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Fasting Glucose, Creatinine and Total Cholesterol Levels in Normal Individuals: Difference with Age

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Abstract

Ageing is one of the well-known risk factors for many physiological disorders. This cross-sectional, observational study was carried out in the Department of Biochemistry, Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh, from January to December 2024, from January to December, to see the association between age and the changes in fasting blood glucose, serum creatinine and total cholesterol levels among normal individuals. 100 subjects were included in this study following inclusion and exclusion criteria and categorized in group A (50 adults aged between 24 and 49 years) and group B (50 adults aged between 50 and 78 years). The clinical and historical information was collected through prescribed questionnaires to evaluate the exclusion criteria of the study. Fasting venous blood samples were taken from the subjects with all aseptic precautions. Fasting blood glucose, serum creatinine and total cholesterol were determined by enzymatic method using semi-automatic clinical chemistry analyzer. A significant increase in fasting blood glucose, serum creatinine and total cholesterol were observed in subjects aged above 50 compared to the subjects aged below 50 years ($p<0.001$). Ageing leads to an increased risk of diabetes, renal failure and cardiovascular disease through derangements of blood glucose, creatinine and total cholesterol levels in elderly people of Bangladesh.

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Introduction

Aging is a natural process correlated with a range of damage both on a molecular and cellular level.[1] Aging is the irreparable, time-related, and proliferative decline of an organism's physiological processes, which maintain the organism's operational balance.[2] These activities result in a progressive deterioration of the operating system and various mechanisms that support the chemical and biochemical balance to prevent phenotypic derangements. Ageing is also responsible for the functional decrease in the physiological integrity of tissue and organ function.[3] Usually, age-related body changes become visible after the age of 30. The typical changes are the loss of bone, cartilage, muscle mass, increased fat, altered hormone levels, and many other physiological processes.[4] Metabolic measures, such as fasting blood glucose, serum creatinine, and total cholesterol are routinely assessed in clinical practice to determine disease risks associated with ageing. Therefore, these indices can serve as physiological biomarkers to study complex links between diabetes, kidney function, and coronary heart disease development as people age.[5]

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Glucose metabolism is a complex process in which glucose levels are maintained within a narrow range. Maintaining normal blood glucose levels is an important determining factor of an individual's capacity to control fasting glucose values and the glycemic response to food intake. Maintaining optimum blood glucose has important implications for health. Fasting glucose increases progressively from adult to old age, even in people without type 2 diabetes.[6] Elevated fasting glucose generally correlates with a higher rate of mortality, indicating the important effect of ageing on these metabolic health indices.[7] However, there is still a lack of understanding about glycaemic behavior and its deterioration with age. Recent advances in blood glucose measurement have provided a better view of glucose profiles in healthy individuals.

The renal condition seems to be one of the most crucial predictors of longevity.[8] Chronic kidney disease is one of the major causes of death worldwide and a leading cause of years of life lost.[9] Due to the kidney's high susceptibility to senescence, early detection of any dysfunction is very important for survival. Alterations in renal structure, function, and creatinine metabolism are associated with normal ageing. The normal ageing process is related to a decline in renal creatinine excretion.[10] However, the effect of age on serum creatinine is not well defined. Free creatinine is a waste product of creatine in all body fluids. Serum creatinine measurement is used clinically in the diagnosis and monitoring of acute and chronic renal disease.[9,11]

Total cholesterol is a significant risk factor for cardiovascular disease in aged people.[12] Cardiovascular disease is the leading cause of death worldwide and is expected to remain the same for the foreseeable future.[13] Ageing is associated with multiple systemic dysfunctions and is accompanied by lipid metabolism disorders. The changes in total cholesterol with the progression of age of individuals remain unclear. Evidence found that total cholesterol increased gradually from early adulthood through late middle age, then declined in older populations.[14] Association between age and total cholesterol needs to be understood very well to prevent cardiovascular disease in aged people.

However, to our knowledge, no studies reported analyzing the effect of ageing on fasting glucose, serum creatinine and total cholesterol levels in Bangladesh. Therefore, this study was proposed to determine the effect of ageing on fasting blood glucose, serum creatinine and total cholesterol levels.

