NUTRITIONAL ASSESSMENT OF ELDERLY PATIENTS (AGED 60 YEARS AND ABOVE) WITH TYPE 2 DIABETES MELLITUS IN CHANDPUR DISTRICT

A PROJECT REPORT

BY

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Submitted to the Department of Nutrition and Food Engineering in the partial fulfillment of B.Sc. in Nutrition and Food Engineering

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APPROVAL

This project, "**Nutritional Assessment of Elderly Patients (aged 60 years and above) with Type 2 Diabetes Mellitus in Chandpur District**", has been turned by **Sumiya Afrin** to the Department of Nutrition and Food Engineering at Daffodil International University. It has been accepted as a partial fulfillment of the requirements for the degree of B.Sc. in Nutrition and Food Engineering and approved for its style and content.

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DECLARATION

The project was completed under the supervision of **Juwel Rana, Assistant Professor**, Department of Nutrition and Food Engineering at Daffodil International University. I also affirm that neither this project nor any portion of this project has been submitted elsewhere for the purpose of earning a degree or certificate.

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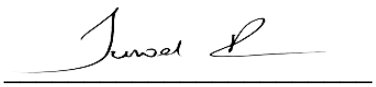

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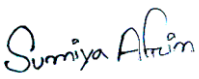

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ABSTRACT

This cross-sectional study, conducted at Chandpur Diabetic Hospital in Sadar Upazila, Bangladesh, aims to assess the socio-demographic, anthropometric, biochemical, and nutritional characteristics of 150 individuals aged 60 to 71 with diabetes mellitus. The study employed a structured questionnaire and the Mini Nutritional Assessment (MNA) screening tool. Descriptive statistics and crosstab analysis were used for data summarization and exploration of associations. Results reveal a predominantly female (66.7%), older adult population with diverse socio-demographic backgrounds. Biochemical parameters indicate variability in glycemic control and lipid profiles. Comorbid conditions, including dyslipidemia and hypertension, underscore the complexity of diabetes management. MNA screening identifies a significant proportion at risk of malnutrition (61.3%) and malnourished (30.7%) individuals. Nutritional status varies across gender, age, residence, income, exercise, and diabetes duration, emphasizing the need for targeted interventions.

Keywords: Type-2 Diabetes, Elderly patients, Nutritional Assessment, Nestle, MNA.

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CHAPTER 1

INTRODUCTION

1.1 Background

Diabetes mellitus (DM) has become a major public health problem whose prevalence rates increase with age. According to Nanda et al. (2022) globally, incident cases of T2DM more than doubled from 8.4 million in 1990 to 21.7 million in 2019, and deaths more than doubled from 606,407 to 1.5 million between 1990 and 2019. Global T2DM prevalence increased from 148.4 million in 1990 to 437.9 million in 2019 (Nanda et al., 2022). Currently, around half of patients with T2DM are over 65 years of age (Bellary et al., 2021). In addition, projections suggest that the number of people affected by DM worldwide will rise to 592 million by 2035 (Hardianto et al., 2020). Approximately half a billion people are living with diabetes worldwide, which means that over 10.5% of the world's adult population now have T2DM (Sanz et al., 2022).

Noncommunicable diseases (NCDs) are now the main cause of mortality in adults aged 60 and over (Alwan et al., 2010). The four main types of NCDs are cardiovascular diseases, cancers, chronic respiratory diseases and diabetes (Alwan et al., 2010), which together accounted for the largest portion of the global burden of disease with 41.1 million deaths (73.4%) and 874,500 (53.0%) years of life lost (YLL) in 2017 (Gilmour et al., 2022). The International Diabetes Federation estimated 7.1 million people with diabetes in Bangladesh (Mohiuddin, 2019). According to the International Diabetes Federation, the prevalence will be 13% by 2030. About 129,000 deaths were attributed to diabetes in Bangladesh in 2015, as reported by leading research organization ICDDR, B. In Bangladesh, the number of patients with diabetes will increase to an estimated 13.7 million by 2045, mainly T2DM, unless addressed (Akter et al., 2022).

It is very important to maintain a healthy nutritional status at any age. As a result, geriatric nutrition is the nutrition that helps to minimize the effects of aging and diseases as well as it helps to manage the physical, psychological and psychosocial states of the elderly population (Naik et al., 1979). The elderly population may be defined as those populations whose age is greater than 65 years of age. The elderly can be classified into two types such as early elderly (between 65 to 74 years of age) and late elderly (above 75 years of age) (Orimo et al., 2006).

In Bangladesh people who has age 60 years and above is considered an elderly person (Ali et al., 2013). The aging of the population is now a global issue and this is also an emerging issue in Bangladesh (Ali et al., 2013).

A study found that a huge number of older people had medical complications like cataracts, joint pain, hypertension, diabetes mellitus, etc (Kalyan et al., 2015). To minimize the adverse nutritional outcome, it is very important to conduct a nutritional assessment in older people to detect malnutrition. BMI is one of the most popular nutritional assessment tools and it is measured by using the weight and height of a person and is expressed as Kg/m^2. It can be used in many nutritional screening programs and it is an appropriate identifier of malnutrition.

Among the various nutritional assessment tools "Mini Nutritional Assessment" (MNA) tool is one of them. The development of the MNA tool was started in 1989 in a meeting of the "International Association of geriatrics and Gerontology" (IAGG). Older people can be classified as nourished, at risk for malnutrition, or malnourished through the MNA tool. MNA is performed in a two-step process to assess the nutritional status. About 10–15 min are required to perform a complete MNA (Secher et al., 2007).

Considering that NCDs have common risk factors that characterize western lifestyle, such as sedentary lifestyle, stress, obesity and smoking, several countries have acknowledged the need to invest in primary prevention of diseases. France, for instance, implemented the National Health Nutrition Program to reduce overweight and obesity in adults and children (Štotl et al., 2022).

