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1. Hansen B. New York City epidemics and history for the public. In: Harden VA, Risse GB, editors. AIDS and the historian. Bethesda: National Institutes of Health; 1991. pp. 21-28.

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Accepted unpublished material

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EDITORIAL

Beyond Bones: The Expanding Role of Vitamin D in Metabolic and Cardiovascular Health

For decades, Vitamin D has been viewed primarily as the “bone vitamin” essential for calcium-phosphate homeostasis and skeletal health. While its role in preventing rickets and osteomalacia is undisputed, a growing body of evidence suggests that Vitamin D has far-reaching effects extending into metabolic and cardiovascular systems. This evolving understanding necessitates a paradigm shift: Vitamin D is not merely a nutrient for bones but a pleiotropic hormone influencing multiple organ systems (1).

Vitamin D as a Hormone: Biological Basis for Expanded Roles

Vitamin D functions more like a steroid hormone than a conventional vitamin. Upon activation, it binds to the Vitamin D Receptor (VDR), which is expressed in more than 30 tissues, including pancreatic β-cells, skeletal muscle, vascular smooth muscle, and cardiomyocytes (2). Through genomic and non-genomic actions, Vitamin D regulates over 200 genes involved in inflammation, cell growth, and metabolic regulation. This widespread distribution of VDRs provides a biological rationale for the diverse systemic effects observed in clinical and epidemiological studies (3).

Vitamin D and Metabolic Health: Diabetes and Insulin Resistance

One of the most consistent areas of research links Vitamin D with glucose metabolism. Experimental studies have shown that Vitamin D directly influences insulin secretion by binding to VDRs in pancreatic β-cells. It also improves insulin sensitivity in peripheral tissues by enhancing expression of insulin receptors and modulating intracellular calcium (4).

Epidemiological studies reveal that Vitamin D deficiency is associated with higher prevalence of type 2 diabetes and metabolic syndrome (5). While some randomized controlled trials demonstrate modest improvements in insulin resistance after Vitamin D supplementation, others fail to show significant benefit (6). These mixed results may be explained by variations in baseline deficiency status, genetic differences in VDR polymorphisms, and heterogeneity in dosage and duration of supplementation.

Obesity and Adipose Tissue Function

Obesity is both a cause and consequence of Vitamin D deficiency. Adipose tissue sequesters Vitamin D, reducing its bioavailability. Conversely, deficiency exacerbates obesity-related metabolic dysfunction by increasing systemic inflammation and impairing lipid metabolism (7). Emerging research suggests that Vitamin D may regulate adipokines such as leptin and adiponectin, thereby influencing energy balance and fat distribution (8).

Vitamin D and Cardiovascular Health:Hypertension and Vascular Function

The renin–angiotensin–aldosterone system (RAAS) plays a pivotal role in hypertension and cardiovascular disease. Vitamin D has been shown to suppress renin expression, thus attenuating RAAS overactivity (9). Observational studies consistently demonstrate an inverse relationship between

serum Vitamin D levels and blood pressure (10). However, supplementation trials yield conflicting outcomes—some report modest blood pressure reduction, while others show no effect (11).

Atherosclerosis and Coronary Artery Disease

Vitamin D deficiency is strongly associated with endothelial dysfunction, vascular stiffness, and increased inflammatory burden—all key contributors to atherosclerosis (12). Experimental studies indicate that Vitamin D modulates macrophage activity, reduces foam cell formation, and inhibits vascular smooth muscle proliferation (13). These anti-atherosclerotic effects provide a mechanistic link to observational findings that low Vitamin D status correlates with higher incidence of coronary artery disease, myocardial infarction, and stroke (14).

Heart Failure and Arrhythmias

The presence of VDRs in cardiomyocytes suggests a direct role for Vitamin D in cardiac remodeling and contractility (15). Deficiency is linked with left ventricular hypertrophy and increased risk of heart failure (16). Furthermore, disturbances in calcium homeostasis caused by inadequate Vitamin D may predispose to arrhythmias (17). While supplementation has not yet emerged as a definitive therapy for heart failure, ongoing trials are exploring its potential in adjunctive management (18).

Controversies and Challenges

Despite promising associations, translating Vitamin D research into clinical recommendations remains fraught with challenges. Several large randomized controlled trials, such as the VITAL study, reported neutral results regarding cardiovascular outcomes (19), raising questions about causality. Critics argue that the benefits of Vitamin D may be confined to individuals with frank deficiency, while supplementation in those with sufficient baseline levels offers little advantage (20).

Another complexity lies in determining the optimal threshold for sufficiency. While most guidelines define deficiency as serum 25(OH)D levels below 20 ng/mL, some experts advocate for higher cut-offs (≥30 ng/mL) for optimal cardiometabolic protection (21). The debate underscores the need for individualized approaches considering genetics, lifestyle, and comorbidities.

Public Health and Clinical Implications

Vitamin D deficiency is highly prevalent worldwide, particularly in South Asia, the Middle East, and parts of Africa, where sun exposure is limited by lifestyle and cultural practices (22). In Bangladesh, recent surveys indicate deficiency rates exceeding 60% in certain populations. This widespread deficiency presents both a challenge and an opportunity.

From a clinical standpoint, screening for Vitamin D deficiency in patients with diabetes, obesity, or cardiovascular disease may help identify those at risk. From a public health perspective, fortification of staple foods and community-level supplementation programs could serve as cost-effective strategies to mitigate the burden of cardiometabolic diseases (23).

Future Directions

To fully elucidate the role of Vitamin D in metabolic and cardiovascular health, future research must address several gaps:

- Precision medicine approaches: Genetic studies on VDR polymorphisms may help identify subgroups that derive the greatest benefit from supplementation (24).

- Long-term interventional trials: Large, well-designed trials with adequate dosing and longer follow-up are needed to establish causality (25).
- Integration with digital health: Wearables and AI-based prediction models could track sun exposure, dietary intake, and serum levels, personalizing Vitamin D recommendations (26).
- Combination therapies: Studying Vitamin D supplementation alongside other interventions—such as statins, antihypertensives, or antidiabetic agents—may reveal synergistic effects (27).

Conclusion

The journey of Vitamin D research has evolved from rickets prevention to exploring its potential in reducing the global burden of chronic diseases. While definitive evidence remains elusive, the expanding role of Vitamin D in metabolic and cardiovascular health is undeniable. For clinicians, the message is clear: ensure sufficiency, particularly in high-risk groups, while awaiting further evidence to refine therapeutic strategies. For researchers, the challenge is to untangle causality from association and move from observational promise to clinical impact.

Vitamin D, once considered merely the guardian of bone health, is now emerging as a silent modulator of the heart, vessels, and metabolism. Its story is still being written—but the chapters ahead may redefine preventive medicine in the 21st century.

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An assessment of the prevalence and contributing factors of road accidents in Bangladesh

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Abstract

Aim: *This study aims to assess the prevalence and contributing factors of road accidents in Bangladesh, discussing the data collection and documentation process, particularly the Accident Report Form (ARF).* ***Methods:*** *Utilizing secondary qualitative data, the study critically evaluates the ARF and associated procedures, identifying deficiencies and proposing criteria for improvement.* ***Findings:*** *The analysis reveals challenges in comprehending the ARF, leading to inaccuracies in data entry. Essential details are missing, contributing to incomplete reporting. Discrepancies between the ARF and other incident records highlight the need for a streamlined and accurate documentation process.* ***Conclusion:*** *The study emphasizes the importance of a reliable incident database for effective transportation risk management. Recommendations include enhancing the ARF, providing better training for personnel, and implementing a robust data entry system to ensure accurate reporting and promote road safety initiatives in Bangladesh.*

Keywords: *Road accidents, tracking, recording, data, Bangladesh.*

Introduction

Over the past 20 years, there has been an unprecedented increase in traffic accidents in the country of Bangladesh, which has resulted in multiple interpersonal and monetary damages due to injury and casualties (1). A thorough accident database may contribute to substantial advancements in incidence minimization. The gathering and execution of reliable and thorough data regarding traffic occurrences is an integral component of crucial significance in the supervisory role of roadway safety. The analysis of the results can allow us to measure the usefulness of highway safety initiatives, enhance the understanding of technical difficulties, and detect incident issues precisely (2). It additionally assists in determining the course of preventative measures. A detailed dataset is a fundamental requirement for the execution of any functional roadway security strategy. The origin, scope, and geographical distribution arrangement of the traffic accident issue should be recognized by any non-government or government organization engaged in transportation security initiatives.

The study addresses the prevalence and contracting factors of road accidents in Bangladesh while examining the dissemination and documenting procedure in the country.

According to the (3), there is a lack of data on the present Accident Report Form (ARF) to carry out an extensive investigation. The form contains 69 fields of data, of which only the incident attributes assessment can be conducted. In addition, the police personnel consider it challenging to comprehend the questionnaire and lack the capacity to fill out it precisely. Although there is no area on the form for this particular type of detail, still photographs are essential for post-accident inspections. Because the police departments lack webcams to record the incident, not even law enforcement has the capacity to take pictures of the accident location. Police utilize an outdated chainage registry that was established in 1996 to identify incident places, but it is unfortunately unable to figure out the precise areas (4). Additionally, the police department only retains files of incidents for which a complaint has been lodged. However, for a great number of tragedies that happen every single day in the country, no criminal complaint is ever registered at police departments, meaning that no evidence is archived anywhere.

In our nation, an FIR can be submitted in the course of a serious incident. The ARF is subsequently filled out in the context of an accident while driving. When we evaluate these two compilations of information, we find inconsistencies, which signals that we have neglected a few significant incident information from the initial documenting period. The validity of the evidence and the accuracy of the details of the linkages process are crucial aspects of the rate of accidents (5). Insufficient reporting has led to discrepancies in the compilations of accident data in our nation, especially when compared to less-intensity incidents. The institution and duties involved in safeguarding a relevant incidents database, the determination and assessment of accident-related factors, probable causes of mistakes in gathering mishap data, and deficiencies of the present framework with a couple of recommendations for advancement (6).

Methods

The study has used secondary data collected in qualitative form and conducted a critical evaluation of tracking traffic incidents in Bangladesh. Collecting data from multiple sources including previous research studies the study provides an analysis of the prevalence of traffic accidents in Bangladesh primary reasons and recommended interventions.

