PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENT CENTRE OF MULAGO HOSPITAL

BY
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2011
DECLARATION

I, Geriga Fadhil, hereby declare that the work presented in this dissertation has not been presented for any other degree in any university.

Signed……………………………………..                    Date………………………………..

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This dissertation has been submitted with the approval of the following supervisors

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2. Dr Eric Wobudeya MBChB. MMed, MSc.                Date
DEDICATION

This book is dedicated to my parents, Hajji Hussein M. Okudriga and Mrs. Naima Uliru, and to my wife and son for their un-ending support during this course of academic endeavor. Fikrah my junior sister and other siblings, relative friends and in-laws for their spiritual, moral and physical support.
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I am grateful to Allah, the creator.

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<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTC</td>
<td>Belgium Technical cooperation</td>
</tr>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>B/S</td>
<td>Blood slide</td>
</tr>
<tr>
<td>DKA</td>
<td>Diabetic keto- acidosis</td>
</tr>
<tr>
<td>DM</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>HAART</td>
<td>Highly active anti retroviral therapy</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IGT</td>
<td>Impaired glucose tolerance</td>
</tr>
<tr>
<td>Hb.</td>
<td>Hemoglobin</td>
</tr>
<tr>
<td>PICU</td>
<td>Pediatric Intensive Care Unit</td>
</tr>
</tbody>
</table>
OPERATIONAL DEFINITIONS

Child: Person aged 2 months to 12 years

Hyperglycemia: Random blood sugar of $\geq 6.7$ mmol/l

Overt hyperglycemia: Random plasma Glucose of $\geq 11.1$ mmol/l

Impaired glucose tolerance: Random plasma glucose of 5.6-6.9 mmol/l

Impaired fasting glucose: 2-hour postprandial glucose reading of 7.8-11.0 mmol/l

Diabetes Mellitus: Random plasma glucose measurement $\geq 11.1$ mmol, or fasting plasma Glucose $> 7$ mmol/l, or a 2-hour plasma glucose $> 11.1$ mmol/L after consumption of 75 g of glucose with polyuria, polydipsia, or unexplained weight loss.

Body mass index: Ratio of the weight to the square of the height / length.

Obesity: Body mass index (BMI) greater than 97% for age and sex.

Overweight: BMI of 85%-97%
ABSTRACT

Background: Hyperglycemia is a common occurrence in children presenting at emergency pediatrics units and is associated with poor immediate outcomes and risk of developing diabetes mellitus and cardiovascular complications later in life. No study had described the prevalence and factors associated with hyperglycemia among children attending out-patient departments in Uganda hospitals. The aim of this study was to determine the prevalence and Factors associated with hyperglycemia among children attending the Assessment Center of Mulago hospital.

Methods: This was a cross-sectional study of 382 Children aged 2 months to 12 years presenting to the Assessment Center of Mulago national referral hospital. Data collected included, socio-demographic characteristics, clinical history, physical examination and laboratory tests (Random blood sugar, urine dipstick results).

Results: The study enrolled 382 children with a median age of 19.5 months and sex ratio of approximately 1:1. The prevalence of hyperglycemia was 28.8% (95% CI; 24.4-33.4%). The factors that were significantly associated with hyperglycemia were; History of convulsions [AOR 4.3 (95% CI 1.4-12.9), p=0.008] and temperature ≥37.5°C [AOR 3.0 (95% CI 1.8-5.0), p<0.001].

Conclusion: Hyperglycemia is common among sick children attending the Assessment Centre of Mulago hospital. Factors independently associated with hyperglycemia were history of convulsions and temperature ≥37.5°C.

Recommendations: Clinicians should have high index of suspicion of hyperglycemia in sick children with history of convulsions and also children with body temperature ≥37.5°C.

Blood sugar should be routinely measured in children with a history of convulsions and documented fever to avoid unnecessary glucose infusions in sick children.
CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Hyperglycemia is a random blood glucose of ≥6.7mmol/L (120mg/dl) (1, 2). Hyperglycemia results from processes of increased gluconeogenesis, glycogenolysis or reduced peripheral glucose utilization (3). Although the definition varies among studies, ranging from ≥120mg/dl, ≥150mg/dl and ≥180mg/dl, all the studies consider a random blood sugar of > 11.1mmol/L (200mg/dl) as an overt hyperglycemia.

