled at the bottom of the glass according to its physical property. This evidence was absent or rather was not considered of importance during the scene of crime visit.

Because of its extensive commercial use, the element is freely available to individuals and the lack of legal measures gives liberty for this toxic element's use in crime effortlessly. Most of the commercially used mercury including waste, remains unregulated, posing a threat to human health as well as the environment and crime. Significantly, there is no national mercury monitoring program in India. Although the Hazardous Wastes (Management and Handling) Rules of 1989, prohibit the import and export of mercury-bearing waste, transportation, handling, and storage and stipulate environmentally sound management, mercury continues to make its way into our Indian territory in various forms³⁷⁻³⁸. Crime cases must propel the government to have strict regulations and standards for its use in various activities. The authorities must wake up to this toxic challenge before it is too late until then medical practitioners and forensic scientists across the globe are expected to continue to encounter mercury poisoning cases.

The legal approaches followed to provide justice to the victim is encouraged by good scientific evidence reports in domestic violence case. Although governments keep amending laws to protect women from domestic violence the effectiveness of laws in reducing the incidences of violence has been limited due to several reasons. One major barrier is proving the incident in a court of law as often the testimony of the victim about the abuse changes due to social stigma. Intoxication cases cause a major problem not only for the victim but also for the multiple investigating agencies as the case needs forensic evidential justification to establish the nature of poisoning whether suicidal or homicidal, at the same time taking into account the circumstantial evidence collected during the process of investigation. Under these conditions, scientific evidence bridges the gap between crime and the victim to search for truth. Investigating Agencies play a very active role with strategic implications in gathering physical shreds of evidence along with proper medico-legal documentation followed by forensic analysis.

CONCLUSION

Due to social stigma even in today's time, domestic violence against women in India is way more than documented and therefore needs attention. United Nations claims violence against women is one of the widespread and devastating violations of human rights. Thus, each incidence matters in the survival of life and mental agony. Even though laws exist to control violence against women, the government needs to form a holistic approach including the

whole of society to counter this crime. Homicidal poisoning by heavy metals including mercury is rare in today's conditions but forensic scientists and medical experts need awareness of the possibility of deliberate intoxication. From the eyes of forensic toxicologists in this study, analysis of case exhibits paved a path for discrete unblemished scientific evidence followed by chemical examination and confirmation by instrumental technique. Domestic violence is still a significant national problem but good scientific evidence can help the criminal justice system to work effectively and create a sense of fear among the culprits.

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CONFLICTS OF INTEREST

There are no financial, or other, reasons that could lead to a conflict of interest.

ETHICAL ISSUES

None

SOURCES OF SUPPORT

None

AUTHOR CONTRIBUTIONS

SS: Study conception and design, acquisition, analysis & interpretation of data, original draft, and editing; **KR:** Chemical analysis; **AR:** Interpretation of data & review of the draft.

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CONTENTIOUS ISSUES

FOETAL PATIENTS, SURGEONS, AND MEDICAL NEGLIGENCE: AN INSIGHT FOR A NEW LEGISLATION

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ABSTRACT

Foetal interventions are the direct result of developments in the field of medicine. The scientific advancements opened the way for pregnant women to select the treatment of the foetus '*in utero*'. This is an option available when the pregnant woman is reluctant to terminate the pregnancy on the grounds of congenital abnormalities of the foetus. Further, treatment of the foetus is considered a psychological relief to pregnant women who otherwise had to wait until the birth of the child to remedy the defects. The predominant method of treatment of the foetus is 'foetal surgery' which facilitates the treatment of the foetus in the womb. This demarcates the treatment of the fatal conditions of the foetus through invasive procedures or open surgery. The problem that arises in this context is whether the foetal surgeons exercise a medical duty of care towards the foetus. The problem is aggravated when the viable foetuses become patients as such patients have the potential to survive outside the womb (ex-utero) irrespective of the destruction of the life of the mother. Medical negligence and a course of action for medical malpractice litigation are established only upon the proof of the existence of a medical duty of care and the breach of it. This paper aims to provide insight into legislation on the medical negligence of surgeons performing surgeries on foetuses. The methodology adopted in the paper is qualitative in nature and a comparative legal analysis with the jurisdiction of the United States of America (USA). The paper's conclusion holds that foetal surgeons legally undertake to act for the benefit of foetal patients and have an obligation to avoid negligence.

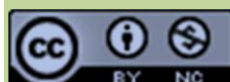
Keywords: *Foetal patients; Medical negligence; Open surgery; Surgeons; Viability*

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INTRODUCTION

Giving birth to an unhealthy child with birth defects is a physical and psychological trauma to the parents¹. Such parents were given two options : terminate the pregnancy or wait until the child is

born and resort to treatments. The third option which has been offered by medical science is the treatment of the foetus within the womb itself (*in utero*). In 1981, the first intrauterine surgery on a foetus was performed by surgeons at the University of California, United States of America (USA). A series of cases identified the imposition of liability on medical practice which inflicted injuries on a foetus encased in a womb². This led to the development of Wrongful Death Actions on behalf of unborn or viable foetal patients. Sri Lanka faces a drastic advancement in the field of medicine and surgery. Among the developments concerning the field of medicine, foetal medicine is of imperative concern. The objective of the paper is to provide insight into legislation on the matter of medical negligence of foetal surgeons. The paper focuses on legal aspects pertaining to the medical practice of surgeons who deal with viable foetal patients. The author has reviewed literature relevant to medical law, medical malpractice litigation, and landmark

cases decided by the US courts in sequence about the imposition of liability on medical professionals relating to the wrongful death of fetuses.