Analysis

Prevalence and contributing factors of Traffic Accidents in Bangladesh

Traffic accidents constitute a pressing global challenge, with developing nations facing a disproportionate burden. Bangladesh, as a densely populated South Asian country, grapples with a concerning prevalence of road accidents. This literature review aims to examine existing studies to comprehend the extent of traffic accidents in Bangladesh and explore the multifaceted reasons behind the alarming rates.

Studies conducted in Bangladesh highlight a consistent increase in road traffic accidents over the past decade. One study reported this upward trend, attributing it to factors such as rapid urbanization, population growth, and inadequate infrastructure development (4). Utilizing data from the Bangladesh Road Transport Authority (BRTA), their findings underscore the urgent need for effective interventions to mitigate the escalating accident rates.

Furthermore, another study conducted a comprehensive analysis revealing a pronounced difference in accident frequency between urban and rural areas (6). Urban regions, characterized by congested traffic, experience a higher incidence of accidents. This distinction emphasizes the importance of tailored interventions that consider the specific challenges posed by both urban and rural road environments.

Inadequate road infrastructure emerges as a significant contributor to traffic accidents in Bangladesh, as highlighted by multiple studies (4,7,16). Insufficient road maintenance, the absence of proper signage, and poorly designed intersections collectively heighten the risks for motorists and pedestrians alike (10). Additionally, high traffic density in urban areas has been linked to increased accident rates, with the incessant flow of vehicles and limited road space creating conducive conditions for collisions (11). Moreover, the role of driver behavior cannot be understated. Some studies emphasize factors such as reckless driving, disregard for traffic rules, and a lack of adherence to speed limits as significant contributors to the elevated incidence of accidents in Bangladesh (15).

The prevalence of traffic accidents in Bangladesh poses a critical challenge, necessitating a comprehensive understanding of contributing factors. The interplay of urbanization, population growth, inadequate infrastructure, and driver behavior underscores the complexity of the issue. Effective interventions must address these multifaceted challenges to mitigate the alarming rates of traffic accidents in the country (7).

The high prevalence of traffic accidents in Bangladesh is intricately linked to the inadequacy of its road infrastructure. Poorly maintained roads, lack of proper signage, and inadequately designed intersections contribute significantly to the heightened risks faced by motorists and pedestrians alike. The lack of maintenance exacerbates existing road hazards, while unclear signage and poorly designed intersections create confusion, further increasing the likelihood of accidents (11). Addressing these infrastructure deficiencies emerges as a pivotal component in any strategy aimed at enhancing road safety and mitigating the alarming rates of traffic accidents (10).

Moreover, the impact of high traffic density, particularly in urban areas, cannot be overstated. Bangladesh's rapid urbanization and population growth have led to an upsurge in vehicular traffic, resulting in chronic congestion on its roadways. The relentless flow of vehicles, constrained by limited road space, establishes

a conducive environment for accidents (18). Effectively managing this traffic congestion and expanding infrastructure to accommodate the growing number of vehicles are imperative measures to alleviate the burden of traffic accidents in the country. Beyond physical infrastructure, tackling the socioeconomic factors contributing to the overwhelming number of vehicles on the roads is equally crucial for fostering a safer and more sustainable road environment in Bangladesh.

Requirement of Accident Database

Reliable and detailed recording and utilization of traffic incidents is a fundamental element of the utmost significance in transportation risk administration. The analysis of the results will assist us in assessing the impact of highway safety initiatives, strengthening our knowledge of technical difficulties, and determining incident concerns promptly. It can also aid in the formulation of remedial actions (7). Incident record is analyzed by multiple individuals and institutions for a wide range of objectives, thus it's critical that the data gathering be done in a methodical, consistent manner using accepted forms. The following organizations are engaged in accessing information regarding traffic incidents:

- Road security professional
- Law enforcement personnel
- Layers
- Insurance companies
- Those in charge of publicity or training concerning safety on the roads
- Investigators
- Security Supervisor
- Suppliers of vehicles or their related parts, as well as distributors of roadway resources.

The accident-related information registry must be revised as precisely as practicable to prevent the loss of its usefulness due to a lack of credible information, which would have significant consequences on the formulation of remedial measures, projections of hazard expenditures, overall incident situation, and investments assessment. Different organizations and groups need traffic accident data for different kinds of purposes that are described below (8).

- Incident data is examined by highway experts to evaluate and come up with recommendations for improvement.
- For reasons of law, the data may be needed by authorities and prosecutors.
- In order to handle insurance claims, insurers need the data.
- To formulate and disseminate security awareness, learners require the details.
- For operational and statistical analysis, safety officials needed the data being
- provided.
  Scholars and investigators need knowledge
- for diagnostic and investigation objectives.
  For improved planning purposes, the producers and vendors of relevant parts desire the expertise.

The process for tracking and documenting incidents

1. Origins and context of the accident report form (ARF)

In Bangladesh, the idea of an Accident Report Form (ARF) was first suggested in the early 1990s. The World Bank and the government of Bangladesh agreed the following year. They posed a query concerning the country's accident records. In the country of Bangladesh, there were no such figures earlier than 1995 (9). There are numerous assessments of individuals, food production, etc., but there is no concrete documentation regarding tragedies in Bangladesh. The World Bank then adopted an agreement to set up a mishap record in Bangladesh.

The World Bank subsequently looked at

adopting a Data Form to preserve track of incident figures, categories, explanations, as well as additional data. The World Bank then sent multiple state Language professionals to assist with the design of an accident data form. A questionnaire from the UK's Transport Research Lab (TRL) was presented. The form was international in dimension, having been implemented by TRL in approximately 32 different countries. Graham Elliott, a TRL consultant, gained incident data from Quazi Zakaria Islam and the Institutional Development Component (IDC) of the Second Road Rehabilitation and Maintenance Project (RRMP-2) for the Dhaka Metropolitan Police (DMP). The Department Responsible for International Development (DFID) of the British parliament grants financing to IDC.

Financing for the holistic development of the ii Road Rehabilitation and Maintenance Project (RRMP-2) was granted by the Department for International Development of the British State, which examines collisions on roadways in Bangladesh. An innovative form for documenting traffic accidents was established by IDC and Bangladeshi law enforcement, and it had its initial trial in DMP in the year 1995. When the DMP's law enforcement agencies were all linked through one computer network by the end of 1996, they were allowed to apply the knowledge to assess the traffic accidents that had taken place in the region surrounding the city. There have been a few beneficial improvements in tragic events as a result of the new accident examination approach.

Subsequently "Who is going to gather incident information?" is the issue to be addressed. The departments at the center of the government of a country usually handle these kinds of inputs. Union Parishad is a specific sort of organization that can be found in Bangladesh. However, union members are rather preoccupied with their corresponding duties. Therefore, it turned out to delegate this role to the security department, as they had to turn in a First Information Report along with going to accident locations in the event anyone suffered injuries there. In June 1995, the law enforcement and IDC partnered to come up with the Traffic Accident Report Form (ARF), which later became prevalent in the DMP's northern region. All DMP units had implemented the Accident Report Form (ARF) by the end of January 1996. By the beginning of 1998, it had been made accessible throughout the country. The ARF began operating across the country in both English and Bangla languages. In order to integrate this form into the FIR for incident instances, measures have been undertaken.

The country's Ministry of Law of the State of Bangladesh determined to formulate guidelines for the security forces of Bangladesh, despite the fact that law enforcement is subject to them. The Ministry of Law required about twelve months to implement the rule into law. According to Directive 254, investigators must thereafter perform the ARF (B). Act 254 (A) relates to incident claimants. ARF initially began as an experimental operation at Gulshan, Uttara, and Cantonment Thana. The first instruction given to law enforcement officers was "How to complete up ARF" by Quazi Zakaria Islam, an IDC analyst. The ARF has been given to the Dhaka Metropolitan Police (DMP) to be passed on around the metropolitan region of Dhaka concluding the trial run and educational sessions. In 1998, the ARF had been successfully distributed throughout Bangladesh by the Law Enforcement Headquarters. The Transport Research Laboratory in the United Kingdom developed the MAAP5 programming package expressly for the maintenance and examination of data concerning collisions on the road. It has been implemented in many nations around the globe, particularly numerous in the Asian continent, and several British enforcement

agencies are currently implementing it. The DMP Headquarters has the MAAP5 technology put in place and a significant amount of this paperwork is made up of information from the device that has been updated with MS Office.

2. Development of the MAAP5 database by police

Law enforcement officers keep track of individual injury-related accident events, fatalities, and automobile details in First Information Reports. Upon the keeping of records of a collision, the officer in charge of investigating accomplishes the Accident Reporting Form after undertaking additional inquiries. Every station of law enforcement has a responsibility to archive a confidential register of accidents. Investigators have a duty to document all incidents in that file with a distinctive number. Below is an instance of such an accident record:

Table 1: Format of accident register to be maintained in all police stations.

Serial No. of the Ac-cident	FIR No.	Date of Accident	Investigation Officer	Submitting Date to the HQ--
***	***	***	***	***
***	***	***	***	***
***	***	***	***	***

The Accident Report Form is then sent by the officer investigating the Superintendent of Police office. All Police Units within his area of responsibility provide Accident Reporting Forms, which the Superintendent of Police compiles and transmits to the Deputy Inspector General of Police (DIG) of the corresponding Area. The Accident Data Units (ADU) set up in DIG locations are where all of the incident evidence retrieved will be entered into systems. The Microcomputer Accident Analysis Package, or MAAP5, was the tool used to enter and evaluate all of the data (Fig.1). Every month, this assignment is sent by Floppy Disk to enforcement offices.

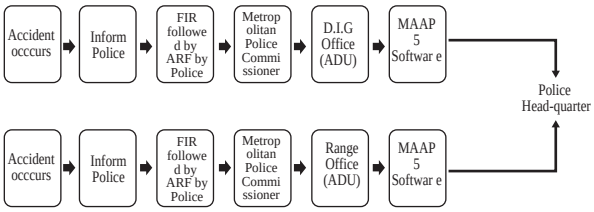

Figure 1. Accident Data Collection System

3. Other associated agencies

During an incident document, law enforcement may file it as a First Information Report or add it to the General Diary. Investigators obtained information at ARF by conducting an FIR. This paperwork is encrypted and provides distinctive numbers. The Superintendent of Police's office and the related Deputy General Police's office get the findings after that. Using MAAP programming, all of these facts have to be entered into an electronic device and examined. In basic terms, BUET's Accident Research Institute (ARI) applies the MAAP software. The roadway Safety Cell (RSC) of the BRTA and the Police Department collaborate to deliver the gathered data to ARI (13).