The specific prevalence of hyperglycemia remains unknown among children in general outpatient’s clinics owing to wide variation of cut off points for its definition and influence of several disease conditions associated with hyperglycemia. Some studies have described the prevalence of hyperglycemia in specific settings. Deepak et al in 2009 observed 28% and 17% prevalence of transient and persistent hyperglycemia among children with traumatic brain injury in the peri-operative period. In Kenya, Osier et al found 2.9% prevalence of hyperglycemia among children outside the neonatal period on admission (4,5). In an emergency setting, Bhisikul et al in 1994 found a 3.8% prevalence of hyperglycemia. Among general patients including both children and adults in Tennessee State in America, a higher prevalence of 38% was reported with 26% having a known history of diabetes (2).

Some studies have described hyperglycemia in children with particular disease conditions. In Kenya hyperglycemia was present in 49.4% of children with malaria, 12.9% in gastroenteritis, 11.8% in lower respiratory tract infection and 7.5% in burns cases (5). Bhisikul et al found hyperglycemia in 9.3 % of children with temperatures greater than 39.5°C, 24.1% among children in critical care unit and 6% in children who had to receive fluids intravenously (6).

The outcome of patients with hyperglycemia is dependent on the associated medical condition and also the severity of hyperglycemia. Guillermo et al in 2002 found that 29% of patients with hyperglycemia end up being admitted to ICU and had a longer hospital stay compared with 9%
in normoglycemic patients (2). Klein et al reported a 12.7% and 43.6% Prevalence of hyperglycaemia among survivor and non survivor children (7).

Osier et al and Guillermo et al both found higher mortality rates of 14% and 16 % in hyperglycemic children compared to 3.8% and 3.0 % in normoglycemic children, respectively. Klein et al reported a mortality rate of 5%. (2, 5, 7).

Sick Children are prone to impaired glucose tolerance and poor outcomes associated with hyperglycemia or hypoglycemia (9).

No studies have described the burden of hyperglycemia in children in Uganda and therefore, the main aim of this study was to determine the prevalence and describe the factors associated with hyperglycemia among children attending Assessment Centre of Mulago Hospital.
1.2 LITERATURE REVIEW

1.2.1 Burden of hyperglycemia

The prevalence of hyperglycemia in children has been variable in different studies. The wide variations are due to the different blood glucose cut-off values used to define hyperglycemia and the spectrum of clinical conditions associated with and influencing hyperglycemia.

Hyperglycemia is described in children in form of impaired plasma glucose tolerance/Diabetes mellitus and stress hyperglycemia. Guillermo et al in a study of children and adult inpatients found a prevalence of 38%, with 26% having a known history of diabetes, and 12% having no known history of diabetes mellitus (2).

**Stress hyperglycemia**

Stress of illness is known to induce hyperglycemia by activation of neuro-endocrine phenomenon leading to activation of an inflammatory cascade causing the release of several hormones (e.g. cortisol) and inflammatory cytokines, humoral mediators leading to inhibition of insulin release and its peripheral insensitivity. The severity of illness correlates with hyperglycemia.

Among inpatient children in a rural Kenyan hospital, Osier et al in 2003 found a hyperglycemia prevalence of 2.7% and Bhisikul et al found a 3.8% prevalence in an emergency Pediatric unit (5, 6).

In a pediatric intensive care unit (PICU) setting, Rakesh et al in India found a 27.7% prevalence among critically ill children, 37.2% of children admitted with severe sepsis/septic shock and 25.6% prevalence among children with respiratory distress requiring ventilation. Krinsley et al found a general prevalence of 22.4% of whom cardiac subgroup had 29.2%, whereas the lowest rate was seen in the trauma subgroup (5.1%) (10, 11).