Methods

The cross-sectional study, observational study was conducted in the Department of Biochemistry, Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh, from January to December of 2024. 100 samples were included in this study following inclusion and exclusion criteria. The subjects were divided into two groups based on inclusion and exclusion criteria. In group A, 50 apparently healthy adults aged between 24 and 49 years were included. In group B, 50 apparently healthy adults aged between 50 and 78 years were selected. The exclusion criteria for the subjects were: i) diabetes mellitus, ii) chronic renal failure, iii) patients and those with diseases known to modify serum cholesterol, iv) obese patients, v) alcoholism, vi) hypertensive, and vii) smokers. From each participant, 5 ml of fasting venous blood sample was collected in the early morning. The chemical analyses were completed within two hours of sample collection. Fasting blood glucose was determined by the glucose oxidase-peroxidase enzymatic method and serum

creatinine was measured by Jaffe reaction method, while total cholesterol was measured by oxidase enzymatic method. All the tests were performed using clinical chemistry autoanalyzer (Yumizen CA60, Horiba, Japan).

Immediately after the completion of data collection, collected data were checked and verified. Data cleaning, coding and recording were done. The values of all the studied parameters were measured as mean±SD (standard deviation). Statistical analysis was performed using MS-Excel and SPSS version 19.0 for Windows. The normal distribution of the studied variables was examined using Kolmogorov-Smirnov tests. The statistical significance of the difference between the two groups was evaluated by using Unpaired Student's 't' test. A p-value <0.05 was considered as statistically significant.

Results

The mean fasting blood glucose levels in group A and group B were found 4.98±0.48 mmol/L and 11.33±1.45 mmol/L respectively. The mean fasting blood glucose of group B (age above 50 yrs) was significantly higher than that of group A (age below 50) (p<0.001) (Table-I, Fig. 1).

Table- I: Fasting blood sugar, creatinine and total cholesterol of the study subjects (N=100)

Variables	Healthy individuals		p-value
	Group A (n=50) Mean±SD	Group B (n=50) Mean±SD	
Fasting blood glucose (mmol/L)	4.98±0.48	11.33±1.45	<0.001*
Serum creatinine (mg/dL)	0.91±0.11	1.67±0.18	<0.001*
Serum total cholesterol (mg/dL)	167.22±9.19	266.20±40.03	<0.001*

Comparison between the groups was done by unpaired Student's 't' test; * = significant

The mean serum creatinine level in group A was 0.91±0.11 mg/dL and in group B was 1.67±0.18 mg/dL; the difference was statistically significant (p<0.001) (Table-I, Fig. 2). The mean total cholesterol levels in group A and group B were found 167.22±9.19 mg/dL and 266.20±40.03 mg/dL respectively; the difference was also statistically significant (p<0.001) (Table-I, Fig. 3).

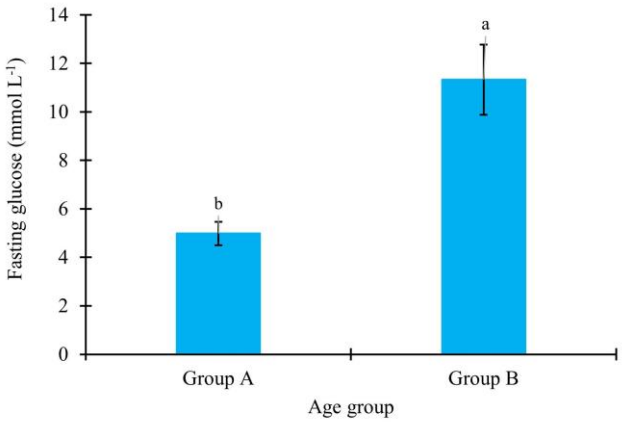

Fig. 1: Comparison of the mean fasting blood glucose levels between two groups (N=100).

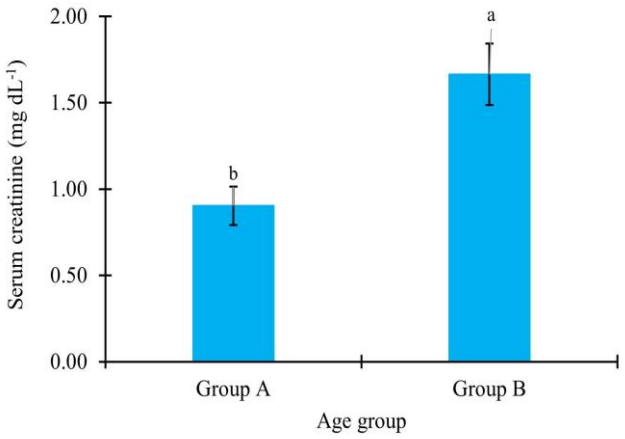

Fig. 2: Comparison of the mean serum creatinine levels between two groups (N=100).