Some additional factors should be included, and the ones currently present that have been extracted from the ARF should be acknowledged, in order to strengthen the repository of data. The Road User Movement (RUM) identifier and additional info have been filled in by the Accident Research Institute by authenticating all ARFs that obtain it from Accident Data Units (ADU) with the objective of developing an accurate Incident Registry database [10]. Accident report forms are primarily assembled and studied and any adjustments that are required are done at ARI. After designating an RUM identifier for every single kind of incident, the MAAP5 repository obtains the data being supplied.

As previously mentioned, law enforcement

personnel in Bangladesh are in responsible for registering incidents. Because they are not sufficiently educated, a great deal of the documentation cannot be filled out accurately. However, ARF is barely lengthy in Bangladesh. In this nation, almost all of the incidents with lesser seriousness go undetected. Since there is a possibility of discrimination, most people have no intention of registering an official claim. Therefore, the majority of fatalities are not registered. Even documented mishaps are frequently not published precisely. Inadequate supervision of duty personnel may be demonstrated by findings.

Mistakes during Data entry

For investigation, 275 ARFs were picked randomly with the goal of exploring the current state of the accident registry in Bangladesh. There are 69 distinct fields in an ARF. Almost every aspect was thoroughly investigated, and certain fields for instance the total number of automobiles involved, the frequency of passenger fatalities, the moment of the incident, the roadway the lesson, etc. were determined that the officers conducting the investigation usually misinterpreted. There are still multiple subjects that need to be investigated, but there was not sufficient opportunity to accomplish so. Authorities continue to commit those mistakes because they are not accurately instructed. The Accident Research Institute, BUET, undertook this examination (12). Due to a lack of reporting and maintaining records, data on accidents in Bangladesh were unable to be obtained with any reliability. Additionally, there are inconsistencies as a result of the Investigating Officer's improper ARF completion. There are undoubtedly adequate explanations for why there are limited documentation and evaluations. The following section includes the explanations for lacking information or not lodging Accident Report Forms:

- Insufficient guidance on submitting the Accident Report Form (ARF).
- Provision of personnel with education or expertise.
- Additional duty from other employees' obligations.

The subsequent table illustrates the extent of discrepancies and inaccurate information caused by law enforcement personnel. This section contains specific information that law enforcement quite frequently completes out mistakenly.

Table 2. Accident Data reporting Situation by analyzing 275 forms of Dhaka Range (2009)

Item name	Police Data	ARF Edited Data	% Reporting	% Missing Data
No. of vehicles in-volved	376	396	96%	4%
No. of driver casual-ties	90	100	90%	10%
No. of passenger Casualties	152	222	68%	32%
No. of pedestrian ca-sualties	87	73	84%	16%

Due to time constraints, information obtained from a review of 275 Accident Report Forms (ARF) has been presented in this table. It should be emphasized that the authorities constantly make blunders with not only these objects but also a variety of others. After the submissions were reviewed, it turned out that 52 forms (about 19%) had in error moments areas, 68 forms (about 25%) had false connection categories, 57 forms (about 21%) had erroneously traffic regulation fields, 66 forms (about 24%) had mistaken accident types, 40 forms (about 15%) had erroneous transportation flow fields, 35 forms (about 13%) had erroneously split fields, and 34 forms (about 12%) had erroneously road lessons fields [14]. The detective always writes these sections out inaccurately. Data neglecting to report to the MAAP application is the consequence of this. It ultimately results in faulty investigation of accidents (11).

Other associated agencies

The only source of data on traffic accidents in the country is the Incident Database, which depends on the Accident Report Form (ARF) and MAAP5. A report of an incident template serves the purpose of tracking incidents that take place over a few decades. However, there are a few drawbacks to this application.

- The Bangladesh ARF does not contain details related to the manufacturer and sort of automobiles. These sections should be incorporated since it would make it less difficult for investigators to identify the person who is the person who owns the automobile.
- We may assess a variety of features of incidents using the ARF and MAAP5 resources. These merely offer us tangible and clearly understandable details. They are incapable of delivering an extensive investigation that is capable of providing a certain level of detail (16).
- There ought to be a space for the type of car in the ARF. However, a vehicle's structure is an essential aspect to take into account since a truck may resemble an emergency vehicle and a passenger car might come with two or four entrances.
- Bangladesh's ARF merely comprises an object-type screening for alcoholic beverages. However, as the majority of Bangladeshis do not consume alcohol, this usually has an undesirable consequence. The findings of any illicit substance tests should be publicized because using substances among adolescents can be an ongoing fashion statement and lead to disasters.
- The ARF does not contain an area for transportation. It would be quicker for the ARF operator to make changes to the submission form if he knew if the path was entirely, partially, or not approachable at all.
- Any time there is a collision, the car owner is not completely accountable. The main root cause of an incident could be an external factor, a pedestrian's erroneous or an imperfection in the automobile. Thus, this requires to be addressed extremely apparent.
- A significant number of car incidents go undetected. The level of regional and geographical inaccuracy of concealing could result in asset misuse and inadequate safeguards planning. The BUET Accident Research Institute (ARI) investigated the Dhaka-Aricha journey to figure out how much understatement there is. In accordance with the table, the Dhamrai Police Station has upwards of a 60% insufficient reporting frequency. Furthermore, an extensive review of publications demonstrated that there is a notable possibility of hiding casualty statistics.

Table 3. Extent of Underreporting of Road Traffic Accident (2003-2004)

Thana	Accident case filed in Thana	Accident in MAAP Data-base	% of Under-Recording
Savar	159	107	33
Dhamrai	58	23	60
Saturia	20	9	55
Manikgonj	47	25	47
Ghior	28	25	11
Shibalay	66	59	11

- Even during instances where incidents are documented, discrepancies may come up due to inaccurate interpretation of the Incident Report Sheet. There are noticeable differences between the monitored replication of ARF at Accident Research Institute and the MAAP facts, according to an examination. Correct information transcribing should be accomplished frequently to address the matter.

  Only the vehicle's seat seatbelt demand in

the ARF is deemed problematic. More hindering initiatives, such as infant restraints and neck and waist belts, ought to be introduced.

- Drivers do not constantly operate an automobile transport. Users of automobiles often drive vehicles. Another time, the one who drives could find employment in another industry. Thus, it is of the utmost importance to incorporate this subject matter.
- Occasionally, inspectors lack the ability to determine the precise location of the vehicle's destruction. An ARF automobile layout will assist the law enforcement officer in precisely determining the kind of vehicle and place of the incident (17).
- Analyzing the automobile's functionality after an incident is crucial. The location of the incident should be documented in the ARF for any subsequent examination, regardless of where the automobile ended up after the collision with the driver, the storage facility, or a repair facility.
- Although the ARF contains highway class, the road's component is not configurable. It is unable to ascertain whether the incident happened on the flyover, at the steps, or in the main street.
- ARF erroneous capture is one of the primary challenges brought on by an abundance of time and assets. This type of mistake is repeated on numerous occasions, leading to false statistical analysis. Typically, a large number of matters are found to be entirely unoccupied. Accurately completed out areas such as address and road distance lead to misinterpretation with additional data.
- Database instability is one of its main challenges. This section's responses can be altered throughout the years by individuals in the midst of that encoding and documenting, making it impractical to assess data from one single time frame to another. Worse yet, the person using the data might not be mindful of uncertainty, which would result in an insufficient assessment. The road safety investigator is truly required to be vigilant to find out if there are any inconsistencies of this kind. A dramatic shift in the frequency of accidents at an exact spot should also encourage the analyst to look for any statistical irregularities or other discrepancies (20).
- The heading of the Kilometer Post Catalogue is a further problem. The officer who is in charge of documenting an accident is frequently unable to complete elements 32 through 37 (Route, KM, 100 m, NODE MAP, NODE 1, and NODE 2). This kilometer post inventory also has some other issues. The inventory's kilometer figures were actually written in 1998.
- Although photographic evidence is crucial for post-accident examinations, there is no capacity on the form for this kind of data. Since there is no webcam in the police department for capturing the incident at the exact location or in the region that was impacted, officers can't manage to capture shots of what happened (18).

Developing Criteria's

- A system for occurrence spot recording has to be devised.
- Incorporating the image element in the Accident Report Form (ARF) must be included.
- A campaign to educate the public about the worth of information databases ought to be conducted.
- The MAAP5 program needs to be converted from the DOS to the Windows version.
- The officers in charge of the investigation who carry out the ARF ought to have received sufficient training.

Sub-inspectors ought to have comprehensive ARF knowledge.

- The instruction program's course outline ought to include the necessary resources.
- Enhanced interaction should be maintained between the BRTA Road Safety Cell, Police the main office, and ADUs (19).

Conclusion

In conclusion, an extensive analysis of contributing factors to the prevalence of traffic accidents in Bangladesh reveals a web of interconnected elements. Inadequate road infrastructure, traffic congestion, driver behavior, and economic-social factors collectively contribute to the challenge. Mitigating this complex issue necessitates a multifaceted approach that encompasses infrastructure development, traffic management strategies, behavioral interventions, and broader socio-economic considerations. Such a holistic approach is crucial for fostering a safer and more sustainable road environment in Bangladesh. The article has highlighted the normative protocol for registering and documenting accidents, along with the inaccuracies and boundaries of the party in charge of investigating and documenting. It also underlines how crucial the growth of databases is to Dhaka. Preserving precise archives of all mishap data is vital because they may inform subsequent efforts to prevent accidents. In Bangladesh, police accident reports are the sole point of information for the incident database. To combat this, personnel must get adequate education, and promoting consciousness is key. In order to address the possibilities associated with a lack of reporting, the collision information should be substantially extensive and trustworthy.