**Non stress Hyperglycemia**

The burden of Diabetes mellitus and impaired glucose tolerance is increasing globally and among children it is associated with particular risk factors.
In a European community survey of obese children and adolescents, Wiegand et al found 7.5% prevalence of impaired glucose tolerance and 1.2% prevalence of diabetes mellitus while Keu et al and Drobac et al both found a 3% prevalence of impaired glucose tolerance in a pediatric general clinic (12, 13, 35).

### 1.2.2 Factors associated with hyperglycemia

Hyperglycemia is described in children in form of impaired plasma glucose tolerance, and stress hyperglycemia. There are several distinct disorders, most of them rare, in which glucose intolerance is a feature (14) and many of the following symptoms of marked hyperglycemia can be demonstrable including: polyuria, polydipsia, weight loss, polyphagia, blurred vision, impairment of growth and susceptibility to certain infections. Acute life threatening consequences of diabetic-keto-acidosis (DKA) and non-ketotic hyper-osmolar syndromes may be the first presenting features. However late and long-term complications of diabetes mellitus including retinopathy, nephropathy, peripheral neuropathy, amputation and Charcot joints, autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms sexual dysfunction may be the presenting complaints especially in type 2 diabetes mellitus. These long term complications occur mainly in among adults (14).

Hyperglycemia has been associated with adverse outcomes since it impairs several physiological processes involved in the human body. It affects fluid balance (through glycosuria and dehydration), immune function, and inflammation. The vaso-constrictive effects lead to organ hypo-perfusion and in the brain, increased glucose levels and oxidative stress lead to cerebral ischemic injury and neuronal apoptosis (14-18).

**Stress hyperglycemia**

Hyperglycemia though common in illness does not appear to be associated with a particular diagnostic category but is significantly associated with severity of illness as evidenced by Bhisikul et al’s finding of prevalence of 9.3% in febrile children with temperatures >39.5 °C compared with 2.8% in patients with normal temperature. He also found a prevalence of 24.1% among children admitted in PICU compared to 4.4% for general ward admissions, and 6% prevalence among children with dehydration who need fluids intravenously (I.V) compared to
2.7% who did not require I.V fluids. In another study, Valerio et al found a prevalence of 14% among children with temperatures ≥39.0°C versus 4.0% temperatures < 39.0°C. In a study of critically ill children in India, Rakesh et al reported a prevalence of 37.2% in severe sepsis/septic shock and 25.6% among children with respiratory distress requiring ventilation (10).

Kinsley et al in PICU described hyperglycemia in 29.2% of all the patients, but a lower prevalence of 5.1% among cardiac and trauma in-patients. In a study by Preissig et al, the prevalence of hyperglycemia in patients with respiratory failure was 21.9%. When combined with patients who had both respiratory and cardiac failure, the prevalence of hyperglycemia was higher (43.4%) (11, 19).

Klein et al further described hyperglycemia in hospitalized patients including asthma and croup. The prevalence was 30.1% in patients with asthma and croup, 25.1% in post-operative acute care, 9.2% in cardiac medical illness, 7.1% in central nervous system disorders, 5.3% among children with sepsis, and 4.3% in liver failure (7).

Some particular disease conditions and their severity have been closely associated with hyperglycemia, such as meningococcal septic shock and pneumococcal pneumonia (20, 21).

**Non stress hyperglycemia**

The presentation of diabetes mellitus in children tends to vary. Among Swedish children, 4.8% and 1.0% of Lithuanian diabetic children had no typical symptoms of diabetes mellitus (22). In another study, Savova et al found 2.9% of the children diagnosed with diabetes mellitus had no specific symptoms while only 1.2% had postprandial hyperglycemia (23).

Diabetes keto-acidosis (DKA) is still the commonest presenting feature of type 1 diabetes mellitus among children. Quinn et al and Savova et al both found DKA prevalence of 44% and 18.2%, respectively. Factors associated with DKA were age < 4 years and a prolonged duration of candidiasis (24).

