



Medical Laboratory Sciences Program
Chemical Pathology Department

Impact of population displacement due to the conflict in Sudan on the percentage of Normal and Abnormal levels of blood glucose in non-conflict areas in Sudan

By

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Supervisor

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BS.C, MS.C in Chemical Pathology

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1.Introduction:

1. Background:

1. Displacement of population:

Displacement of population is defined as forced displacement and displaced populations are persons who are forced to leave or flee their homes due to conflict, violence, and human rights violations. Several reasons cause people to be displaced such as armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters.

Displacement populations usually encounter basic challenges such as finding a safe place to live or adapting to camp life, as well as gaining access to basic humanitarian assistance in the often unfamiliar and insecure location of displacement. While other basic challenges such as livelihoods and access to health or educational services are frequently shared by poor host populations or poor populations in areas of settlement, they become intensified for Internally Displaced Populations and refugees both in exile and when they strive to find durable solutions to their displacement by returning to their places of origin or settling somewhere else.

Displacement has significant effects not only on the displaced population but also on the safe areas where people move to, some of these challenges hurt what the development of host communities due to pressure on local resources, infrastructure and services, along with environmental degradation. Moreover, after fleeing the effects of armed conflict, generalized violence, or human rights violations, Internally Displaced populations and refugees often fail to be able to access justice and feel secure in the location of displacement. However, in situations where the host government – if needed with adequate support – allows refugees access to its educational and health facilities, and provides the right to work or even opportunities for livelihoods. (1)

Glucose is a simple sugar and building block of disaccharides, oligosaccharides and polysaccharides.

Glucose concedes the main source of energy in the body in and provides energy in the form of ATP produced from two molecules of pyruvic acid by the glycolysis process.

Some vital processes in the body work to maintain glucose hemostasis, during demand, the body tends to increase blood glucose levels by entering the cell under the action of insulin hormone while during the excess of energy, the body tends to store glucose in the form of glycogen in muscle and liver and the adipose tissue as fat by processes gluconeogenesis, lipolysis and glycogenolysis under the glucagon, growth hormones, epinephrine and cortisol hormones.[2].

Failure of the body to maintain glucose hemostasis leads to hyperglycemia and hypoglycemia their associated with metabolic disorders.

Diabetes mellitus is the metabolic disorder related to abnormalities in glucose levels resulting from defects in insulin secretion or action and has two main classes.

Type 1 diabetes mellitus: is the result of autoimmune destruction of pancreatic beta cells leading to insulin deficiency.

Type 2 diabetes mellitus: is characterized by hyperglycemia as a result of insulin resistance. Most patients are obese and are diagnosed after years. The people at risk of diabetes are obese, elderly, and People who do not exercise.

Hyperglycemia: Is increase in plasma glucose level in healthy patients during which insulin is secreted by beta cell and enhances membrane permeability to cells in the liver while hypoglycemia is a condition where blood glucose levels fall below normal levels.[2].

1.2-Blood Glucose:

Blood glucose, or blood sugar, refers to the concentration of glucose in the blood, which is crucial for energy production and metabolic processes. Maintaining blood glucose levels within a narrow range is essential for normal bodily function, and deviations can lead to health issues.

According to the World Health Organization (WHO), FBG:70-100mg/dl, PP: is less than 140mg/dl, and RBG: is below 200mg/dl.

1.2.2-Monitoring and Management:

Self-monitoring of blood glucose (SMBG) should be part of a regular management plan for patients with diabetes. Self-monitoring of blood glucose provides information regarding an individual's dynamic blood glucose Profile. This information can help with the appropriate scheduling of food, activity, and medication. It is also required for understanding the timing of blood glucose variations. Lack of regular SMBG predicts hospitalization for diabetes-related complications. Self-monitoring of blood glucose is an essential tool for people with diabetes who are taking insulin or for those who experience fluctuations in their blood glucose levels, especially hypoglycemia. The application of practical aspects that aid in the easy management of SMBG makes the task of checking blood glucose more achievable. For patients taking insulin and adjusting their dose, SMBG is needed. [7].

Glycosylated hemoglobin (HbA1c).