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ORIGINAL ARTICLE

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Antimicrobial susceptibility pattern of Escherichia coli from various clinical samples of urban health care facilities, Bangladesh

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Abstract

Background: *Escherichia coli is the main cause behind human infections of the urinary tract, ears, wounds, and other tissues. Concern over E. Coli's increasing antibiotic resistance is spreading throughout the world. The aimed of this study to determine antimicrobial susceptibility of E. coli from various clinical sources.* ***Methods:*** *A total of 160 samples of blood urine, wound swab and throat swab were analyzed for identification of bacterial isolates and their antimicrobial susceptibility pattern. Patient data was analyzed using descriptive statistical methods, including sample processing, organism identification, microscopic examination, and antimicrobial sensitivity testing, in accordance with Clinical and Laboratory Standards Institute guidelines.* ***Results:*** *Escherichia coli (E. coli) was isolated from 87 (54.37%) samples. The blood samples contained the majority of the E. Coli, 60 (68.96%), followed by urine 15 (17.24%) and throat swab 07 (8.05%). Nitrofurantoin (40%), nalidixic acid (32.8%), netilmycin (31.8%), and cotrimoxazole (26.9%) had the highest rate of resistance.* ***Conclusions:*** *Escherichia coli exhibits varying antibiotic sensitivity patterns, with high resistance to commonly used antibiotics. Effective antibiotics include nitrofurantoin, nalidixic acid, netilmycin, and cotrimoxazole, suggesting the need for antibiotic sensitivity testing.*

Keywords: *Antimicrobial susceptibility, Escherichia coli, Antibiotics, Bangladesh.*

Introduction

Escherichia coli is a rod-shaped, gram-negative bacterium usually inhabits the lower intestines of humans. It can result in nosocomial infections and is also present in hospital environments (1). Escherichia coli, often known by its widely used abbreviation, E. coli, is a common gut habitant which can be found in water, soil, and vegetation in among humans and animals. Escherichia coli is one of the most common causes of UTIs and also a major pathogen that can lead to bloodstream infections (2), otitis media, wound infections (3), newborn meningitis, and nosocomial pneumonia (4). Escherichia coli is a common cause of food- and water-borne diarrhea in humans, particularly in developing nations (5). It has been associated with multiple deaths, especially in children under the age of five (6,7).

Antimicrobial resistance poses a severe threat to public health worldwide, especially in developing nations where poverty, malnutrition, and infectious illnesses are rampant (8,9,10). It is one of the primary reasons why infectious disorders, such as those brought on by E. coli, fail to respond well to therapy, which raises morbidity, mortality, and healthcare costs (11). Globally, the problem of multidrug-resistant E. Coli is becoming more and more prevalent (12). There are notable regional variances in the incidence and susceptibility profile of E. coli clinical isolates, in addition to notable changes in different populations, clinical samples, and environmental factors.

Treatment of illnesses becomes more difficult when bacterial resistance to drugs increases. Generally speaking, bacteriological testing is not done in up to 95% of instances with severe symptoms before treatment begins. The susceptibility and occurrence profiles of Escherichia coli show notable changes across different populations and environments, in addition to large geographic variances (13). The region has conducted extensive research on the periodic epidemiology of E. coli to identify patterns of antibiotic resistance in individuals suffering from urinary tract infections (3,14). However, there is a need to look into the antibiotic susceptibility patterns of E. coli that has been isolated from different clinical samples in our area. The development of empirical treatment guidelines for E. coli in the region may be improved by the routine monitoring of antibiotic resistance patterns in E. coli from various specimens. The aimed of this study to determine antimicrobial susceptibility of E. coli from various clinical sources at Ad-din Akij Medical College, Khulna.

Methodology

The study was conducted at Ad-din Akij Medical College, Khulna, from May 2023 to December 2023. Data on microorganism culture and sensitivity was collected from blood, urine, wound swabs, and throat swab. 160 unique samples were collected and informed consent was obtained. Patient data was extracted from case sheets, and the collected data was analyzed using descriptive statistical methods. The procedural aspects encompassed sample processing, organism identification, microscopic examination and antimicrobial sensitivity testing (conducted using disc diffusion test in Mueller Hinton agar media,) in accordance with Clinical and Laboratory Standards Institute guidelines (15).

Culture and identification

Blood culture samples were collected aseptically in sterile containers following standard procedures (16). Hand hygiene was performed to reduce contamination risk. Blood culture bottles were inoculated with 8-10 mL of blood and sent to the microbiology laboratory. Urine samples were collected and incubated aerobically at 37ºC for 24-48 hours (17). Pus and throat swab samples were collected from wounds and throat with sterile swab stick and inoculated onto Blood agar, Chocolate agar, and MacConkey agar media. The inoculated samples were stored at room temperature and examined after 24 hours (18,19,20).

Microscopic examination

The colonies obtained from Blood agar and MacConkey agar plate were subjected to gram staining and observation under microscope was noted.

Sensitivity test

Susceptibility to various antimicrobial agents were tested by the disk diffusion method following Clinical and Laboratory Standards Institute (CLSI) guidelines (21). The tested antibiotic discs were amikacin, ciprofloxacin, cefixime, cefotaxime, ceftriaxone, cotrimoxazole, gentamycin, imipenem, levofloxacin, nalidixic acid, colistin, vancomycin, linezolid and nitrofurantoin. Nitrofurantoin used only for urinary isolates. After incubation at 37ºC for 24 hours, diameter of the zone of inhibition was measured and the isolates were classified as susceptible, intermediate and resistant according to CLSI criteria (15).

Results

A total of 160 samples were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing. E coli was isolated from 87 (54.37%) samples. The highest number of isolates (68.96%) were obtained from the blood samples followed by urine (17.24%), sputum (8.05%) and pus sample (5.75%). (Table -1)..

Table I: Distribution of specimens and culture positivity of E. coli

Sample	Number of samples tested	Positive for E. coli	Positive (%)
Blood	90	60/87	68.96
Urine	30	15/87	17.24
Pus	15	05/87	5.75
Sputum	25	07/87	8.05
Total	**160**	**87/160**	**54.37**

Table II: Age group and gender wise distribution of wound infection

Age group (years)	Male	Female	Total (%)
0-10	29	38	67 (41.87)
11-20	09	15	24 (15)
21-30	13	15	28 (17.5)
31-40	07	09	16 (10)
41-50	05	06	11 (6.87)
51-60	04	05	09 (5.62)
61-70	02	03	05 (3.12)
Total	**65**	**95**	**160 (100)**

The age of the patients ranged from 2 months to 70 years. E. coli was most common in the age group of 0-10 years followed by age group up to 10 years. (Table 2)

Table III: Antimicrobial susceptibility pattern of E. coli isolates.

Antimicrobial Agents	Total Number of isolates tested	Susceptible isolates			
		Total No.	%	Total No.	%
Amikacin	145	130	89.66	15	10.34
Cotrimoxazole	130	95	73.08	35	26.92
Ciprofloxacin	142	115	80.98	27	19.02
Ceftriaxone	145	110	75.86	35	24.14
Gentamycin	148	125	84.45	23	15.55
Imipenem	145	135	93.1	10	6.9
Netilmycin	135	92	68.14	43	31.86
nalidixic acid	125	84	67.2	41	32.8
Cefotaxime	125	95	76	30	24
Linezolid	135	115	85.18	20	14.82
Vancomycin	148	128	86.48	20	13.52
levofloxacin	145	132	91.03	13	8.97
Colistin	135	120	88.88	15	11.12
Nitrofurantoin	15	09	60	06	40

The overall antimicrobial susceptibility pattern of E. coli isolates from various clinical sources is given in the table 3.

Discussion

One of the most frequent bacteria that causes infections is Escherichia coli. Pub-patterns are still seriously threatened by E. Coli's antimicrobial resistance patterns. Overall, E. Coli showed a significant level of resistance to antibiotics in this investigation. The outcome agrees with the conclusions of earlier research (22). In this investigation, the resistance rates were found to be higher than in Khan (23) results and lower than in Iqbal and Patel's and Okonko (25) results. According to studies done in Slovenia (26) and Ethiopia (27), there is a high level of resistance in E. coli to erythromycin and tetracycline. The isolation rate of E. coli in the present study was 54.37% and it was commonly isolated from blood samples (68.96%). These findings are in conformity with the reports by other researchers (14). Although E. coli is generally perceived as an ‘antibiotic friendly’ pathogen, resistance has increased over the past decade (15). In this study, the overall resistance of E. coli to antimicrobial agents was high. Increasing irrational consumption rate of antibiotics, self-medication due to over- the-counter availability of antibiotics, non-compliance with medication, sales of substandard drug, consumption of food from animals that have received antibiotics, and

transmission of resistant isolates between people may account for the rise in antibiotic resistance. Among the various antibiotics tested, it showed highest rate of resistance to nitrofurantoin (40%), followed by nalidixic acid (32.8%), netilmycin (31.8%) and cotrimoxazole (26.9%).

Nitrofurantoin exhibits efficiency against prevalent sources of urinary tract infections, such as Enterococcus, Citrobacter, and E. Coli. Less consistently susceptible are Enterobacter and Klebsiella. Typically, resistant bacteria include Serratia, Acinetobacter, Morganella, Proteus, and Pseudomonas. In general, nitrofurantoin resistance is rare, and many organisms that are resistant to many drugs yet show susceptibility (28,29). Since nitrofurantoin was first used in clinical practice more than 50 years ago, susceptibility to it has essentially not changed. The use of regular nitrofurantoin therapy is limited to cases with complex cystitis since it does not reach therapeutic quantities in the bloodstream. This study found that nitrofurantoin has a remarkably high degree of sensitivity (60%) which is consistent with findings from earlier research carried out in Nepal (1,14). High rate of resistance (32.8%) has been detected in the present study for nalidixic acid, one of the important members of monocarboxylic acid. Consequently, new therapies must be developed when there is significant resistance to fluoroquinolones. One study they found that out of 50 E. Coli isolates that were tested, 100% of them showed resistance to penicillin and erythromycin. They also showed resistance to nalidixic acid (49%) and cephalexin (47%) as well as amoxicillin (86%), ampicillin (42%) and ciprofloxacin (37%), tetracycline (32%) and cefixime (18%) (30).