DKA was associated with the classical symptoms of ketonuria in 13.5%-66.0%, enuresis abdominal pain, weight loss, vomiting thirst and polyuria (22, 23, 25). Periodontitis has also been described and is thought to be among the first changes in clinical manifestation of diabetes mellitus (26). Other findings like acanthosis nigricans and obesity are described in at least 60% of patients with impaired glucose control (27).
Several clinical conditions have been associated with the risk of developing impaired glucose tolerance. Stenhammer et al in Sweden found that infection in the previous 3 months with common cold, sore throat, febrile seizures were associated with impaired glucose tolerance in 60%, 11%, 7 %, respectively (25). Other risk factors for the development of impaired plasma glucose tolerance and diabetes mellitus include a family history of diabetes, gestational diabetes in the mother, breastfeeding shorter than 12 months, low (<2500 g) or high (>4000 g) birth weight, maternal obesity and use of steroids by the child (12,28).
CHAPTER TWO

2.0 PROBLEM STATEMENT AND STUDY JUSTIFICATION

2.1 Problem statement
The Global burden of impaired glucose tolerance and diabetes mellitus is increasing and hyperglycemia is known to be of common occurrence in pediatric emergency units (6, 29). This hyperglycemia is attributable to stress of illness, impaired glucose tolerance and sometimes diabetes mellitus (5, 13, 30). Hyperglycemia is associated with poor immediate outcomes in patients and also a risk factor for developing cardiovascular diseases and diabetes in later life (2, 31). Incidental hyperglycemia is a relatively common finding in the pediatric population. Children with incidental hyperglycemia have a 2.5% three-year cumulative risk of developing type 1 diabetes mellitus regardless of familial history of type 1 diabetes (32). Hyperglycemia related morbidity and mortality can be significantly reduced by early diagnosis and institution of appropriate therapy before severe metabolic decomposition occurs. A significant proportion can be diagnosed using simple routine blood testing. (32)

A plasma glucose concentration >11.0 mmol/l with features of polyuria, polydipsia and fatigability at any time is overt hyperglycemia and indicative of diabetes mellitus (33). Some children with diabetes mellitus may not have symptoms suggestive of the disease at diagnosis (22) highlighting the need for routine blood sugar testing.

Some clinical conditions like fever, respiratory illnesses, CNS diseases and critical care which are very common in our setting are found to be associated with a high prevalence of hyperglycemia in several studies. In Kenya Hyperglycemia among children was found to be associated with features of severe disease that includes prostration, deep breathing and hypothermia. This was in the absence of insulin dependent diabetes mellitus. This is thought to be as part of stress response to hypovolemia.

2.2 Justification
In the developed world, it is recommended that children presenting for evaluation of dehydration, abdominal pain, or fatigue (albeit nonspecific complaints) and the presence of yeast infection should prompt immediate measurement of serum glucose concentration (24, 34).
However this is not a routine practice in assessment centre of Mulago national referral hospital. This may lead to delay in diagnosing children with hyperglycemia and hence averting its immediate and long term complications. This study therefore aimed at determining the prevalence and describing the factors associated with hyperglycemia among children attending the Assessment Centre of Mulago hospital.

The findings from this study form the basis for further research in this area which in the long run would be necessary in influencing policy to design interventions to address the problem.

2.3 Research Questions

- What is the prevalence of hyperglycemia among children attending the Assessment Centre of Mulago Hospital?
- What are the Factors associated with hyperglycemia among children attending Assessment Centre of Mulago hospital?

2.4 Research Objectives

2.4.1 General Objective
To describe hyperglycemia and its associated factors among children attending Assessment Centre of Mulago hospital

2.4.2 Specific Objectives

- To determine the prevalence of hyperglycemia among children attending Assessment Centre of Mulago hospital
- To describe the factors associated with hyperglycemia among children attending assessment centre of Mulago hospital.
Figure 1: CONCEPTUAL FRAME WORK

The following is an adaptation of the network for hyperglycemia as described by Weigand et al and also by Osier et al (5,35)

The scope of this study is limited to the clinical characteristics, physical examination and laboratory tests (random blood sugar and urine dipstick and blood slide for malaria).
CHAPTER THREE

3.0 METHODS

3.1 Study design

This was a cross-sectional descriptive study.

3.2 Study setting

The study was carried out at the Assessment Centre of Mulago national referral hospital.