Aging is associated with changes in individuals' body composition, increased fat mass and decreased lean mass due to decreased basal metabolism rate and physical activity, changes in appetite, decreased visual, olfactory and gustatory capacity, and swallowing disorders, thus leading to altered and lower nutrient intake (Soenen et al., 2013). These factors may contribute to the onset of eating disorders, which may result in obesity or malnutrition, which may be worsened by disability, social isolation, and mood disorders (Sanz et al., 2011).

In addition, malnourished diabetic patients have longer hospitalizations: four days longer than patients who are not malnourished. Therefore, screening for malnutrition is important not only to correct malnutrition, but also to prevent the unnecessary use of drug therapy in the prophylaxis of episodes of hypoglycemia (Guigoz et al., 1997). Given that, the present study aimed to screen the nutritional status of older adults with diabetes mellitus, seeking to outline the needs of this population group considering their socioeconomic status.

This study aims to conduct a comprehensive nutritional assessment of elderly patients with Type 2 diabetes mellitus (T2DM) residing in Chandpur district, Bangladesh. Elderly individuals with T2DM are a vulnerable population with unique nutritional needs and challenges, making it imperative to understand their nutritional status.

1.2 Objectives of the study

1.2.1 Primary objective

The primary objective of this study was nutritional assessment of elderly patients (aged 60 years and above) with Type 2 Diabetes Mellitus in Chandpur District, Bangladesh.

1.2.2 Specific objectives

1. To assess the socio-demographic characteristics of elderly patients with T2DM.
2. To evaluate the anthropometric measurements and biochemical parameters to understand the physical and biochemical characteristics of the patients.
3. To assess the nutritional status of the study population using MNA tool.
4. To analyze the relationship between socio-demographic characteristics and nutritional status.

CHAPTER 2

LITERATURE REVIEW

Vellas et al. (1999) have developed and validated the Mini Nutritional Assessment (MNA) as a comprehensive tool for promptly evaluating the nutritional status of older individuals in various healthcare settings, including outpatient medical centers, hospitals, and nursing homes. The document has undergone translation into other languages and has been subjected to validation in numerous clinics throughout the globe. The MNA exam comprises straightforward measures and concise inquiries that may be completed within around 10 minutes. The researchers used discriminant analysis to compare the results obtained from the Mini Nutritional evaluation (MNA) with the nutritional status as evaluated by doctors. The physicians utilized a comprehensive nutritional evaluation that included many measurements such as anthropometric data, clinical the field of biochemistry and dietary factors. The MNA score is used to differentiate between older patients based on their nutritional state. Specifically, it categorizes them into three groups: 1) those with acceptable nutritional status, indicated by an MNA score of 24 or more; 2) those with protein-calorie malnutrition, identified by an MNA score below 17; and 3) patients at risk of malnutrition, characterized by an MNA score ranging from 17 to 23.5. The scoring system yielded sensitivity of 96%, specificity of 98%, and prediction value of 97%. The MNA scale was also shown to have predictive capabilities in relation to death and hospitalization cost. It is of utmost significance to be able to identify individuals who are susceptible to malnutrition, with scores ranging from 17 to 23.5, prior to the manifestation of substantial alterations in body weight or albumin levels. According to Vellas et al. (1999), there is a higher probability for these people to have a reduction in their calorie intake, which may be effectively addressed by dietary intervention.

As to the findings of Vellas et al. (2001), the occurrence of malnutrition is comparatively lower, ranging from 5-10%, among senior individuals living independently. However, it significantly rises to 30-60% among older individuals who are hospitalized or residing in institutional settings. Consequently, the inclusion of nutritional evaluation within the standard clinical practice for aged individuals who exhibit frailty, illness, or are admitted to a hospital is essential. There is a pressing need for the development of a complete screening tool that can effectively evaluate an individual's nutritional status in a clinical setting, while also being cost-effective in its implementation. Several expeditious and uncomplicated diagnostics for the identification and assessment of malnutrition in the older population have been recently devised. If the screening tests indicate the presence of malnutrition, it is recommended that traditional nutritional evaluation be conducted prior to the development of a treatment plan (Vellas et al., 2001).

The study conducted by Charlton et al. (2007) aimed to assess the validity of several nutrition screening techniques currently available for implementation in the elderly population of South Africa. The present investigation included a cross-sectional research with a sample of 283 black South Africans aged 60 years or older, encompassing both those living independently and those residing in institutional settings. The study found a substantial positive correlation between the MNA score and several anthropometric parameters, cognitive function, instrumental activities of daily living. Additionally, among the female participants, there was a significant association between the MNA score and percentage of body fat, handgrip strength, and activities of daily living. In contrast to the

Malnutrition Universal Screening Tool (MNA), the DETERMINE instrument had a very poor positive predictive value (55.6%) and specificity (11.2%). Consequently, a considerable number of false positives were identified as malnourished individuals. According to Charlton et al. (2007), the MNA screening test is deemed suitable for detecting malnourished or at-risk elderly black South Africans, but the DETERMINE instrument is not considered adequate for this purpose.

Wyka et al. (2012) reported that there is a notable surge in the percentage of old individuals among the world population. The individual's nutritional status exhibits many inadequacies that pose potential health risks. The sample consisted of 30 women who were identified as being at risk of malnutrition. It was shown that these women had a considerably lower energy intake in their diet, with an average of 1127 kcal. In comparison, women who had appropriate nutrition had an average energy intake of 1351 kcal. The collective cohort of persons under investigation had insufficient intake levels of fiber, calcium, vitamins C and D, and folates. The majority of the women under investigation had an elevated body mass index (BMI), with an average value of 28.8. Additionally, their waist circumference was 96.3 cm, while the triceps skinfold (TSF) thickness averaged at 25.2 mm. Women who are at risk of malnutrition exhibited significantly lower lipid parameters compared to those who have adequate nutrition. Specifically, the total cholesterol levels were 191.1 mg/dl for women at risk of malnutrition, compared to 219.1 mg/dl for those with adequate nutrition ($p < 0.001$). Similarly, the LDL-cholesterol levels were 107.1 mg/dl for women at risk of malnutrition, compared to 125.1 mg/dl for those with adequate nutrition ($p < 0.008$). Additionally, the triglyceride levels were 129 mg/dl for women at risk of malnutrition, compared to 143 mg/dl for those with adequate nutrition. Men who are at risk of malnutrition exhibited a statistically significant decrease in their body mass index (BMI) compared to men with adequate nutrition (26.0 vs. 28.7, $p < 0.04$). Additionally, these men also had reduced waist and arm perimeters in comparison to their counterparts with proper nutrition. Based on the findings of the Charlson comorbidity index (CCI), it was shown that 8.2% of individuals with sufficient nutritional status exhibited a negative prognostic signal for overall survival. All people who were tested had several noteworthy dietary deficits. The cohort characterized by nutritional risk had more notable nutritional deficits. Despite people with proper nutrition consuming meals with a low calorie value, their anthropometric measures paradoxically indicate the existence of excessive adipose tissue. According to Wyka et al. (2012), the prevalent disorders seen among the analyzed cohort were coronary artery disease and congestive heart failure.