In this study, E. coli exhibited 10.34% and 15.55% resistance to the commonly used amynoglycosides i.e amikacin and gentamicin respectively. Resistance to aminoglycoside antibiotics, which are the only medications that may be used to treat serious Gram-negative infections acquired in hospitals, is concerning because persistent infections may need to be treated with more expensive, newer medications as a last resort. One of the antibiotics of last choice for numerous bacterial infections, including E. Coli and Klebsiella pneumoniae (31), is carbapenems, such as imipenem. Recently, there has been concern about these coliforms developing drug resistance to carbapenem antibiotics because they produce the New Delhi metallo β-lactamase, or NDM-1. Since bacteria resistant to carbapenems are now unaffected by new antibiotics, the global expansion of the resistance gene is viewed as a possible worst-case scenario (32,33). Thankfully, less isolates resistant to Imipenem were found during the current investigation. Imipenem is therefore a medication that should only be used to treat infections that have not responded to other antibiotics.

Conclusion

E. coli remains common pathogen among patients with urinary tract infection, wound infection and respiratory tract infection. It exhibits high rate of resistance to the commonly used antibiotics. Therefore, we must adapt guidelines to recommend antibiotics and design a comprehensive control program to reduce the high levels of bacterial antibiotic resistance among our population.

Conflict of interest: There is no conflict of interest relevant to this paper to disclose.

Ethical approval

This study was approved by the Institutional Ethics Review Committee (IERC) of Ad-din Akij Medical College, Khulna.

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ORIGINAL ARTICLE

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Trends in Addressing Different Cognitive Domains in SAQs of Anatomy Paper-I Written Examination Held Under Rajshahi Medical University

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Abstract

Background: *Short answer question (SAQ) is an important component of the written part of the first professional MBBS examinations in Bangladesh even after several revisions of the curriculum. No study was noted regarding the status of the implementation of the curricular directive on SAQ to assess the learning of the medical students at Rajshahi Medical University.* ***Objectives:*** *The present study was designed to assess the weightage given to different components of the cognitive domain in SAQs in anatomy in the first Professional MBBS Examination held under Rajshahi Medical University.* ***Materials and methods:*** *This was a descriptive cross-sectional study conducted in the Department of Anatomy, Ad-din Akij Medical College in Khulna, Bangladesh. All the SAQs of Anatomy, Paper-I of Rajshahi Medical University (from 2019 to 2023) were included. A total of 424 question parts and 550 question segments from 126 SAQs were analyzed in this study. Every question segment was assessed, categorized, and tagged as either recall, understanding, or application types. Then the total marks allocated for each type of the questions were calculated and compared with the total marks (98) allocated for total questions in a paper. Then the resultant weightage of marks was also compared with the curricular directive weightage of marks allotted for each type of SAQ.* ***Result:*** *In this study, it was revealed that 87.64% and 12.36% of SAQ segments were recall and understanding types respectively. No application type of question was found in any question paper.* ***Conclusion:*** *This study interpreted a lack of implementation of the curricular demands in SAQ question papers.*

Keywords: *SAQ, Anatomy, Recall, Understanding, Application*

Introduction

The assessment is a vital component of medical education, as it allows educators to measure the students' understanding of the subject matter, their mastery of specific skills, and their readiness for real-world application. In addition, a good assessment can help students become more effective self-directed learners (1). Assessment also influences the students' learning process, motivation, and self-regulation (2). Therefore, the assessment should be aligned with the curriculum and the expected outcomes of the medical education program to maintain a high professional standard. Hence, the review and formulation of curriculum components is an ongoing process in several medical schools all over the world (3). In Bangladesh, the undergraduate medical [Bachelor of Medicine and Surgery (MBBS)] curriculum was developed first in 1988 followed by several revisions in 2002, 2012, and 2021. Although the curriculum includes the continual formative assessment, nonetheless, the final summative (professional) examination plays a major role in determining students' passing or failing status. The written papers, viva voce sessions, and practical exercises are incorporated into the final summative examination of the first phase (i.e., the first professional MBBS examination).

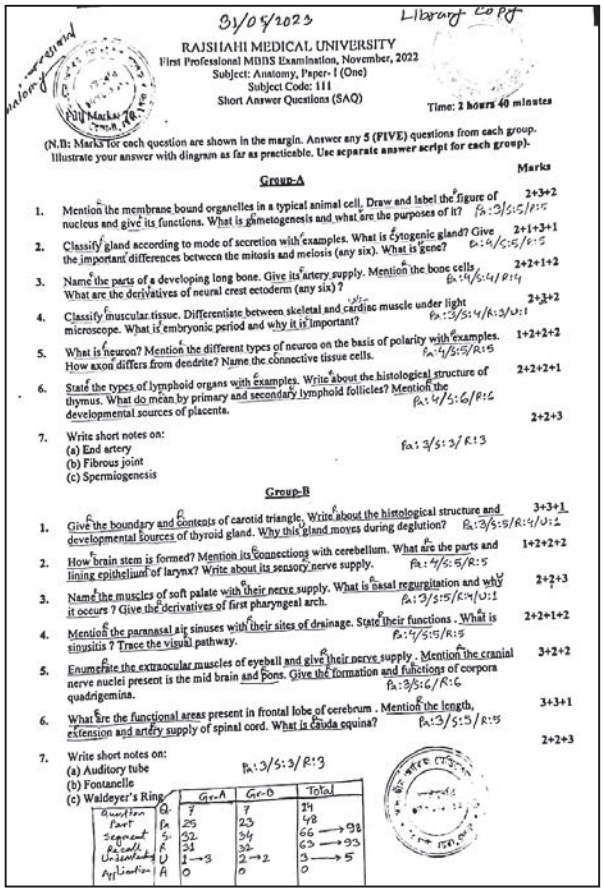
The written examination is traditionally an integral part of the evaluation in undergraduate medical education. It is a helpful assessment tool that evaluates students' higher-order cognitive abilities, such as data interpretation and problem-solving techniques, in addition to their memory of facts. The cognitive ability is also assessed by the written examination using essay question (EQ), modified essay question (MEQ), short answer question (SAQ), and multiple- choice questions (MCQ). The SAQ is an open-ended, semi-structured question format. The predetermined marking scheme of SAQ improves its objectivity and even these questions can incorporate clinical scenarios. Moreover, SAQs have better content coverage as compared to long essay questions (4). Therefore, the SAQs are more flexible in that, they can test creativity, spontaneity, and perhaps the most widely accepted tool. Although, the undergraduate medical (MBBS) curriculum of Bangladesh, published in 2021, shows an extensive modification of the assessment system in the written examination format adopting SEQ (structured essay question), PBQ (problem-based question), and SBA (single-best answer) type MCQ along with MTF (multiple true-false) type MCQ of the previous MBBS curriculum of 2012. However, SAQs still remain as an important part of written examinations in this new curriculum bearing 40% marks in each paper whereas 70% marks were allocated for SAQs in each paper in the previous curriculum. Therefore, the written examinations held under the curriculum of 2012 are a good

Source of SAQs for analysis which recommended 70% marks for recall, 20% for understanding, and 10% for application types of questions during the construction of the SAQs to assess different cognitive domains of students in anatomy. Moreover, no systematic evaluation has yet been conducted on the status of implementation as directed in the curriculum to assess the medical students' learnings in the first professional MBBS written examination of anatomy held under Rajshahi Medical University, a leading medical university in Bangladesh. Keeping this fact in mind, the present study was conducted to evaluate the status and determine the trends in addressing the cognitive domains of the students in the anatomy of MBBS course while constructing SAQs for the final summative (first professional) examination intended for further improvement in constructing SAQs according to the new MBBS curriculum of 2021.

Materials and Methods

This descriptive cross-sectional study was conducted in the Department of Anatomy of Ad-din Akij Medical College in Khulna, Bangladesh after obtaining permission from the institutional review board (IRB). The short answer questions (SAQs) of the Anatomy Paper-I of the first professional MBBS examination held under Rajshahi Medical University from the initiation of its activities till date i.e., from May 2019 to May 2023 were selected. As the first professional MBBS examination is being held twice a year, a total of 9 SAQ papers [(2 x 4) + 1 = 9] were included in this study. A total of 14 questions carrying 98 marks were contained in each paper as there were two groups (Group A and Group B) each having seven (07) questions contained seven (07) marks for each question. Every question had one or multiple parts (a separate complete sentence of an SAQ) and every 'part of an SAQ' had one or multiple segments (a component of a 'part of an SAQ' that calls for a different answer). Therefore, a total of 424 question parts and 550 question segments from 126 questions of 18 groups in 9 question papers were analysis in this study.

Every segment of an SAQ in a paper was assessed, and categorized as recall, understanding, or application type of question and was tagged accordingly by the superscripted symbols on each question paper. The process of selecting the parts and segments of the SAQs and tagging the question-type is shown in Figure 1. Subsequently, a table was formulated to calculate the total marks against each type of question observed in a paper and compared with the total marks of each group (49) as well as that of each paper (98). Then the resultant weightage (percentage) of marks was compared with the curriculum-recommended weightage (percentage) of marks for the respective component of the addressed cognitive domain (i.e., 70% for recall, 20% for understanding, and 10% for application types of questions). The statistical analysis was carried out using the software SPSS version 25.



RAJSHAHI MEDICAL UNIVERSITY
First Professional MBBS Examination, November, 2022
Subject: Anatomy, Paper- I (One)
Subject Code: 111
Short Answer Questions (SAQ)
Time: 2 hours 40 minutes

(N.B: Marks for each question are shown in the margin. Answer any 5 (FIVE) questions from each group. Illustrate your answer with diagram as far as practicable. Use separate answer script for each group).