The Assessment Centre is located at the old Mulago wing of the hospital and is one of the entry points into the national referral hospital. It accommodates all the general out-patient clinics for both pediatrics and adult patients and some specialized clinics e.g. the diabetes mellitus clinic for adults.

The pediatric wing of Assessment Centre receives an average of 5000 patients per month. These patients have both medical and surgical conditions. It operates 6 days a week and receives 220 children on a daily basis. Children with non complicated conditions receive outpatient treatment from here, however, children less than 12 years with danger signs are transferred to Acute Care Unit (the pediatric emergency ward) for further management while children between 12-18 years with danger signs receive emergency care from the causality wing located at the New Mulago hospital. Assessment Centre additionally carries out laboratory services like blood smears for malaria, stool analysis, and urinalysis, and also X-ray and ultra-sound services.

3.3 Study Population

The target population was all children in Kampala.

- Accessible population was all children receiving health care services at the Assessment Centre of Mulago hospital during the study period.
- The reference population was all outpatient children in Kampala Hospitals.
- The study unit was all children who meet the eligibility and selection criteria.
3.4 Selection criteria

3.4.1 Inclusion criteria

- All children 2 months-12 years attending Assessment Centre of Mulago hospital.
- A written informed consent and/ or assent

3.5 Sample size

The sample size was calculated using a formula by Kish Leslie as follows;

\[ N = \frac{Z^2 \cdot p(1-p)}{D^2} \]

- \( Z \) - Standard deviation value corresponding to 95% confidence interval (1.96)
- \( D \) - Absolute error between the estimated and true value = 5% (0.05)
- \( p \) - The prevalence of hyperglycemia to be studied (unknown, we assumed a 50% prevalence)

\( N = \) sample size required (calculated to be 384)

Therefore a minimum sample size of 384 children was required.

3.6 Sampling procedure

The enrollment was done between 10:00 am and 4:00 pm from Monday to Saturday. All children attending healthcare at the Assessment Centre were eligible. Enrollment method was systematic till the required sample size was obtained.

Using the patient’s registry at the pediatric wing of Assessment Centre, the first participant was randomly selected and then subsequently every third child and their care takers were selected and briefed about the study. Participants were enrolled from Assessment Centre and brought over to ACU where the researcher with the help of a research assistant first sought consent/assent then administered the questionnaires. This was because of availability of sitting space in ACU for the researcher, the research assistant and the participants.
Children who were selected but needed resuscitation were transferred to Acute Care Unit (ACU) emergency room and the process of enrollment carried out there. Blood slide for malaria parasites was done on all the patients from the side laboratory of ACU.

**3.7 Study procedure.**

All children aged 2 months to 12 years presenting to Assessment Centre were eligible. The researcher with the help of the research assistant systematically selected the eligible children. These children and their care takers were briefed about the study.

Children above 8 years and care takers of children below 8 years who were willing to participate in the study had to undergo the informed assent and consent process, respectively. When the informed written consent/ assent was obtained, the study questionnaire was administered by the researcher or the research assistant (Appendix 1). These questionnaires captured the demographic characteristics, clinical characteristics and known risk factors for hyperglycemia and a thorough physical examination was then done.

Once the questionnaires were completed, blood sample were taken for random plasma glucose. This sample was taken via finger prick on the left ring finger (for uniformity) after cleaning the finger with saline and then letting it to dry under free air. The sugar level was measured using an Acu-check Active Glucometer by allowing a drop of blood spot on the glucose stick which is preloaded on the reader. Children with random blood sugar greater than 120mg/dl (6.7mmol/l) had their urine samples taken for Dipstick. Urine samples from Children less than 2 years and unconscious children were collected using urine collection bags. These children with elevated blood sugar were admitted overnight at ACU for the early morning Blood sugar (fasting) testing.