The objective of Dorner et al. (2014) was to investigate the correlation between compromised nutritional status and frailty in elderly patients admitted to acute care hospitals. To achieve this, the researchers employed two assessment instruments: the MNA®-SF (Mini Nutritional Assessment® short-form) and the SHARE-FI (Frailty Instrument for Primary Care of the Survey of Health, Ageing and Retirement in Europe).The prevalence of malnutrition or the likelihood of malnutrition was seen in 76.7% of the whole sample, with rates of 46.8% among robust individuals, 69.0% among pre-frail individuals, and 93.0% among frail participants. A prevalence rate of 75.9% for frailty or prefrailty was seen in the whole sample. Specifically, 45.1% of those without any risk of malnutrition, 80.9% of those at risk of malnutrition, and 94.1% of malnourished patients exhibited frailty or prefrailty. The two used instruments demonstrate similarities in three dimensions: (1) issues related to nutrition, (2) issues related to mobility, and (3)

anthropometric measures that exhibit a moderate to good internal consistency, as shown by Cronbach's Alpha values of 0.670, 0.834, and 0.946, respectively. According to Dorner et al. (2014), a significant proportion of the overall sample (64.7%) expressed willingness to engage in a muscle training and nutritional intervention program conducted in a home-based setting. Specifically, a higher percentage of frail individuals (79.5%) and malnourished participants (87.9%) indicated their intention to participate in such a program. This statement highlights the correlation and intersection between frailty and compromised nutritional status. There exists a notable inclination among individuals to engage in a program aimed at addressing the issues related to malnutrition and frailty, particularly among those who would get the most advantages from such an initiative (Dorner et al., 2014).

Cereda et al. (2016) found that elderly individuals are at a heightened risk of experiencing malnutrition, a condition that may lead to increased need on assistance for everyday tasks. The objective of the study conducted by Cereda et al. (2016) was to provide a quantitative analysis of prevalence data about malnutrition and its associated risk, as evaluated via the use of the Mini Nutritional Assessment, across various healthcare environments. The researchers also examined the correlation between nutritional status and the extent of dependency associated with the specific context. The prevalence of malnutrition varied significantly across different healthcare settings as follows: in the community, it was found to be 3.1% (95%CI, 2.3–3.8); among outpatients, it was 6.0% (95%CI, 4.6–7.5); for home-care services, it was 8.7% (95%CI, 5.8–11.7); in hospitals, it was 22.0% (95%CI, 18.9–22.5); among nursing homes, it was 17.5% (95%CI, 14.3–20.6); for long-term care, it was 28.7% (95%CI, 21.4–36.0); and in rehabilitation/sub-acute care, it was 29.4% (95%CI, 21.7–36.9) (Cereda et al., 2016). Significant heterogeneity in individual research findings was seen across all settings, as shown by an I2 value of ≥80% and a P-value of less than 0.001. Furthermore, meta-regression analysis revealed that study quality emerged as the most influential factor in determining the observed heterogeneity. In conclusion, the meta-regression analysis conducted on the collective body of research demonstrated a significant positive correlation between malnutrition, its risk, and the degree of dependency on the setting ($P < 0.001$). Nevertheless, after implementing several modifications, there was still a significant amount of residual heterogeneity present.We have presented revised assessments of malnutrition and its associated vulnerability across various healthcare environments. While the degree of reliance seems to be a significant factor, there is still a considerable amount of unexplained variation in the outcomes of different studies. Additional research is required to explore the causal association between nutritional status and the degree of reliance (Cereda et al., 2016).

Aziz et al. (2017) express worry on the escalating global population of older individuals throughout time, mostly owing to the prevalent health challenges experienced by this demographic. Based on prior research, there is a growing frequency of malnutrition among older individuals who are hospitalized, both at a local level and globally. The persistent high prevalence of malnourished elderly individuals in hospitals may be attributed to the under-recognition of malnutrition. Consequently, much research has been conducted on the advancement of nutritional screening and evaluation methods, resulting in their widespread availability in contemporary times. The nutritional assessment techniques known as SGA, MNA, and GNRI have been particularly created for the aged population and have undergone extensive validation in several countries. Nevertheless, as of now, there is a lack

of a singular instrument that can be regarded as the universally accepted benchmark for assessing the nutritional condition of patients who are admitted to hospitals (Aziz et al., 2017). The identification of an appropriate nutritional assessment instrument is crucial in order to produce a systematic evaluation and recording of the nutritional status within this particular population. The prompt emphasizes the need of promptly and accurately identifying the proper therapy for malnutrition in order to reduce the prevalence of malnutrition within a certain population in the future (Aziz et al., 2017).

CHAPTER 3

METHODOLOGY

3.1 Study Design

The study employed a cross-sectional research design to assess the socio-demographic, anthropometric, biochemical, and nutritional characteristics of the study population.

3.2 Study Location

The study was conducted in the Chandpur Diabetic Hospital, Sadar Upazila, Chandpur, Bangladesh. The choice of Chandpur Diabetic Hospital as the study location is based on considerations of feasibility, access to the target diabetic population, and the relevance of the study to the community within Chandpur district, Bangladesh.