DISCUSSION

Modern medicine has clearly shown that foetal surgery or foetal intervention is an emerging field³. The mission statement of the International Foetal Medicine and Surgery Society has elaborated that, it has two main functions namely to advance the field of foetal diagnosis, therapy, and related medical and scientific pursuits⁴. 'Foetal Medicine' has earned the epithet as a super speciality enterprise and a technology-driven field where fatal-foetal conditions are being treated⁵. The recent developments pertaining to foetal diagnosis have opened ways to the detection of foetal defects and conditions. The foetal treatments have been developed through the courage to experiment with emerging techniques. With the current developments in foetal surgery, medical interventions have become supportive in the benefit of foetal diseases. The surgeries performed on fetuses show the promotion of long-term health interests of children⁶.

Medical negligence arises when the duty of care does not comply. Medical Negligence is the result of the breach of duty of care and emerged from the law of delict⁷. Determining negligence is based on a test comprised of three stages namely the person owed a duty of care, the duty of care was breached, and the breach has caused in the direct result of a legally recognized harm⁷. In this process, the doctor's fault/ negligence must be established by the claimant on the balance of probabilities. The compensation is paid to return the claimant to a position if the harm had not occurred.

In view of the Common Law, compensation cannot be granted to an injured foetus in a womb, even if the foetus was capable of surviving and being born alive². The reason was basically the fact that there was uncertainty as to the legal personhood of the fetus⁸. This context was changed with the development of perceptions of 'foetal viability'⁹. A viable foetal patient must be understood in terms of both biological and technological factors⁹. The reason is that a viable foetus is capable of surviving *ex-utero* (outside the womb)⁹. This stands to an instance where the foetus is of sufficient maturity and has the capacity to survive up to the neonatal period provided the requisite technological support. In *Verkennes v. Corniea*, it has been clearly defined that, an unborn child reaches the stage of viability means an instance where its existence is unfettered by the destruction of the life of the mother¹⁰. In

Bonbrest v. Kotz, an injured foetus in a womb due to medical malpractice was born alive. The court's view was that the pregnant woman and the viable foetus are separate entities. The significance of the viable foetus is that it can survive outside the womb, even after the death of the mother¹¹. The landmark case *Bonbrest* opened the way for the claims by children who suffered injuries at the stage of the foetus in the womb upon the proof of the continued effects of the injury even after the birth.

When it comes to the death of the foetus, the courts confront the difficulty in ascertaining the causation between the negligent act of the surgeon and the death². With the invention of new techniques of foetal surgery, the constant monitoring which takes place before or after the surgery easily facilitates the identification of the causal nexus between the negligent act of the surgeon and the death of the fetus². This context becomes problematic when the death of the foetus is a result of a completely unrelated result of the surgery. The proof of injury in the context of foetal surgery is not considered as difficult as in the context of a conventional case pertaining to the wrongful death of a foetus. A conventional case denotes an instance where the foetus is injured due to acts that do not fall under the category of medical negligence. In such a case, the court is doubtful of the fact whether the mother who claims compensation is opportunistic in nature and where her own behaviour resulted in an injury to the foetus. A woman's own behaviour causes injury to the foetus when she does not exercise proper care, does not have an understanding of her pregnancy, and has the intention to terminate the pregnancy. The confidence that the court derives in the process of foetal surgery is grounded on the fact that it is an elective choice on the part of the mother. The pregnant woman's decision to operate on the foetus and avoid termination of pregnancy itself is a manifestation of the bond she has with the fetus².

The surgeon's duty of care is affirmative in nature which means that they have to use their skill to support the patients that they have undertaken to treat. When surgeons meet both the pregnant woman and the foetus, there are certain instances to sacrifice the foetus to protect the life of the pregnant woman. The situation in foetal surgery is different as the surgeon has lawfully undertaken the duty to act for the sole benefit of the unborn child². A foetal surgeon has a clear understanding and knowledge about the existence of a foetus, the fact that his/her negligence would cause harm to the foetus and there is a duty on his/her part to guard against the negligence. As the new developments in

the field of foetal medicine signify, there is a direct medical duty of care owed to the foetus by the surgeon, and in the process of legislating; the interests of the foetus, pregnant woman, and the surgeon should be balanced.

CONCLUSION

Foetal surgery is a process that facilitates pregnant women to continue the pregnancy without selecting the option of termination due to birth defects of the child. In the USA, wrongful death liability has been recognized in the context of unborn children as well. An injury caused to a foetus as a result of a negligent act of a surgeon was considered compensable. A claim was predominantly based on two grounds namely the 'born alive' standard and the 'viability' standard. A viable foetus is entitled to be compensated for the injuries caused. Thus, when a viable foetus is injured in a womb and born alive, the child is capable of claiming compensation upon the proof of the continued effects of the injury so inflicted. When it comes, to the continued effects of the injury on a foetus, the establishment of the causal nexus is significant, and it becomes convenient due to the process of monitoring before and after the surgery. The proof of injury is way more convenient in comparison to the conventional cases of wrongful death of a foetus when the behaviour of the mother and outsiders caused the dilemma. The foetal surgery is done at a request of a pregnant woman for the best interest of the foetus, and it cannot be argued that she was an opportunistic claimant of compensation who had no knowledge of pregnancy and the wellbeing of the foetus. In addition, a foetal surgeon is fully aware and legally undertakes the duty of acting for the sole benefit of the foetus and has a crystal-clear obligation to avoid negligence.

CONFLICTS OF INTEREST

None

ETHICAL ISSUES

None

SOURCES OF SUPPORT

None

AUTHOR CONTRIBUTIONS

APR: Whole work including interpretation and analysis.

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