**3.8 Study instrument**

A structured data collection tool was used to collect information. This instrument was first pretested for appropriateness. The data collection tool was administered by the researcher with the help of a research assistant. This captured socio-demographic characteristics, clinical characteristics, physical examination findings and laboratory tests.
Figure 2: Patient flow

All children aged 2 months - 12 years attending Assessment Centre during the study period

Number of patients to whom screening questionnaire was administered

Eligible

Administer study questionnaire by researcher/ research assistant

RBS, urine dipstick by researcher with the help of research assistant

Hyperglycemia

No Hyperglycemia
3.9 Data collection

3.9.1 Study variables

- Socio-demographic characteristics of the child including, age, sex,
- Clinical characteristics, medical history, peri-natal history, family history of DM
- Physical examination of all the systems, anthropometry,
- Laboratory test for random plasma glucose, urine dipstick, and blood Slide for malaria.

3.10 Data management.

Data was recorded on the pre-corded data collection tool and entered into the computer using EPI INFO package version 3.1. It was subsequently transferred into a statistical program SPSS version 10 for analysis.

3.11 Data analysis

Data was summarized in Tables; categorical data was analyzed using the chi-square test. Continues variables were summarized using means, medians, Standard deviations and analyzed using the student’s t-test.

Objective 1; the proportion of children with hyperglycemia was expressed as the number of children with hyperglycemia divided by the total number of children enrolled.

Objective 2; the characteristics of children with hyperglycemia were compared with those without hyperglycemia in a two-by-two table and associated factors determined using logistic regression. A p-value of < 0.05 was considered significant using a 95% confidence interval.

3.12 Quality control

- The data collection tool was pre-tested before the commencement of the study to ascertain if the required information could be obtained using the specific questions.
- A research assistant was trained on data collection procedures (test for blood sugar, urine test for protein, ketones, and glucose.).
• Collected data was cross checked at the end of everyday for completeness and they were stored in a secure place.
• The manufactures instructions were used for testing plasma glucose and urine dipstick and blood slide was done in ACU side laboratory.

3.13 Ethical considerations

Approval was obtained from the department of Pediatrics and child health and from the research and Ethics committee of Makerere Medical School and the National Council for Science and Technology.

Written informed consent was sought from the caretaker for children <8 years of age and assent for children > 8 years of age before enrolment into the study and participation in the study was voluntary. The results of random plasma glucose, urine dipstick, were communicated to the children/care takers and their attending doctor/ physician for care and management.

3.14 Dissemination of results

The results of the study will be disseminated to the children/their legal care takers, department of Pediatrics and child health, School of Graduate studies Makerere University, Albert Cook Library, Mulago Ethics Committee and Ministry of health.
4.0 RESULTS

4.1 Description of study participants

Data for the hyperglycemia study among children aged 2 months - 12 years (144 months) attending the Assessment Centre were collected from 01 February to 03 March 2011. During this period, 4294 children aged 0-144 months received care from Assessment Centre. A total of 446 were screened for assent or consent and 382 children finally participated in the study (figure 1).

Figure 3: Study profile
The socio demographic characteristics of the study participant

There were almost equal numbers of male and female children with hyperglycemia. Their median age (IQR) was 19.5 (9 to 44.2) months. Other characteristics were as shown in Table 1 below

Table 1: socio demographic characteristics of the study participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number=382(N)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caretaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>340</td>
<td>89.0</td>
</tr>
<tr>
<td>Father</td>
<td>11</td>
<td>2.9</td>
</tr>
<tr>
<td>Others</td>
<td>31</td>
<td>8.1</td>
</tr>
<tr>
<td>Age of participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-11</td>
<td>100</td>
<td>26.2</td>
</tr>
<tr>
<td>12-59</td>
<td>212</td>
<td>55.5</td>
</tr>
<tr>
<td>60-144</td>
<td>70</td>
<td>18.3</td>
</tr>
<tr>
<td>BMI for age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>8</td>
<td>2.1</td>
</tr>
<tr>
<td>Overweight</td>
<td>18</td>
<td>4.7</td>
</tr>
<tr>
<td>Normal</td>
<td>284</td>
<td>74.3</td>
</tr>
<tr>
<td>Underweight</td>
<td>72</td>
<td>18.9</td>
</tr>
<tr>
<td>Family history of DM</td>
<td>27</td>
<td>7.1</td>
</tr>
</tbody>
</table>
Clinical characteristics of the study participants

Majority of the participants had history of fever 307/382 (80.4%) and only 138/382 (36.1%) had documented fever with temperature $\geq 37.5^\circ \text{C}$. Few children 13/382 (3.4%) had edema and 3/382 (0.8%) had oral thrush. Forty children (10.5%) had severe pneumonia, 10 (2.6%) had severe malaria, 2 children had meningitis and 23 (6.0%) had diarrhea with dehydration. Other details are shown in table 2, below.