Group-A

1. Mention the membrane bound organelles in a typical animal cell. Draw and label the figure of nucleus and give its functions. What is gametogenesis and what are the purposes of it? 2+3+2
2. Classify gland according to mode of secretion with examples. What is cytogenic gland? Give the important differences between the mitosis and meiosis (any six). What is gene? 2+1+3+1
3. Name the parts of a developing long bone. Give its artery supply. Mention the bone cells. What are the derivatives of neural crest ectoderm (any six) ? 2+2+1+2
4. Classify muscular tissue. Differentiate between skeletal and cardiac muscle under light microscope. What is embryonic period and why it is important? 2+3+2
5. What is neuron? Mention the different types of neuron on the basis of polarity with examples. How axon differs from dendrite? Name the connective tissue cells. 1+2+2+2
6. State the types of lymphoid organs with examples. Write about the histological structure of thymus. What do mean by primary and secondary lymphoid follicles? Mention the developmental sources of placenta. 2+2+2+1
7. Write short notes on: 2+2+3
   (a) End artery
   (b) Fibrous joint
   (c) Spermiogenesis

Group-B

1. Give the boundary and contents of carotid triangle. Write about the histological structure and developmental sources of thyroid gland. Why this gland moves during deglution? 3+3+1
2. How brain stem is formed? Mention its connections with cerebellum. What are the parts and lining epithelium of larynx? Write about its sensory nerve supply. 1+2+2+2
3. Name the muscles of soft palate with their nerve supply. What is nasal regurgitation and why it occurs ? Give the derivatives of first pharyngeal arch. 2+2+3
4. Mention the paranasal air sinuses with their sites of drainage. State their functions . What is sinusitis ? Trace the visual pathway. 2+2+1+2
5. Enumerate the extraocular muscles of eyeball and give their nerve supply . Mention the cranial nerve nuclei present is the mid brain and pons. Give the formation and functions of corpora quadrigemina. 3+2+2
6. What are the functional areas present in frontal lobe of cerebrum . Mention the length, extension and artery supply of spinal cord. What is cauda equina? 3+3+1
7. Write short notes on: 2+2+3
   (a) Auditory tube
   (b) Fontanelle
   (c) Waldeyer's Ring

Question Part	Gr-A	Gr-B	Total
Q	7	7	14
Pa	25	23	48
S	32	34	66 → 98
R	31	32	63 → 93
U	1 → 3	2 → 2	3 → 5
A	0	0	0

Figure 1: A sample question paper showing how each 'part' (Pa), 'segment' (S) and their cognitive domain addressed ['recall' (R), 'understanding' (U), or 'application' (A)] was tagged and counted using underlines, super-scripted symbols, and table on each paper.

Results

Among 424 question parts and 550 question segments of 126 short answer questions studied, the question parts were found more in Group-A (n = 221) than Group-B (n = 203) whereas the question segments were almost

equally distributed among both groups. The distribution of the question parts and the question segments is shown in Table 1.

Table I: Distribution of the parts and segments in each group of the question papers

Group	Examination	Part	Segment	Recall	Understanding	Application
Group A	May, 2019	23	29	25	4	0
	November, 2019	22	26	22	4	0
	May, 2020	23	27	22	5	0
	November, 2020	22	25	20	5	0
	May, 2021	26	34	32	2	0
	November, 2021	26	34	31	3	0
	May, 2022	27	33	28	5	0
	November, 2022	25	32	31	1	0
	May, 2023	27	34	32	2	0
Total		**221**	**274**	**243**	**31**	**0**
Group B	May, 2019	22	29	27	2	0
	November, 2019	21	35	35	0	0
	May, 2020	20	22	19	3	0
	November, 2020	19	28	25	3	0
	May, 2021	25	31	30	1	0
	November, 2021	25	36	35	1	0
	May, 2022	23	30	27	3	0
	November, 2022	23	34	32	2	0
	May, 2023	25	31	30	1	0
Total		**203**	**276**	**260**	**16**	**0**

Regarding the cognitive domain addressed in the SAQ papers, it was observed that the mean ± SD percentages of marks allocated for the recall type of question was 87.64% ± 7.49% whereas that of understanding type was 12.36% ± 7.49%. The scenario of the distributed marks over the years is shown in Table 2. Moreover, the application type of question was found to be not addressed in any segment of any question paper of any year.

The trends of the types of questions show an increased tendency of occurring the recall type of questions in recent years (the lowest was 79.59% in May 2020 and November 2020 and the highest was 94.90% in November 2022) and it was always far more than the curriculum directed recommendations (70%). A decreasing tendency of occurring the understanding type of questions (lowest was 5.10% in November 2022 and highest was 20.41% in May 2020 and November 2020) was observed

Table II. Proportion of the types of questions of the SAQs in Anatomy Paper-I written examination held under Rajshahi Medical University

Examination	Recall	Under-standing	Appli-cation
May, 2019	84.69%	15.31%	0%
November, 2019	89.80%	10.20%	0%
May, 2020	79.59%	20.41%	0%
November, 2020	79.59%	20.41%	0%
May, 2021	92.86%	7.14%	0%
November, 2021	90.82%	9.18%	0%
May, 2022	83.67%	16.33%	0%
November, 2022	94.90%	5.10%	0%
May, 2023	92.86%	7.14%	0%
Mean	**87.64%**	**12.36%**	**0%**

that didn't meet the curriculum directives (20%) except for the year 2020 (Figure 2).

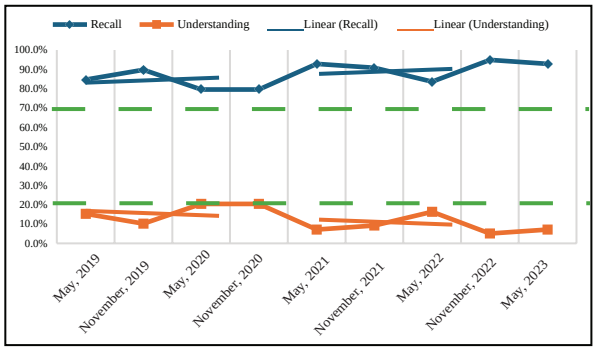


Fig 2. Percentages of marks as distributed for different types (recall, understanding, or application) of questions in SAQs of anatomy and their trends over the years in the first professional written examination held under Rajshahi Medical University. Note the green dotted lines placed as reference lines representing the curriculum directed marks for recall (70%) and understanding (20%) types of questions. Record the absence of the application type of questions also.

Discussion

All the short answer questions (SAQs) of Anatomy, Paper-I of the first professional MBBS written examination held under Rajshahi Medical University were analyzed in this study revealing that the recall type of question is dominating in every group of Paper-I of all question papers (mean was 87.64%) and even it always goes beyond the curricular recommendations of 70%. This increased tendency of distributing more marks for recall type of question is also observed in the first professional MBBS written examination of Anatomy held under the University of Dhaka from the year 2009 to 2014 as observed by Akhter and Sayeed (5), meanwhile, their observed value (76.58%) was almost nearer to the curricular directives. In 2022, Rajwana et al. (6) noted that more than 80% of the total SAQs of physiology written examination among all the four medical universities of Bangladesh were also recall type of question. A report by Tariq et al. (7) in Pakistan also depicted a similar trend of distribution of marks for the recall type of question (90.7%) in their 'internal assessment examination' on pharmacology. However, this higher percentage of occurring the recall type of question in the SAQ papers showed be shifted towards addressing the higher level of the cognitive domains as the assessment culture in the newer curriculum aims at assessing the acquisition of higher- order thinking processes and competencies instead of mere factual knowledge and low-level cognitive skills (8).

In this study, it was found that the weightage of the distributed understanding type of questions (12.36%) throughout the papers did not meet the recommendation of the curriculum (i.e. 20%). Moreover, it showed a downward trend over the last few years. In contrary to this, Akhter and Sayeed (5) observed 23.42% of marks were allocated for the understanding

type in the question papers of the University of Dhaka, which was not much deviated from the curricular directive. Rajwana et al. (6) found 11-13% understand type questions in physiology. Nevertheless, this declining tendency should be taken into account during the construction of questions to implement the recommendations of the curriculum.

The most striking finding of the current study was the absence of the application type questions in all the question papers. This lack was also pointed out by Akhter and Sayeed (5) in the anatomy questions of the University of Dhaka. A very negligible portion of the questions in physiology (0.25-0.95%) were found to be of application type as noted by Rajwana et. al. (6). Although the detailed scenario of anatomy, as well as that of the other subjects, is not clear yet, this small scenario of the present study assumes that the effort in the construction of SAQs may not be reached up to the mark or there may be a lack of training on implementation of the curriculum. However, structuring the question papers may improve the status.

Conclusion

The study interpreted the lack of implementation of the curricular demands in addressing different cognitive domains of the students in the first professional MBBS examination held under Rajshahi Medical University. Nonetheless, further study would be instituted to ascertain the detailed scenario of the written examination of anatomy. To improve the quality of SAQ and increase the efficacy of the faculty members, we recommend regular and intensive training programs on curriculum should be arranged.

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Study of Oxidative stress in patients with type 2 diabetes mellitus

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Abstract

Aim: *Oxidative stress is increased in metabolic syndrome and type 2 diabetes mellitus (T2DM) and this appears to underlie the development of T2DM and diabetic complications. This study aims to know the oxidative stress as malondialdehyde (MDA) in type 2 diabetes mellitus patients.* ***Method:*** *This cross-sectional analytical study was carried out in the Department of Pharmacology & Therapeutics in collaboration with Rajshahi Diabetic Association General Hospital, Rajshahi from July 2017 to June 2018 to evaluate oxidative stress in type 2 diabetes mellitus. In this study, 30 patients with type 2 diabetes mellitus and 30 healthy control subjects were evaluated. Oxidative stress was determined by using a spectrophotometer. Most of the patients were aged 35-55 years of both sexes.* ***Result:*** *The mean fasting blood glucose and malondialdehyde levels of type-2 diabetes mellitus were 8.68±1.90 mmol/l and 5.14±1.33 µmol/l & that of control was 4.88±0.66 mmol/l and 1.73±1.16 µmol/l. MDA level was high in type 2 diabetic patients.* ***Conclusion:*** *There is an increase in MDA level which may be regarded as an important causative factor for the development of type-2 diabetes mellitus & its further complication.*

Keywords: *Type2 diabetes mellitus, MDA level.*

Introduction

Diabetes is considered a state of increased oxidative stress. Persistent hyperglycemia secondary to insulin resistance & diminished insulin secretion in type-2 diabetes mellitus leads to progressing organ injuries known as chronic or late diabetes complications (1). Hyperglycemia causes a release of tissue-damaging reactive oxygen species (ROS) and diminishes antioxidant agents. Several hypotheses describe the linkage of hyperglycemia with complications of diabetes. Among which it is postulated that (i) metal-catalyzed oxidation of glucose, described as auto-oxidative glycosylation, generates superoxide anion; (ii) nonenzymatic glycation and oxidation of proteins and lipids generate advanced glycation end products; and (iii) glycated proteins and advanced glycation end products react by glyco-oxidation, resulting in the production of oxygen-derived free radicals which impair insulin signaling pathways and induce cytotoxicity in the pancreatic beta cells (2). The free radicals induce damage to cells by passing the unpaired electron resulting in oxidation of cell components and molecules (3). Reactive oxygen species (ROS) have been involved in oxidative damage to DNA, proteins, and other macromolecules that contribute to the pathogenesis of a wide variety of diseases such as diabetes and cancer (4). To scavenge the deleterious effects of these free radicals, the body has different mechanisms to produce antioxidants, endogenous or exogenous, that will neutralize the elevated number of free radicals keep the cells protected against their toxic effects, and contribute toward the prevention of diseases (5). The imbalance between the rate of free radical generation and their elimination due to a decrease in the available antioxidant mechanisms leads to the imbalance of oxidative stress (OS), which is ultimately linked to the manifestation of macro and microvascular complications (6). The increased prevalence of free radicals in type-2 diabetes mellitus results in the activation of stress-signaling pathways and drains both enzymatic and non-enzymatic antioxidants, harming the quality of life and lifespan of the patient (7). Free radicals cause overproduction of malondialdehyde (MDA), which is a biomarker of oxidative damage to lipids. This study was undertaken to assess the oxidative stress as expressed by MDA levels in type 2 diabetic patients.