The percentage of glycated hemoglobin in circulation is indicated by the HbA1c. A non-enzymatic method of measuring glucose levels over time is called glycosylation. It represents the average plasma glucose over the preceding 8–12 weeks as a biomarker. It is currently regarded as the gold standard in the evaluation of diabetes-related outcomes and is used for both diabetes diagnosis and management. A key component of blood glucose monitoring is hemoglobin A1C (HbA1c), which is utilized as an index of average blood glucose measurement over months. This parameter, which predicts diabetes-related microvascular problems, is simple to assess and quite affordable to get. However, HbA1c does not address short-term glycemic variability (GV); rather, it simply offers an approximative measurement of glucose management. [8].

HbA1C greater than or equal to 6.5 % using the National Glycohemoglobin Standardization program.

Factors that affect the reliability of results :

- Anything which affects erythrocyte turnover will alter the age distribution of erythrocytes and subsequently affect HbA1c levels. Anecdotally, splenectomy is thought to increase HbA1c.[9].

However, it is also potentially associated with an increased rate of diabetes. [10].

There is currently insufficient evidence to make any recommendation relating to HbA1c in a splenic patients.

Thyroid status affects haematopoiesis and may influence HbA1c levels, independently of MBG. [11].

Several studies have demonstrated statistically but not clinically elevated HbA1c levels in subclinical and overt hypothyroidism, which normalize following thyroxine therapy and establishment of thyroid status. [12,13].

Notably, while the effects were statistically but not clinically significant.

A 2017 study with a hyperthyroid arm demonstrated no statistical difference in HbA1c between hyperthyroid and matched thyroid controls at baseline or following treatment. [14].

Based on this small study, we suggest stable hyperthyroidism does not need to be considered when performing HbA1c.[15]

-CKD is proven to affect HbA1c,56 [16] in varying degrees. [17].

HbA1c should therefore not be used to diagnose T2DM in end-stage renal failure (CKD 5). [18].

Data, however, support its use in milder CKD as, after adjustment for age, ethnicity, gender and hemoglobin, HbA1c is not associated with CKD stage 3. [19].

A study of 15 patients with T2DM and CKD (3B/4) receiving erythropoietin demonstrated a clinically significant reduction in HbA1C values56; therefore, we suggest limiting HbA1c for diabetes diagnosis use to those with CKD 1–3 and use of alternative biomarkers in those with CKD 4/5 and/or receiving erythropoietin. [20].

2. Literature Review:

Chronic diseases, commonly referred to as non-communicable diseases (NCDs), are characterized by a multitude of complicated causes, a sudden or gradual onset, a long duration of persistence that leads to gradual mobility, and an increased risk as people age. Chronic respiratory conditions, cancer, diabetes, kidney disease, and chronic respiratory disorders are the main categories of non communicable diseases (NCDs).

A survey on the prevalence of non-communicable diseases (NCDs) was carried out in Sudan in 2005, The study's findings showed that 62.5% of the female participants and 41.5% of the male participants were overweight or obese. For the male and female subjects, the percentage of elevated serum cholesterol was 19.6% and 19.9%, respectively. Furthermore, the percentage of participants with high fasting blood glucose was represented by 17.8% of female participants and 22.2% of male participants, respectively With a frequency of 12%, Diabetes mellitus is the second most common non-communicable disease (NCD). Adults are most likely to be affected; West Darfur has the lowest frequency at 2%, and Khartoum State has the highest, at 19.35 percent. [21].

A study conducted in 2019 examined the prevalence of diabetes and hypertension among Syrian refugees in northern Jordan and reported that the prevalence of prevalence of hypertension is 17.2% among those over the age of 18, diabetes is 9.8%, and both conditions 7.3%. The prevalence of diabetes is 19.3% and hypertension is 39% among those 30 years of age or older. The prevalence of all conditions rises with age, with women more likely than men to have diabetes [22].

3. Rationale:

Maintaining normal glucose levels is crucial for overall health: **Energy Balance:** Normal glucose levels provide a steady supply of energy for the body's cells, especially the brain, which relies heavily on glucose for optimal function. **Prevention of Complications:** Well-regulated glucose levels reduce the risk of both short-term and long-term complications such as cardiovascular disease, neuropathy, nephropathy, and . **Enhanced Immune Function:** Proper glucose levels support immune function, helping the body fight infections more effectively.