Table 2: Clinical characteristics and diagnosis of the study participants

<table>
<thead>
<tr>
<th>History</th>
<th>Number(382)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convulsions</td>
<td>16</td>
<td>4.2</td>
</tr>
<tr>
<td>Cough</td>
<td>257</td>
<td>67.3</td>
</tr>
<tr>
<td>Vomiting</td>
<td>143</td>
<td>37.4</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>120</td>
<td>31.4</td>
</tr>
<tr>
<td><strong>Signs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jaundice</td>
<td>29</td>
<td>7.6</td>
</tr>
<tr>
<td>Unconsciousness</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Tachypnoea</td>
<td>272</td>
<td>71.2</td>
</tr>
<tr>
<td>Chest in drawing</td>
<td>58</td>
<td>15.2</td>
</tr>
<tr>
<td>Duration since Last Meal &gt; 2 hours</td>
<td>124</td>
<td>32.5</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>125</td>
<td>32.7</td>
</tr>
<tr>
<td>Malaria</td>
<td>40</td>
<td>10.5</td>
</tr>
<tr>
<td>Diarrhoea and vomiting</td>
<td>85</td>
<td>22.3</td>
</tr>
</tbody>
</table>
Table 3: Laboratory urine dipsticks

The participants with elevated blood sugar (≥6.7mmol/l) had their urine dipstick done thus giving the following findings. Three patients had both positive urine sugar and ketones.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Numbers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketones</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Glucose</td>
<td>7</td>
<td>6.4</td>
</tr>
<tr>
<td>proteins</td>
<td>6</td>
<td>5.5</td>
</tr>
</tbody>
</table>
4.2 Prevalence of hyperglycemia

Of the 382 children, 110 [28.8% (95% CI 24.4-33.4%)] had hyperglycemia. Overt hyperglycemia (RBS 11.1mmol/L and above) was present in 9/382 (2.4%) children.

Random Blood Sugar mean was 6.3 ±1.9 and Rang of 2.2-22.2mmol/l.

Table 4: Prevalence of hyperglycemia

<table>
<thead>
<tr>
<th>Description</th>
<th>Frequency</th>
<th>Percentage</th>
<th>95% CI</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperglycemia</td>
<td>110</td>
<td>28.8</td>
<td>24.4-33.4</td>
<td>±4.6</td>
</tr>
<tr>
<td>No hyperglycemia</td>
<td>272</td>
<td>71.2</td>
<td>66.6-75.7</td>
<td>±4.5</td>
</tr>
<tr>
<td>Total</td>
<td>382</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3: Factors associated with hyperglycemia

Factor associated with hyperglycemia at bivariate analysis are summarized in table 4 and 5, below. The factors significantly associated with hyperglycemia and increased risks of hyperglycemia include history of fever, history of convulsions and feeding.

Table 5: Bivariate analysis of the characteristics of the study participants.