Methods

This was a cross-sectional analytical study conducted in the Department of Pharmacology and Therapeutics, Rajshahi Medical College, in collaboration with Rajshahi Diabetic Association General Hospital, Rajshahi. The study was conducted among 30 type 2 diabetes mellitus & 30 normal healthy individuals. The inclusion criteria were: Clinically diagnosed type-2 diabetes mellitus patients & healthy controls between 35 to 55 years of age, irrespective of sex. The exclusion criteria were: Patients with serious comorbid diseases (stroke, myocardial infarction, major surgery, etc.), patients with liver and kidney dysfunction, history of using drugs that significantly affect glucose metabolism (glucocorticoids, oral contraceptives, thiazide diuretics, etc.) or taking vitamin supplements. The study variables were age, duration of disease, MDA (micromol/l) and glucose (mmol/l). Formal permission was obtained from the Ethical Review Committee of Rajshahi Medical College, Rajshahi to select this study. After getting permission from the concerned authority, every patient was informed about the study, and they were also informed that there was no chance of any significant harm. The data was collected from the outpatient department fulfilling the inclusion criteria attending Rajshahi Diabetic

Association General Hospital, Rajshahi. An elaborate history was taken for everyone regarding present & previous history of illness suggesting type-2 diabetes mellitus and any diabetic complication. After obtaining in -formed consent, complete history taking, and physical examination were done and recorded in a preformed data sheet. Then 4 ml blood was taken from each person in a test tube containing anticoagulant tri-potassium EDTA (Ethylene di-amine tetra acetic acid). Plasma was collected after centrifuging for 15 minutes at 3000 rpm. Then plasma MDA level was measured and the obtained data was analyzed using SPSS version 16. Frequency and percentages were calculated. The unpaired t-test was used for comparing means. Significance was kept at a p-value less than 0.05.

Measurement of oxidative stress as MDA (Lipid peroxidation)

Measurement of oxidative stress as MDA (Lipid peroxidation)

Principle

The most frequently used test is the measurement of MDA by the thiobarbituric acid (TBA) reaction. Here, TBA reacts with MDA to form a pink 2:1 TBA: MDA adduct, which is extracted by n-butanol and absorbs maximally at 532 nm. This colored complex can be measured by a spectrophotometer (SEQUOIA TURNER CORP. model 340 spectrophotometer).

Sample:

Plasma

Reagents:

Reagents for estimation of MDA
20% TCA- reagent grade
0.05 M sulfuric acid---E. mark
2 M sodium sulfate-mol. wt.-142.05 BDH (lab reagent grade)
0.2 G% TBA in sodium sulfate
n-butanol---Riedel-de Hein (analytical grade)
MDA standard (1-1-3-3 tetra ethoxy propane)

Procedure

0.5 ml plasma was mixed with 0.5 ml distilled water and 1 ml of 20% trichloroacetic acid and waited for 10 min. Then 2 ml sulfuric acid (0.05 mol/L) and 2 ml of thiobarbituric acid (TBA) reagent (2.0gm TBA/L in 2 mol sodium sulfate/liter) were mixed. The test tube was placed in a boiling water bath for 30 min and cooled in running tap water. The TBA reactive material was mixed with 2 ml n-butanol and centrifuged for 10 minutes after vortexing. A standard MDA was treated similarly. The optical density (O.D) of the n-butanol extract of plasma and MDA standard was measured at 532 nm against a butanol blank. The result was expressed as µmol MDA/L of plasma.

Calculation

$$\text{MDA (µmol/L)} = \frac{O.D\ of\ sample}{O.D\ of\ standard} \times 10$$

Parameters of study

Demographic parameter: Age & duration of the disease
Study parameter: Oxidative stress as Malondialdehyde (MDA)

Results

Table-I. Demographic parameters of type-2 DM and normal subjects.

Parameters	Group	
	DM (Mean±SD)	Control (Mean±SD)
Age	47.43±5.41	41.56±6.43
Duration	5.63±3.58	-

Table-I. Shows that 30 patients belonged to each group. The mean age and duration of disease in type-2 DM was 47.43±5.41 & 5.63±3.58 years. The mean age in normal control was 41.56±6.43 years.

Table-2. Study parameters of type 2 DM and normal subjects.

Variables	DM patients (30)	Control (30)
FBS (mean±SD)	8.68±1.90 **mmol/l**	4.88±0.66 **mmol/l**
MDA (mean ±SD	5.14±1.33 **µmol/l**	1.73±1.16 **µmol/l**

Table-2. Shows that 30 patients belonged to each group. The mean of FBS and MDA in type-2 DM was 8.68±1.90 mmol/l and 5.14±1.33 µmol/l. The mean of FBS and MDA in normal control was 4.88±0.66 mmol/l and 1.73±1.16 µmol/l.

Table-3. Comparison of biochemical parameters between type 2 DM and normal subjects

Variables (biochemical characteristics)	DM (Mean± SD)	Normal subject (Mean± SD)	Test of Significance
FBS	8.6800± 1.90071	4.8833± 0.66493	**t**=10.327 **df**= 58 **P**=.000
MDA	5.1433± 1.33899	1.7333± 1.16570	**t**=10.521 **df**= 58 **P**=.000

Test of significance done by Independent 't' test

Table-3 Shows a comparison of biochemical parameters between DM patients and healthy individuals. It was observed that biochemical parameters were statistically significant (P<0.05) when compared between these two groups.

Table-4. Pearson correlation of FBS and MDA level of type 2 DM patients.

Variables	Pearson Correlation	p-value
FBS with MDA	**0.66**	**0.00001**

Table 4 shows a positive correlation between FBS and MDA (r = 0.66, P<0.00001) in DM patients.

Discussion

Oxidative stress arises when the production of ROS exceeds the capacity of the available antioxidant defense system. Elevated oxidative stress is a well-accepted explanation for the development and progress of complications in diabetes mellitus. The excess ROS tends to react with all cell components, resulting in lipid peroxidation, protein denaturation, and DNA damage. In this study, 30 were type-2 DM patients and 30 were normal healthy control. The mean age and duration of disease of type-2 DM was 47.43±5.41 & 5.63±3.58 & the mean age of healthy control was 41.56±6.43 years. The mean of FBS and MDA of type-2 DM was 8.68±1.90 mmol/l, 5.14±1.33 µmol/l. The mean of FBS and MDA of healthy control was 4.88±0.66 mmol/l, 1.73±1.16 µmol/l. These results revealed that FBS & MDA were significantly increased in type-2 DM patients compared with healthy individuals. Similar findings were observed by Rani AJ et al., and Pinaki Saha et al., (8,9). They suggested that decreased levels of antioxidants and elevated oxidative stress are associated with increased risk of type-2 DM and its complications. A study performed by Kedziora-Komatowska et al., Bandeira et al., Li et al., and Ganjifrockwale et al., showed that high levels of lipid peroxidation in patients with type-2 DM & type-2 DM with complication compared to healthy individual (7,10,11,12). This agrees with the present study. In our study, it was observed that increased oxidative stress in type-2 DM patients compared to healthy individuals. Beg N et al., Bikkad et al., and Djordjevic et al., also reported increased lipid peroxidation in type-2 DM compared to healthy individuals (6,13,14). Another study performed by Rama Strivatsan et al., found that the MDA level was

significantly elevated in type-2 DM with complication compared to type-2 DM without complication & healthy control (15). In the present study, it was found that there was a positive correlation between FBS and MDA. Similar findings were observed by Pinaki Saha et al., (9). Free radicals and oxidative stress may act as a common pathway to diabetes itself as well as its later complications and significantly higher lipid peroxide in diabetic patients. Thus, it could be concluded that increased oxidative stress may play an important role in the development of type-2 diabetes mellitus & its further complications.

Conclusion

This study is compatible with the hypothesis that persistent hyperglycemia leads to increased production of oxidants. A high level of lipid peroxidation accompanied by insufficient antioxidant capacity in plasma could be attributed to the development of diabetes mellitus disease & its chronicity. Thus, the delivery of antioxidants and concentration-based dosage schedule in antioxidant trials might synergistically affect antioxidants in human plasma and provide greater protection against free radicals.

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Relation between BMI and Non alcoholic fatty liver risk

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Abstract

Background: *Nonalcoholic fatty liver disease (NAFLD) is the most ordinary liver disease worldwide. The growing body of evidence has demonstrated that BMI is risk factor for cardiovascular disease, and the pathological processes included insulin resistance, oxidative stress, and systemic inflammation, which are all considered as important risk factors for the development or progression of NAFLD. Limited evidence is available regarding the association between BMI and NAFLD.* ***Aims and Objectives:*** *The aim of this study was to investigate the association of BMI with non-alcoholic fatty liver disease.* ***Materials and Methods:*** *A cross-sectional observational study carried out in the Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet in collaboration with the Department of Hepatology, Sylhet MAG Osmani Medical College, Hospital during the period between July 2017 and December 2018. Fifty cases of NAFLD and 50 age and sex matched healthy subjects were selected. BMI of both case & control were measured.* ***Results:*** *The mean BMI of the non-alcoholic fatty liver disease was 26.08 ± 1.41 (range 23.44-30.10) kg/m^2; whereas the mean BMI of the control subjects was 23.89 ± 2.31 (range 17.82-30.10) kg/m^2. The mean BMI of non-alcoholic fatty liver disease was significantly higher than that of control subjects ($t=5.718$; $p<0.001$).* ***Conclusion:*** *It may be concluded that BMI is strongly associated with non-alcoholic fatty liver disease.*

Keywords: *BMI, Nonalcoholic fatty liver disease*

Introduction

Nonalcoholic fatty liver disease (NAFLD) is the most prevalent causes of chronic liver disease worldwide. It is characterized by increased fat accumulation in the hepatocytes of the liver parenchyma (1). Increasingly sedentary lifestyles and altering dietary patterns mean that the frequency of adiposity and insulin resistance has accelerated worldwide, and so fat collection in the liver is a familiar finding during abdominal imaging probes and on liver biopsy.