Poor glucose metabolism leads to diabetes mellitus. According to the American Diabetes Association, the prevalence of diabetes in the year 2015 was 9.4%, with people aged 65 and older forming the largest group. Every year, 1.5 million Americans receive a diagnosis of Diabetes. [23]

4. Objectives:

1.4.1. General objectives:

To study the effect of the displacement of populations due to the ongoing conflict in Sudan on the percentage of normal and abnormal levels blood glucose levels.

1.4.2. Specific objectives:

1.4.2.1. To estimate blood glucose levels for the study population.

1.4.2.2. To Compare the percentage of normal and abnormal levels of blood glucose before and after the war.

1.4.2.3. To correlate the percentages over the time of war.

5. Materials and Methods:

2.1 Study area

2.2 Study Population

2.3 Study Design

d. Sampling strategy

e. Sample Size: equation for calculation of sample size:

f. Selection Criteria

g. Analytical methods. for more details check the appendix.

h. Ethical Clearance

i. Quality Control.

j. Statistical Analysis

5.1.Study Area and Population:

This study will be carried out on the patients who attend Kassala Teaching Hospital and Shendi Hospital.

5.2.Study design and duration :

This descriptive cross-sectional study will be conducted during the period from January 2022 to July 2024.

5.3.Sampling Technique and Sample Size:

A Quota sampling technique will be used to select the participants, therefore the sample size of this study will be all participants who attended Kassala Teaching Hospital and Shendi Hospital to estimate their blood glucose level.

5.4..Study subject: selection & definitions

inclusion criteria: any patient who attends the hospital for estimation of blood glucose in March and April 2023 and March and April 2024.

5.5.Data Collection and Analysis:

the clinical data of participants will be collected from the hospital records.

5.6.Data management and statistical analysis:

The collected data will be coded to protect the privacy and confidentiality of participants, and data will be analyzed using Statistical Package for Social Sciences (SPSS computer program) version 21.

5.7.Calculation:

The glucose concentration in the sample was calculated using the Formula:

Calculation (Specimen) Glucose concentration (mg/dl) x 100 (Standard).

5.8.Selection Criteria:

any patient who attends the hospital for estimation of blood glucose.

5.9.Analytical methods. For more details check the appendix.

5.10.Ethical Clearance:

All individuals included in this study were told for study purposes and asked for an agreement and verbal Consent was taken regarding acceptance to participate in the study and - reassurance of confidentiality. Before the sampling from the laboratory

5.11.Quality Control:

Normal and abnormal commercial control serum of known concentrations should be analyzed with each run.

6. Expected (Anticipated) Outcome:

(management and control, Screening and prevention)

7. Work plan / Time plan:

Description	Date (dd/mm/yy)
Problem Statement And Hypotheses Generation	20 Jul 2024 - 27 Jul 2024
Facility Assessment And Resource Availability	28 Jul 2024 - 4 Aug 2024
Proposal Writing	5 Aug 2024 - 8 Aug 2024
Proposal Check	9 Aug 2024 - 16 Aug 2024
Proposal Submission	17 Aug 2024
Ethical Clearance	
Data And Sample Collection	
Samples Analysis	
Data Analysis	
Graduation Project Writing	
Graduation Project Submission	

8. Estimated budget:

Item	Number	Single / Price SDG	Total /Price SDG
Travel Expenses	-		
Data Collection Equipment	1		
Personal Cost			
Total price			

9. References:

1-Asger Christensen, Asger Christensen, Niels Harild World Bank, 2009.