3.3 Sample Size Determination

$$\text{Sample size } = \frac{z^2 \hat{p}(1-\hat{p})}{\varepsilon^2}$$

$$= \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{0.05^2}$$

$$= \frac{3.8416 \times 0.25}{0.0025}$$

$$= 385$$

The sample size was calculated using the *calculator.net*, which is designed specifically for surveys to calculate the sample size and determine how many responses are needed. However, a total of only 150 patients were agreed to take part and were requested to fill in the questionnaire form after the importance of the study.

3.4 Study Population

The study comprised of 150 individuals with diabetes mellitus. Inclusion criteria included individuals aged 60 to 71 years old, residing in both rural and urban settings, and belonging to different religious beliefs and income groups.

3.5 Data Collection

Data collection involved utilizing a structured questionnaire (Appendix 1) along with Mini Nutritional Assessment(MNA) screening tool (Appendix 2) developed by Nestle. The questionnaires encompassed with a wide range of socio-demographic information, anthropometric measurements, biochemical parameters, comorbid conditions, and nutritional assessments(MNA). Participants were interviewed face to face.

3.6 Nutritional Assessment Scoring System

A scoring system was applied to assess the nutritional status of participants using the Mini Nutritional Assessment-Short Form (MNA) developed by Nestle. This tool assigned scores to various aspects of nutrition, allowing for the classification of participants into three categories: normal nutritional status, at risk of malnutrition, and malnourished.

Table 1: Mini Nutritional Assessment-Short Form (MNA) Screening score

Nutritional Status	Screening score (max. 14 points)
Normal nutritional status	24-30 points
At risk of malnutrition	17-23.5 points
Malnourished	Less than 17 points

3.7 Statistical Analysis

Data was entered and cleaned using Microsoft Office Excel 2021 manufactured by Microsoft Corporation. Statistical analysis was carried out using SPSS(Statistical Package for the Social Sciences) version 23.0 manufactured by IBM. Descriptive statistics used to summarize the socio-demographic characteristics, biochemical parameters and nutritional status of the elderly patients. Crosstab used to explore associations between nutritional status and socio-demographic variables.

3.8 Methodology

The methodology of this study involved a systematic approach to data collection, organization, and analysis.

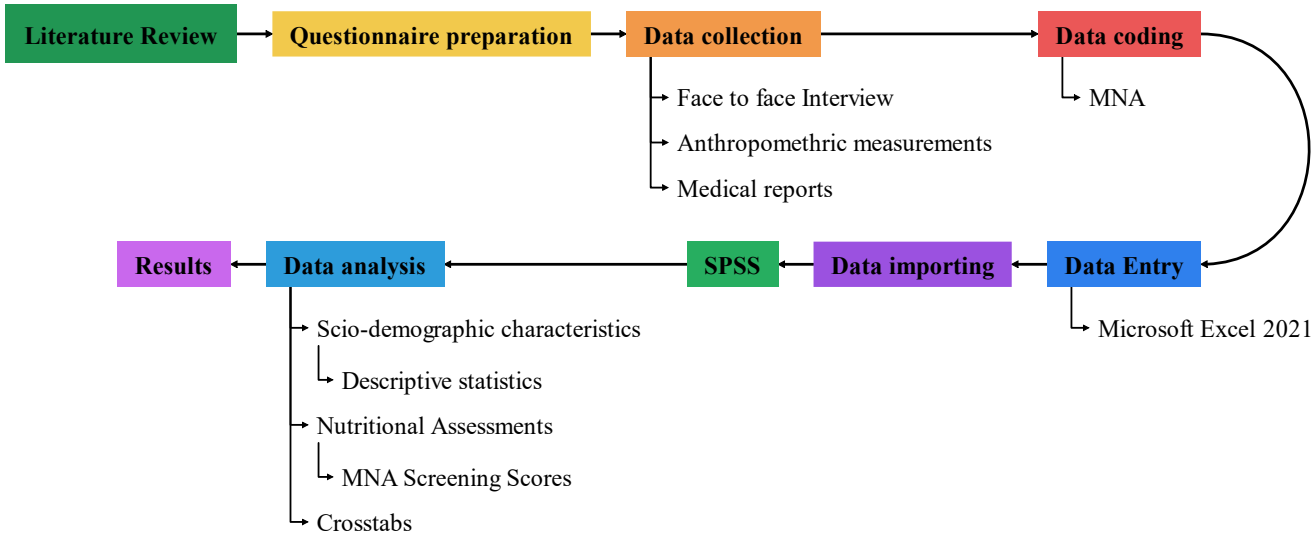

Figure 1: Research Methodology flowchart

3.9 Ethical Considerations

Informed consent was obtained from all participants, ensuring their voluntary participation and understanding of the study's purpose. Data confidentiality and privacy were rigorously maintained to protect the participants' sensitive information.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

Table 2 represents the socio-demographic characteristics of the study's participants. It provides valuable information about the composition of the sample population.

Table 2: Socio-demographic characteristics

Characteristics	Frequency	Percent
Gender		
Female	100	66.7
Male	50	33.3
Age group		
60 - 66 years old	109	72.7
67 - 71 years old	41	27.3
Residence status		
Rural	60	40.0
Urban	90	60.0
Religion		
Islam	137	91.3
Hindu	12	8.0
Christianity	1	0.7
Monthly Income (BDT)		
Below 15,000	9	6.0
15,000 – 29,999	41	27.3
30,000+	100	66.7
Type of family		
Nuclear	100	66.7
Extended	3	2.0
Joint family	47	31.3
Educational level		
No education	5	3.3
Primary	24	16.0
Secondary	51	34.0
Higher Secondary	43	28.7
University/Above	27	18.0
Regular exercise		
Yes	103	68.7
No	47	31.3
Duration of diabetes		
1–10 years	74	49.3
11–20 years	69	46.0

More than 20 years	7	4.7

Table 3 represents anthropometric data, including height, weight, and waist circumference.