Several studies have suggested that a high BMI triggers risk factors for lifestyle-related diseases such as type 2 diabetes, cardiovascular diseases, cancers, and high UA (2). Indeed, a study by De Oliveira et al. has shown that individuals with BMI ≥25 kg/m^2 showed greater chances of high UA levels [odds ratio (OR) = 2.28 (1.13–4.6)] (3). Consequently, this study indicates that elevated BMI levels are closely related to high UA levels, and in order to prevent high UA, one should pay attention to BMI level change.

Hyperuricemia is associated with the NAFLD development, even after adjusting for potential confounders including metabolic syndrome features and insulin resistance (4,5). Regarding the prospective role, hyperuricemia has pro-inflammatory, pro-oxidant and insulin resistance properties in adipose tissue (6).

Therefore metabolic derangement based on insulin resistance is the most acknowledged cause of fat accumulation (7), and metabolic syndrome is considered to be a crucial mediator from simple over-nutrition to severe body lesion by promoting inflammation (6), and are hypothesized to explain the complex pathgenesis and progression of non-alcoholic fatty liver disease (8).

The proportion of nonalcoholic fatty liver disease is higher in people with type 2 diabetes (60%-70%), and in those who has high BMI compared to the general population (9,10,11). It seems that insulin resistance (IR) related to obesity is central to the pathogenesis of NAFLD. Moreover, oxidative stress and cytokines are main contributing factors, together resulting in steatosis and progressive liver damage in genetically susceptible individuals. Key histological components of NASH are steatosis, hepatocellular ballooning, and lobular inflammation (7).

Materials and Methods

This cross-sectional observational study was carried out in the Department of Biochemistry, Sylhet MAG Osmani Medical College, Sylhet in collaboration with the Department of Hepatology, Sylhet MAG Osmani Medical College, Hospital, during the period from July 2017 to December 2018 with a view to compare BMI between non-alcoholic fatty liver disease and healthy subjects. In this study 50 cases of NAFLD and another 50 age and sex matched healthy subjects were selected and grouped as group-A and group-B respectively. Informed written consent was taken before interview. Anthropometric measurements including height, weight, waist circumference and blood pressure were recorded. BMI was considered as weight in kilogram divided by the height in meter square. Fatty liver was diagnosed based on the findings of abdominal ultrasonography without alcohol consumption, viral or autoimmune liver disease. Fasting plasma glucose and fasting insulin were collected for biochemical analysis.

Result

The mean age of the participants of non-alcoholic fatty liver disease (Group-A) was 40.04 ± 9.37 years and control subjects (Group-B) was 40.90 ± 12.37 years. The mean age of the participants did not differ significantly between two groups (t=0.519; p=0.605) (Table-I).

The mean BMI of the non-alcoholic fatty liver disease was 26.08 ± 1.41 (range 23.44-30.10) kg/m^2; whereas the mean BMI of the control subjects was 23.89 ± 2.31 (range 17.82-30.10) kg/m^2. The mean BMI of non-alcoholic fatty liver disease was significantly higher than that of control subjects (t=5.718; p<0.001) (Table-I).

Table-I: Distribution of the participants according to baseline characteristics

Parameters	Case (n=50)	Control (n=50)	Test value	p-value
Age in years Mean ± SD	40.04 ± 9.37	40.90 ± 12.37	t=0.519	*p=0.605
Sex				
Male	28 (56.0%)	32 (64.0%)	p=0.667	p=0.414
Female	22 (44.0%)	18 (36.0%)		
BMI in Kg/M^2 Mean ± SD	26.08 ± 1.41	23.89 ± 2.31	t=5.718	*p<0.001

*unpaired 't' test and †Chi-Square (χ2) test were employed to analyze the data. P<0.05 was the level of significance.

Distribution of patients by serum insulin level:

The median serum insulin level (µIU/ml) was 9.36 (inter quartile range, 5.94-14.05) in non-alcoholic fatty liver disease and was 4.69 (inter quartile range, 3.44-6.72) in control subjects. The serum insulin level of the non-alcoholic fatty liver disease was significantly higher compared to control subjects (p<0.001) (Figure-1).

* Mann-Whitney U test was employed to analyze the data.

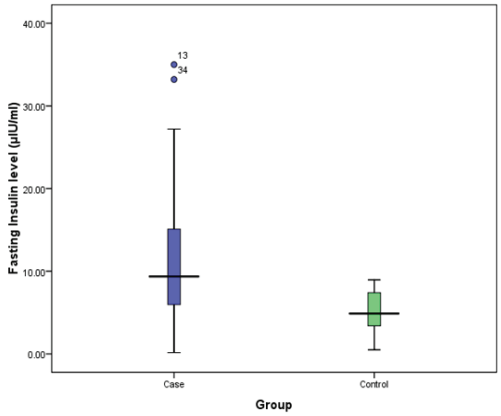

Figure 1. Distribution of patients by serum insulin level

Distribution of patients by fasting plasma glucose level:

The mean fasting plasma glucose level (mg/dl) was 130.54 ± 41.06 (range, 75.0-195.0) in non-alcoholic fatty liver disease and was 87.94 ± 17.38 (range, 66.0-161.0) in control subjects. The mean serum glucose level of the non-alcoholic fatty liver disease was significantly higher compared to control subjects (t=6.810; p<0.001) (Figure-2).

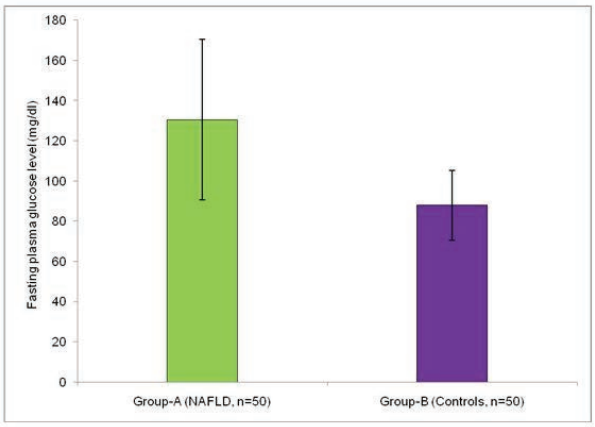

Figure 2. Distribution of patients by fasting plasma glucose level

* unpaired 't' test was employed to analyze the data.

Comparison of HOMA and insulin resistance between NAFLD and control subjects:

The mean HOMA level (mg/dl) was 3.29 ± 1.97 (range, 0.45-7.65) in non-alcoholic fatty liver disease and was 1.07 ± 0.40 (range, 0.38-1.95) in control subjects. The mean HOMA level of the non-alcoholic fatty liver disease was significantly higher compared to control subjects (t=7.803; p<0.001).

The frequency of insulin resistance and sensitive subjects were 56.0% and 44.0% in the group of NAFLD whereas none was insulin resistance and all were insulin sensitive in the without NAFLD group. Insulin resistance was significantly more in non-alcoholic fatty liver disease compared to control subjects (χ 2=38.889; p<0.001).

Table II. Comparison of HOMA and insulin resistance between NAFLD and control subjects

Parameters	Case (n=50)	Control (n=50)	Test value	p-value
HOMA	3.29 ± 1.97	1.07 ± 0.40	t=7.803	*p<0.001
Insulin				
Resistance	28 (56.0%)	0 (0.0%)	p=38.889	p<0.001
Sensitive	22 (44.0%)	50 (100.0%)		

*unpaired t test and Chi-square ($\chi 2$) Test were employed to analyze the data.

Discussion

Nonalcoholic fatty liver disease (NAFLD) representing a range of conditions from simple steatosis, nonalcoholic steatohepatitis to cirrhosis, is the most prevalent liver disease worldwide. NAFLD has been received as a major health compulsion and the prevalence is increasing year by year. In western countries, NAFLD has also become one of the most liver illnesses, affecting 20% to 40% of the general population. NAFLD is considered as a multifactorial chronic disease that is associated with genetic, environmental, and metabolic factors (12).

This study revealed that the mean BMI was 26.08 ± 1.41 kg/m^2 in non-alcoholic fatty liver disease and was 23.89 ± 2.31 kg/m^2 in control subjects. The mean BMI of non-alcoholic fatty liver disease was significantly higher than that of control subjects (p<0.001). This result was consistent with the study of Mohan et al., (2014) (13) where they observed the he mean BMI (kg/m^2) for NAFLD was 27.01 ± 3.53 and for controls (no fatty liver) was 23.91 ± 3.11. Elevated BMI was seen in NAFLD with a statistical significance (p < 0.05). This result was consistent with the study of Li et al., (2009) that body mass index (kg/m^2) was 25.9 ± 2.8 in non-alcoholic fatty liver disease and 22.5 ± 2.8 in control subjects; difference was significant (p<0.001) (14).

NAFLD subjects in the Bangladeshi population have previously been shown to have insulin resistance; however, the underlying causes of this defect are high BMI and hyperuricemia. In this settings, we found significantly higher (p<0.001) levels of HOMA in NAFLD subjects (3.29 ± 1.97) compared to the controls (1.07 ± 0.40). This result was consistent with the study of Hossain et al., (2018)(15) where they found that HOMA level was significantly higher (p=0.001) in NAFLD subjects (2.21 ± 1.01) compared to the controls (1.79 ± 0.51). This observation was also in agreement with a number of studies (16,17).

Conclusion

This study revealed that the mean BMI, serum insulin level, HOMA and insulin resistance were significantly higher in non-alcoholic fatty liver disease compared to control subjects. From the findings of this study, it may be concluded that high BMI has strong association in non-alcoholic fatty liver disease.

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