- 2-Clinical Chemistry .I.Bishop, Miceal L.II.fody ,Edward p III.scheoff ,Larry E[DNCM:1.Chemistry , clinical .Method .2 clinical chemistry Test .QY 902.Clinical Chemistry .I.Bishop, Miceal L.II.fody ,Edward p III.scheoff ,Larry E[DNCM:1.Chemistry , clinical .Method .2 clinical chemistry Test .QY 90C6414.2010] pag 309-318.
- 3-World health report 2002: Reducing risks, promoting healthy life.
- 4-Diabetes Care, 46(Supplement 1), S1-S291.Glick, A. Endocrinology and Metabolism. (2023)
- 5-6.-Bishop et 2010.
- .7-Julienne K Kirk, Jane Stegner Journal of diabetes science and technology 4 (2), 435-439, 2010
- 8-Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK. Significance of HbA1c test in diagnosis and prognosis of diabetic patients. Biomark Insights. ;1:95–104.(2016).
- 9-Champ RC, diabetes Dof. Consider life span of red cells. BMJ 2009;339(dec31 1):b5645.
- 10-Ley EJ, Singer MB, Clond MA, et al. Long-term effect of trauma splenectomy on blood glucose. J Surg Res 2012;177:152–6.
- 11-National Glycohemoglobin Standardization Program, 2017. Factors that Interfere with HbA1c Test Results. 2018].
- 12-Kim MK, Kwon HS, Baek KH, et al. Effects of thyroid hormone on A1C and glycated albumin levels in nondiabetic subjects with overt hypothyroidism. Diabetes Care2010;33:2546–8.
- 13- Anantarapu S, Vaikkakara S, Sachan A, et al. Effects of thyroid hormone replacement on glycated hemoglobin levels in non diabetic subjects with overt hypothyroidism. Arch Endocrinol Metab 2015;59:495–500.
- 14-.Makadia MG, Patel VI, Patel KP, et al. Study of glycated haemoglobin (HbA1c) in nondiabetic subjects with subclinical hypothyroidism. J Clin Diagn Res 2017;11:BC01-BC04.
- 15- Bhattacharjee R, Thukral A, Chakraborty PP, et al. Effects of thyroid status on glycated hemoglobin. Indian J Endocrinol Metab 2017;21:26–30.
- 16-Ng JM, Cooke M, Bhandari S, et al. The effect of iron and erythropoietin treatment on the A1C of patients with diabetes and chronic kidney disease. Diabetes Care2010;33:2310–3.
- 17-.World Health Organization. Use of glycated haemoglobin (HbA1c) in the diagnosis of diabetes mellitus. Geneva: World Health Organization, 2011.
- 18-Little RR, Rohlfing CL, Tennill AL, et al. Measurement of Hba(1C) in patients with chronic renal failure. Clin Chim Acta 2013;418:73–6.
- 19-.Kilpatrick ES, Atkin SL. Using haemoglobin A(1c) to diagnose type 2 diabetes or to identify people at high risk of diabetes. BMJ 2014;348:g2867.
- 20- Shipman KE, Jawad M, Sullivan KM, et al. Effect of chronic kidney disease on A1C in individuals being screened for diabetes. Prim Care Diabetes 2015;9:142–6
- 21-Sudan Household Health Survey- 2006.
- 22-Balcilar M. Health Status Survey of Syrian Refugees in Turkey: Non-communicable Disease Risk Factors Surveillance Among Syrian Refugees Living in Turkey. World Health Organization; 2017.

23-Zhang N, Jiang H, Bai Y, Lu X, Feng M, Guo Y, Zhang S, Luo Q, Wu H, Wang L. The molecular mechanism study of insulin on proliferation and differentiation of osteoblasts under high glucose conditions. *Cell Biochem Funct.* 2019 Jul;37(5):385-394.

Appendix

Written Informed Consent

Study Objectives: This study aims to measure glucose in samples of blood from a group of population , with the purpose of research .

Type of Research Intervention: We will take a sample of blood to measure glucose We will ask some questions related to the study topic.

Voluntary Participation: Your decision to participate in this study is voluntary. You can change your mind later or withdraw from the study at any stage. Your participation or non-participation in this study will not affect your diagnosis or treatment stages.

Procedures: We will ask you some questions, and if you meet the criteria, you will be selected to participate in the study. A sample of blood will be taken. The samples will be used only for this study.

Expected Risks: We do not expect any risks from participating in this study.

Benefits: This study is of great importance in knowing when displacement is dangerous

Confidentiality: All the information we collect will be confidential and will only be accessible to the researcher and the supervisors of the research.

Sharing Results: Personal information will not be published, and we will publish the study results to spread the benefit.

Consent Certificate: I have read/had read to me the above information, and the study objectives and all related details have been explained to me. I voluntarily agree to participate in this study.

Name: _____

Signature: _____

Researcher: _____

Napata College - Medical Laboratory Sciences Program

Department of Chemical Pathology - Fourth Year

Napata College
Medical Laboratory Sciences
Chemical Pathology Department

Research Title:

Impact of population displacement due to the conflict in Sudan on the percentage of Normal and Abnormal levels of blood glucose in non-conflict areas in Sudan

Questionnaire:

Patient NO: ()

Date: / /

Name: _____

Tel: _____

Address: _____

Age (years): _____

Gender: _____

Results:

Parameter	Result