Table 3: Anthropometric assessment

Parameters	**mean±SD**
Height	163.88±11.26 cm
Weight	65.35±10.12 kg
Waist circumference	36.16± 3.06 inches

Table 4 provides information on various biochemical parameters including blood glucose levels, HbA1c, TG (Triglycerides), HDL (High-Density Lipoprotein), LDL (Low-Density Lipoprotein), and Total Cholesterol.

Table 4: Biochemical parameters

Parameters	**mean±SD**
Blood glucose(F)	15.26±11.26 mmol/dl
Blood glucose(ABF)	16.25±4.91 mmol/dl
HbAlc	6.71±3.20%
TG	128.93±56.31 mg/dl
HDL	48.95±17.33mg/dl
LDL	131.08±30.49mg/dl
Cholesterol(total)	195.29±175.72 mg/dl

Table 5 lists comorbid conditions and their presence in the patients. Conditions include Dyslipidemia , Hypertension, Coronary Artery Disease, and Stroke.

Table 5: Comorbid conditions

Conditions	**Present in Patients**	
	Frequency(n=150)	Percent(%)
Dyslipidemia	38	25.3
Hypertension	137	91.3
Coronary artery disease	30	20.0
Stroke	10	6.7

Table 6 represents the responses to MNA screening questionnaire for assessing the nutritional status of the participants. Questions cover changes in food intake, weight loss, mobility, psychological stress, neuropsychological problems, Body Mass Index (BMI), and calf circumference.

Table 6: MNA screening by Nestle

Questions	**Responses**	**%**
Food intake declined over the past 3 months	0 = severe decrease in food intake	15.3
	1 = moderate decrease in food intake	44.0
	2 = no decrease in food intake	40.7
	0 = weight loss greater than 3 kg (6.6 lbs)	32.0

Weight loss during the last 3 months	1 = does not know	20.7
	2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)	25.3
	3 = no weight loss	22.0
Mobility	2 = goes out	100.0
Psychological stress	0 = yes	10.7
	2 = no	89.3
Neuropsychological problems	0 = severe dementia or depression	1.3
	1 = mild dementia	58.7
	2 = no psychological problems	40.0
Body Mass Index (BMI) (weight in kg) / (height in m)^2	0 = BMI less than 19	6.7
	1 = BMI 19 to less than 21	16.7
	2 = BMI 21 to less than 23	20.7
	3 = BMI 23 or greater	56.0
Lives independently	0 = no	2.0
	1 = yes	98.0
Takes more than 3 drugs per day	0 = yes	56.7
	1 = no	43.3
Pressure sores or skin ulcers	0 = yes	44.7
	1 = no	55.3
Full meals daily	1 meal	0.7
	2 meals	99.3
Selected consumption markers for protein intake	if 0 or 1 yes	40.0
	if 2 yes	36.7
	if 3 yes	23.3
Consumes two or more servings fruit/vegetables	0 = no	56.0
	1 = yes	44.0
Fluid consumed per day	0.0 = less than 3 cups	78.7
	0.5 = 3 to 5 cups	21.3
Mode of feeding	0 = unable to eat without assistance	0.7
	1 = self-fed with some difficulty	45.3
	2 = self-fed without any problem	54.0
Self view of nutritional status	0 = views self as being malnourished	0.7
	1 = is uncertain of nutritional state	50.0
	2 = views self as having no nutritional problem	49.3
The patient considers his /her health status	0.0 = not as good	12.7
	0.5 = does not know	23.3
	1.0 = as good	64.0
Mid-arm circumference (MAC) in cm	0.0 = MAC less than 21	24.7
	0.5 = MAC 21 to 22	38.7
	1.0 = MAC greater than 22	36.7
	0 = CC less than 31	64.7

Calf circumference (CC) in cm	1 = CC 31 or greater	35.3

Table 7 summarizes the overall nutritional status of the participants based on their scores from the MNA screening questionnaire. Nutritional status is divided into three categories: Normal nutritional status, At risk of malnutrition, and Malnourished.

Table 7: MNA Screening scores (Malnutrition Indicator Score**)**

Nutrition status	**Frequency**	**Percent**
24 to 30 points: Normal nutritional status	12	8.0
17 to 23.5 points: At risk of malnutrition	92	61.3
Less than 17 points: Malnourished	46	30.7

Table 8 represents the distribution of participants in the three nutritional status categories (Normal, At risk of malnutrition, and Malnourished) based on characteristics such as gender, age group, residence status, monthly income, regular exercise, and duration of diabetes.

Table 8: Nutritional status based on Socio-demographic characteristics

Socio-demographic characteristics		**Nutritional status**		
		Normal	At risk of malnutrition	Malnourished
		n=150(% of Total)		
Gender	Female	7.3%	39.3%	20.0%
	Male	0.7%	22.0%	10.7%
Age group	60 - 66 years old	6.0%	47.3%	19.3%
	67 - 71 years old	2.0%	14.0%	11.3%
Residence status	Rural	2.0%	24.7%	13.3%
	Urban	6.0%	36.7%	17.3%
Monthly Income (BDT):	Below 15,000	1.3%	16.7%	9.3%
	15,000 – 29,999	6.7%	40.0%	20.0%
	30,000+	--	4.7%	1.3%
Regular exercise	Yes	6.0%	43.3%	19.3%
	No	2.0%	18.0%	11.3%
Duration of diabetes	1–10 years	5.3%	32.0%	12.0%
	11–20 years	2.0%	29.3%	14.7%
	More than 20 years	0.7%	--	4.0%

4.2 Discussion

4.2.1 Socio-demographic characteristics

Table 2 provides socio-demographic characteristics of the study participants. The gender distribution has a higher representation of females 66.7% compared to males 33.3%.The majority of participants, 72.7%, fall into the 60-66 years old category, with the remaining 27.3% being in the 67-71 years old category. This age distribution reflects the predominance of older adults in the study, suggesting a focus on the health and socio-demographic aspects of this age group.60% of participants live in urban areas, while 40% reside in rural areas.