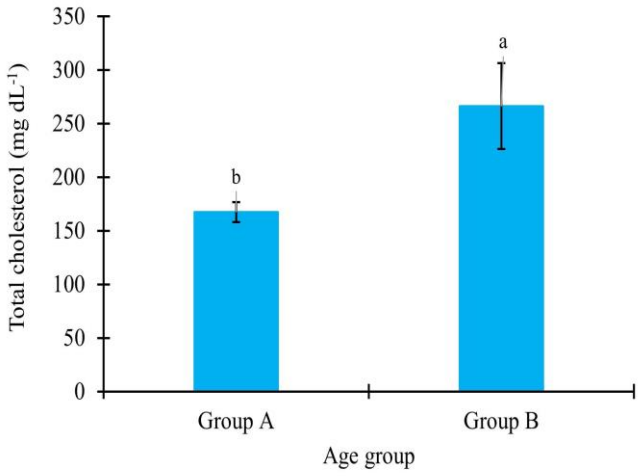

Fig. 3: Comparison of the mean total cholesterol levels levels between two groups (N=100).

Discussion

Knowledge of the impact of ageing on blood glucose, creatinine, and total cholesterol is essential for determining the mechanisms and prevention of the risks of early diabetes, renal failure, and cardiovascular disease in healthy adults over 50 years. Whether the increase in blood glucose is an actual ageing effect or due to increased incidences of diseases with growing age is mooted. Information on the relationship between age and plasma glucose is relatively limited. Our study showed an increase in fasting blood glucose levels with advancing age. A previous study reported similar observation that fasting glucose increases in 232 non-diabetic subjects between the ages of 20 and 70.[15] However, in another study, fasting plasma glucose levels showed no relationship with age. This adverse finding is likely due to the small sample size. In another study with more than 15,000 subjects observed an apparent and significant increase in plasma glucose levels with age.[16] A recent study reported lower plasma glucose levels in the young age group (20-29 years) and higher plasma glucose levels in the old age group (>69 years) in men.[17] Moreover, the increment of plasma glucose per decade was almost twice as high in men. Increased plasma glucose with an increasing age is believed to be multi-factorial. Evidence suggested that age could affect the glycaemic index values of foods. However, there is a lack of data to support this concept, and a recent study concluded that the glycaemic index for lentils was not affected by age.[18] Insulin levels have been reported to decrease with advancing age,[19,20] which might be another reason for higher blood glucose in elderly people. On the other hand, insulin sensitivity has been reported to decrease with age.[21] Insulin resistance associated with aging has been suggested to be related to an age-related decline in serum dehydroepiandrosterone sulfate (DHEA) levels.[22] This hormone can reduce visceral fat accumulation and improve insulin resistance. An increase in other stress hormones, e.g., cortisol level, may also play a role in age-associated hyperglycaemia.[23] A better understanding of the metabolic derangements in the aging population is essential for adequate preventive measures.

The present study showed that the serum creatinine concentration increases with the age of the subjects aged between 50 to 78. The mean serum creatinine concentration in group A (age 24-49 years) is lower than that for group B (age 50-78 years) supports a reported earlier findings.[24] The elevated serum creatinine of adults over 50 is of clinical concern. It is of interest that the increase in serum creatinine concentration occurs at around 50 years of age in adults. Previous studies have reported a rise in serum creatinine concentration with the age of subjects.[25,26] Serum creatinine levels appear to be influenced by factors other than kidney function and muscle mass.[26] Our study also revealed that older people (50 - 78 years) tend to have significantly higher total

cholesterol than younger people (24-49 years). Vascular disease commonly affects those over 50 years of age. Regarding the effect of age on total cholesterol, the current results were comparable with the findings of previous studies that total cholesterol increases gradually from early adulthood through late middle age.[14,27] The decrease in serum total cholesterol after midlife may be partly described by physiological ageing.[27,28] Sedentary lifestyle-related factors such as diet, physical activity, or smoking may also enhance the total cholesterol pattern. There are several other reasons for increasing cholesterol levels in older. Ageing affects the body's ability to regenerate any damaged cells. The liver, which processes excess cholesterol, does not function as efficiently in older people because of ageing. This might be due to the fact that liver cells do not get enough energy they require to replace the damaged cells due to ageing.[28]

Conclusion

The overall results suggest that fasting blood glucose, serum creatinine, and total cholesterol increase gradually with age, especially above 50 years. In addition, significantly higher fasting blood glucose, creatinine, and total cholesterol levels were observed in subjects above 50 compared to subjects below 50. Therefore, it can be concluded that aging leads to the increased risk of diabetes, renal failure, and cardiovascular disease by enhancing the blood glucose, creatinine, and total cholesterol levels in elderly people of Bangladesh.

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