The majority of participants identify as Muslim 91.3%, with smaller percentages being Hindu 8.0% and Christian 0.7%. A substantial proportion of participants 66.7% have a monthly income of 30,000 BDT or more. The majority of participants 66.7% are part of nuclear families, while a smaller proportion reside in extended families 2.0%, and 31.3% live in joint families.

Educational attainment varies from no education 3.3% to higher secondary 28.7%, and university or above 18.0%. A significant majority of participants (68.7%) engage in regular exercise, while 31.3% do not. A substantial number (49.3%) have had diabetes for 1-10 years, while 46.0% have been managing diabetes for 11-20 years, and a smaller percentage (4.7%) have had diabetes for more than 20 years.

4.2.2 Anthropometric assessment

Table 3 provides anthropometric assessment data, which includes measurements related to the participants' physical characteristics.

The mean height of 163.88 cm represents the average height of the participants. This measurement is important because it can influence various health factors, such as body mass index (BMI) and the risk of certain health conditions. The standard deviation (SD) of 11.26 cm indicates the degree of variation in height within the sample.

The mean weight of 65.35 kg provides insights into the average weight of the participants. Weight is a fundamental parameter in understanding overall health and can be critical in studies on nutrition and weight-related conditions. The standard deviation (SD) of 10.12 kg indicates the variation in weight within the sample, which may be important in analyzing differences in weight distribution among individuals.

Waist circumference is a significant measurement in health research, as it is associated with the risk of various health conditions, including cardiovascular diseases and diabetes. The average waist circumference of 36.16 inches is an important indicator of abdominal obesity. The standard deviation (SD) of 3.06 inches shows the variability in waist circumference within the sample.

4.2.3 Biochemical parameters

Table 4 presents a set of biochemical parameters, including measurements of blood glucose, HbA1c, triglycerides (TG), high-density lipoprotein (HDL), low-density

lipoprotein (LDL), and total cholesterol. These parameters are critical in assessing the health and metabolic status of the study population.

The mean blood glucose level of 15.26 mmol/dl reflects the average fasting glucose in the study population. The standard deviation (SD) of 11.26 mmol/dl suggests considerable variability in fasting blood glucose levels among participants, which could be relevant for assessing the control of diabetes and identifying individuals at higher risk.

Blood glucose after a meal (ABF) provides additional information about glucose control and postprandial hyperglycemia. The mean value of 16.25 mmol/dl indicates the average post-meal glucose levels. The standard deviation (SD) of 4.91 mmol/dl demonstrates variability in postprandial blood glucose levels among participants, which is important for evaluating the effectiveness of diabetes management strategies.

Hemoglobin A1c (HbA1c) is a crucial marker for long-term blood sugar control in individuals with diabetes. The mean HbA1c of 6.71% provides an insight into the overall glycemic control within the sample. The standard deviation (SD) of 3.20% suggests variations in HbA1c levels, which could indicate differences in the management of diabetes among participants.

TG levels are a marker of lipid metabolism and are relevant for assessing cardiovascular health. The mean TG level of 128.93 mg/dl represents the average level in the study population. The standard deviation (SD) of 56.31 mg/dl indicates significant variability in TG levels, which may be associated with differences in dietary habits and metabolic profiles.

HDL is known as good cholesterol and is important for heart health. The mean HDL level of 48.95 mg/dl is relevant for assessing cardiovascular risk. The standard deviation (SD) of 17.33 mg/dl suggests variations in HDL levels, which can be an important indicator of heart health and risk factors.

LDL is often referred to as bad cholesterol and is associated with cardiovascular risk. The mean LDL level of 131.08 mg/dl indicates the average LDL cholesterol level within the sample. The standard deviation (SD) of 30.49 mg/dl shows variability in LDL levels, which is relevant for assessing cardiovascular health and potential risks.

Total cholesterol is another indicator of cardiovascular health. The mean total cholesterol level of 195.29 mg/dl represents the overall cholesterol profile within the study population. The standard deviation (SD) of 175.72 mg/dl demonstrates considerable variation in total cholesterol levels, which can be relevant for assessing cardiovascular risk.

4.2.4 Comorbid conditions

Table 5 provides information on the comorbid conditions that are present in the study population. Comorbid conditions are additional medical conditions that coexist with the primary condition under investigation, which in this case appears to be diabetes. These comorbid conditions are essential to understand as they can impact disease management, prognosis, and treatment decisions.

Dyslipidemia is a condition characterized by abnormal levels of lipids (fats) in the blood, often including high levels of LDL cholesterol and triglycerides, and low levels of HDL cholesterol. It is a significant comorbid condition in the study, affecting 25.3% of the participants. High levels of dyslipidemia in the study population may indicate an increased risk of cardiovascular diseases, which is common in individuals with diabetes.

Hypertension, or high blood pressure, is highly prevalent in the study population, affecting a substantial 91.3% of the participants. This is a significantly high prevalence and indicates that hypertension is a major comorbid condition among individuals with diabetes in the study. The high occurrence of hypertension underscores the importance of blood pressure management in diabetes care. Hypertension is a well-known risk factor for cardiovascular complications and needs to be effectively managed to reduce associated health risks.

Coronary artery disease (CAD) is a condition that affects the blood vessels supplying the heart, leading to reduced blood flow and a higher risk of heart attacks. CAD is present in 20% of the study participants. The prevalence of CAD suggests that cardiovascular health is a significant concern among individuals with diabetes in the study.

Stroke is a relatively less common comorbid condition in this population, affecting 6.7% of participants. However, it is still a notable presence in the study sample. Stroke is a severe condition often associated with cardiovascular risk factors. The presence of stroke in the study population highlights the need for stroke prevention strategies and management, particularly in diabetic individuals.

4.2.5 MNA Screening scores

The analysis of MNA screening scores in Table 6 provides valuable insights into the nutritional status of the studied population. The observed 8.0% of participants with scores ranging from 24 to 30 points signifies a segment of the population enjoying a normal nutritional status. This finding aligns with the expectation that a proportion of any population would exhibit optimal nutritional health. While this percentage is relatively small, it serves as a benchmark against which the prevalence of malnutrition and the at-risk population can be contextualized.

The majority of participants, constituting 61.3%, fall within the category of being at risk of malnutrition (17 to 23.5 points). This result is of particular concern as it suggests a substantial portion of the population may be experiencing nutritional challenges that, if unaddressed, could lead to adverse health outcomes. Identifying individuals at risk provides an opportunity for targeted interventions, such as nutritional counseling or supplementation, to prevent the progression towards malnutrition.

The 30.7% of participants scoring below 17 points are categorized as malnourished. This finding is noteworthy and underscores the urgency of implementing interventions to address existing malnutrition within the population. Malnutrition is associated with a range of health complications, and its prevalence at this magnitude emphasizes the need for comprehensive public health strategies to address the root causes and mitigate the associated risks.

4.2.6 Nutritional status based on Socio-demographic characteristics

The investigation of nutritional status across various socio-demographic characteristics in Table 8 provides valuable insights into the potential factors influencing the nutritional health of the studied population.

Females exhibit a higher prevalence of being at risk of malnutrition (39.3%) and malnourished (20.0%) compared to males (22.0% at risk, 10.7% malnourished). This gender-based disparity in nutritional status suggests the need for targeted interventions that consider the specific nutritional requirements and challenges faced by females.

The prevalence of individuals at risk of malnutrition and malnourished increases with age. Notably, the age group of 60-66 years old has the highest percentage of individuals at risk (47.3%) and malnourished (19.3%).

Participants residing in rural areas exhibit higher percentages of being at risk of malnutrition (24.7%) and malnourished (13.3%) compared to their urban counterparts.

A clear association between monthly income and nutritional status is evident. Participants with lower monthly incomes are more likely to be at risk of malnutrition or malnourished. This emphasizes the socio-economic determinants of nutritional health and suggests the importance of addressing income-related disparities through policies that enhance economic stability and access to affordable, nutritious food.

Engaging in regular exercise appears to be associated with a lower risk of malnutrition. Participants who report regular exercise demonstrate lower percentages of being at risk of malnutrition (43.3%) and malnourished (19.3%). This highlights the potential benefits of incorporating physical activity into lifestyle interventions aimed at improving nutritional health.

The duration of diabetes also influences nutritional status. Participants with longer durations of diabetes (>20 years) exhibit a lower prevalence of malnutrition (4.0%). This finding may suggest that individuals with longer diabetes durations have adapted their lifestyle and dietary habits to better manage their nutritional needs.

CHAPTER 5

CONCLUSION

5.1 Conclusion

In this study, a comprehensive analysis was conducted to investigate the nutritional assessment of elderly patients with type 2 diabetes mellitus. The nutritional assessment conducted with MNA revealed that a substantial proportion of participants were at risk of malnutrition, with a smaller percentage classified as malnourished. Only a minority maintained a normal nutritional status. These findings emphasize the importance of addressing nutritional challenges and implementing interventions to improve the overall nutritional status of the population. Nutritional intervention programs including dietary guidance, food assistance, and nutritional counseling can be implemented to improve the nutritional status of elderly patients with T2DM at risk of malnutrition or those who are already malnourished.

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APPENDICES

Appendix 1: Questionnaires

FOR OFFICIAL USE: Date: _ _ / 1 _ / 2023 | Respondent No: _ _ _ | Data Entry: □ OK

Nutritional Assessment of Elderly Patients (aged 60 years and above) with Type 2 Diabetes Mellitus in Chandpur District

Consent

You are cordially invited to partake in a research study focusing on the evaluation of your nutritional status. The procedures or activities employed in this investigation are entirely benign. There are no associated fees for participation in this study, and no compensation will be provided. If you consent, you will be prompted with a series of personal inquiries. Individuals have the prerogative to decline responding to any inquiry or depart at their discretion. All data collected in this research is subject to strong confidentiality measures, ensuring that your name will remain undisclosed. Access to the information will be restricted solely to individuals associated with academic pursuits. We greatly value your collaboration.

_____

Signature of the respondent

Please answer these questions by putting a tick (✓) in the appropriate box for each question.

A.SOCIO-DEMOGRAPHIC CHARACTERISTICS

[1].ID of the Respondent:_____

[2].Mobile no:_____

[3].Gender: ☐Male ☐Female

[4].Age:_____(Years)

[5].Residence status: ☐Urban ☐Rural

[6].Religion: ☐Islam ☐Hindu ☐Christianity ☐Others

[7].Monthly Income (BDT):

☐Below 15,000 ☐15,000 – 29,999 ☐ 30,000+

[8].Type of family: ☐Nuclear ☐Extended ☐Joint family

[9].Educational level

☐No education ☐Primary ☐Secondary ☐Higher Secondary ☐University/Above

B.ANTHROPOMETRIC ASSESSMENT

[10].Height:_____ft_____inch

[11].Weight:_____ kilogram

[12].Waist circumference:_____ inch

[13]. Regular exercise ☐No ☐Yes

C.BIOCHEMICAL PARAMETERS

[14].Blood glucose(F): _____ mmol/dl

[15].Blood glucose(ABF): _____mmol/dl

[16].HbAlc: _____%

[17].TG: _____mg/dl

[18].HDL: _____mg/dl

[19].LDL: _____mg/dl

[20].Cholesterol(total):_____mg/dl

D.CO-MORBID CONDITIONS

[21].Duration of diabetes: ☐1–10 years ☐11–20 years ☐More than 20 years

[22].Dyslipidemia: ☐Present ☐Absent

[23].Hypertension: ☐Present ☐Absent

[24].Coronary artery disease: ☐Present ☐Absent

[25].Stroke: ☐Present ☐Absent

E. MINI NUTRITIONAL ASSESSMENT (MNA) SCREENING BY NESTLE

Complete the screen by filling in the boxes with the appropriate numbers.

Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

26.Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?

0 = severe decrease in food intake

1 = moderate decrease in food intake

2 = no decrease in food intake ☐

27.Weight loss during the last 3 months

0 = weight loss greater than 3kg (6.6lbs)

1 = does not know

2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)

3 = no weight loss

☐

28.Mobility

0 = bed or chair bound

1 = able to get out of bed / chair but does not go out

2 = goes out

☐

29.Has suffered psychological stress or acute disease in the past 3 months?

0 = yes

2 = no

☐

30.Neuropsychological problems

0 = severe dementia or depression

1 = mild dementia

2 = no psychological problems

☐

31.Body Mass Index (BMI) = weight in kg / (height in m)^2

0 = BMI less than 19

1 = BMI 19 to less than 21

2 = BMI 21 to less than 23

3 = BMI 23 or greater

☐

Screening score (subtotal max. 14 points)

12-14 points: ☐Normal nutritional status

8-11 points: ☐At risk of malnutrition

0-7 points: ☐Malnourished

For a more in-depth assessment, continue with questions 32-43

Assessment

32.Lives independently (not in nursing home or hospital)

1=Yes 0=No

33.Takes more than 3 prescription drugs per day

0=Yes 1=No

34.Pressure sores or skin ulcers

0=Yes 1=No

35.How many full meals does the patient eat daily?

0 = 1 meal

1 = 2 meals

2 = 3 meals

36.Selected consumption markers for protein intake

At least one serving of dairy products (milk, cheese, yoghurt) per day. ☐Yes ☐No

Two or more servings of legumes or eggs per week, ☐Yes ☐No

Meat, fish or poultry every day. ☐Yes ☐No

0.0 = if 0 or 1 yes

0.5 = if 2 yes

1.0 = if 3 yes

37.Consumes two or more servings of fruit or vegetables per day?

0 = No 1 = Yes

38.How much fluid (water, juice, coffee, tea, milk...) is consumed per day?

0.0 = less than 3 cups

0.5 = 3 to 5 cups

1.0 = more than 5 cups

39.Mode of feeding

0 = unable to eat without assistance

1 = self-fed with some difficulty

2 = self-fed without any problem

40.Self-view of nutritional status

0 = views self as being malnourished

1 = is uncertain of nutritional state

2 = views self as having no nutritional problem

41.In comparison with other people of the same age, how does the patient consider his / her health status?

0.0 = not as good

0.5 = does not know

1.0 = as good

42.Mid-arm circumference (MAC) in cm

0.0 = MAC less than 21

0.5 = MAC 21 to 22

1.0 = MAC greater than 22

43.Calf circumference (CC) in cm

0 = CC less than 31

1 = CC 31 or greater 

Assessment (max. 16 points): _____

Screening score.:_____

Total Assessment (max. 30 points):_____

Malnutrition Indicator Score

24-30 points: ☐Normal nutritional status

17-23.5 points: ☐At risk of malnutrition

Less than 17 points: ☐Malnourished

Thanks for Your Co-operation

Appendix 2: MNA

Mini Nutritional Assessment
MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) = weight in kg / (height in m)^2 ☐
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐
12-14 points: ☐ Normal nutritional status
8-11 points: ☐ At risk of malnutrition
0-7 points: ☐ Malnourished
For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day yes ☐ no ☐
- Two or more servings of legumes or eggs per week yes ☐ no ☐
- Meat, fish or poultry every day yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC greater than 22 ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score
24 to 30 points ☐ Normal nutritional status
17 to 23.5 points ☐ At risk of malnutrition
Less than 17 points ☐ Malnourished

Save Print Reset

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For more information: www.mna-elderly.com

Appendix 3: Synopsis

Nutritional Assessment of Elderly Patients (aged 60 years and above) with Type 2 Diabetes Mellitus in Chandpur District

Synopsis

Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder with significant implications for health, especially in elderly populations. Chandpur District, Bangladesh, has seen a rise in the prevalence of T2DM among the elderly. This study aims to conduct a comprehensive nutritional assessment of elderly patients (aged 60 and above) with T2DM in Chandpur District, considering socio-demographic characteristics, anthropometric measurements, biochemical parameters, and nutritional status.

Objectives

1. To assess the nutritional status, including anthropometric measurements, and biochemical parameters(blood glucose level, LDL, HDL, TG etc.), of elderly patients (aged 60 and above) with Type 2 diabetes mellitus in Chandpur district.
2. To determine the prevalence of malnutrition or nutrient deficiencies in this group.
3. To explore the association between nutritional status and demographic characteristics in elderly individuals with T2DM.

Methodology

A cross-sectional study will be conducted involving elderly patients with Type 2 diabetes mellitus in Chandpur district. Data will be collected through interviews, medical reports. Anthropometric measurements (e.g., BMI, waist circumference) and biochemical parameters (e.g., Blood glucose(F), Blood glucose(ABF), HbAlc, HDL, LDL, TG) will be assessed. **Nestlé Mini Nutritional Assessment-Short Form (MNA)** Screening tool by Nestle will be used for the nutritional assessment.

Timeframe

Activities	**September**	**October**	**November**	**December**
Synopsis	**14th Sept, 23**			
Data collection		**27th Oct, 23 -17th Nov, 23**		
Data entry			**20th-29th Nov, 23**	
Data analysis				**1st Dec, 23**

Statistical Analysis

Data will be analyzed using statistical software; SPSS(Statistical Package for the Social Sciences) version 23.0 manufactured by IBM. Descriptive statistics will be used to summarize the demographic characteristics, biochemical parameters and nutritional status

of the elderly patients. Inferential statistics may be used to explore associations between nutritional status and other relevant factors.

Significance

This study will be significant as it will address the unique nutritional needs of elderly individuals with Type 2 diabetes mellitus. Understanding their nutritional status and other relevant factors can inform healthcare providers and policymakers in designing targeted interventions to enhance their nutritional status and also health outcomes.

Expected Findings

The study will be expected to reveal the prevalence of malnutrition among elderly T2DM patients in Chandpur district. It may also uncover specific challenges and needs within this population, allowing for the development of dietary and educational interventions.

Nutritional Assessment of Elderly Patients (aged 60 years and above) with Type 2 Diabetes Mellitus in Chandpur District

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