<table>
<thead>
<tr>
<th>History</th>
<th>Hyperglycemia</th>
<th>No hyperglycemia</th>
<th>OR (CI 95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=110(%)</td>
<td>N=272(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 2-48 months</td>
<td>84(76.4)</td>
<td>222(81.6)</td>
<td>0.7(0.5-1.2)</td>
<td>0.244</td>
</tr>
<tr>
<td>Female sex</td>
<td>39(35.5)</td>
<td>144(52.9)</td>
<td>0.4(0.3-0.7)</td>
<td>0.002</td>
</tr>
<tr>
<td>History of fever</td>
<td>98(89.1)</td>
<td>209(76.8)</td>
<td>2.4(1.2-4.7)</td>
<td>0.006</td>
</tr>
<tr>
<td>History of convulsions</td>
<td>8(7.3)</td>
<td>8(2.9)</td>
<td>2.5(0.9-7.0)</td>
<td>0.056</td>
</tr>
<tr>
<td>History of cough</td>
<td>77(70)</td>
<td>180(66.2)</td>
<td>1.1(0.7-1.9)</td>
<td>0.471</td>
</tr>
<tr>
<td>History of vomiting</td>
<td>41(37.3)</td>
<td>102(37.5)</td>
<td>0.9(0.6-1.5)</td>
<td>0.967</td>
</tr>
<tr>
<td>History of Diarrhea</td>
<td>34(30.9)</td>
<td>86(31.6)</td>
<td>0.9(0.6-1.5)</td>
<td>0.893</td>
</tr>
<tr>
<td>Duration since last meal</td>
<td>45(40.9)</td>
<td>79(29.0)</td>
<td>1.6(1.0-2.6)</td>
<td>0.025</td>
</tr>
<tr>
<td>&gt;2 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of DM</td>
<td>4(3.6)</td>
<td>23(8.5)</td>
<td>0.4(0.1-1.2)</td>
<td>0.096</td>
</tr>
</tbody>
</table>
The association of clinical characteristics of study participants to hyperglycemia is summarized in table 6. All severe forms of illness except severe pneumonia and unconsciousness are associated with hyperglycemia and have increased risk of hyperglycemia.

Table 6: Bivariate analysis of the clinical characteristics of the study participants.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Hyperglycemia</th>
<th>No hyperglycemia</th>
<th>OR (CI 95%)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N =110(%)</td>
<td></td>
<td>N=272(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI &gt;97%</td>
<td>3(2.7)</td>
<td>4(1.5)</td>
<td>1.8(0.4-8.6)</td>
<td>0.400</td>
</tr>
<tr>
<td>Temperature≥37.5° C</td>
<td>58(52.7)</td>
<td>80(29.4)</td>
<td>2.6(1.6-4.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>unconsciousness</td>
<td>1(0.9)</td>
<td>2(0.7)</td>
<td>1.2(0.1-13.8)</td>
<td>0.862</td>
</tr>
<tr>
<td>Tachypnea</td>
<td>66(60.0)</td>
<td>206(75.7)</td>
<td>0.4(0.3-0.7)</td>
<td>0.002</td>
</tr>
<tr>
<td>Chest indrawing</td>
<td>24(21.8)</td>
<td>34(12.5)</td>
<td>1.9(1.0-3.4)</td>
<td>0.022</td>
</tr>
<tr>
<td>Severe pneumonia</td>
<td>10(9.1)</td>
<td>30(11.0)</td>
<td>0.8(0.3-1.7)</td>
<td>0.575</td>
</tr>
<tr>
<td>Severe malaria</td>
<td>6(5.5)</td>
<td>4(1.5)</td>
<td>3.8(1.0-3.9)</td>
<td>0.027</td>
</tr>
<tr>
<td>Diarrhea with dehydration</td>
<td>23(20.9)</td>
<td>0</td>
<td>4.1(3.4-4.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>16(14.5)</td>
<td>109(40.1)</td>
<td>0.2(0.1-0.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Malaria</td>
<td>17(15.5)</td>
<td>23(8.4)</td>
<td>1.9(1.0-3.8)</td>
<td>0.043</td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>64(58.2)</td>
<td>21(7.7)</td>
<td>16.6(9.2-29.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Severe disease</td>
<td>41(37.3)</td>
<td>34(12.5)</td>
<td>4.1(2.4-7.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
4.4: Multivariate analysis by logistic regression.

Factors that were independently associated with hyperglycemia are shown in table 7.

Table 7: multivariate analysis of the independent variables associated with hyperglycemia

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>CI (95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>0.6</td>
<td>0.3-1.0</td>
<td>0.054</td>
</tr>
<tr>
<td>Convulsions</td>
<td>4.3</td>
<td>1.4-12.9</td>
<td>0.008</td>
</tr>
<tr>
<td>Temperature &gt;37.5</td>
<td>3.0</td>
<td>1.8-5.0</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

p≤ 0.05 is significant

The above were the variables that remained in the final module. There was a significant association between hyperglycemia and history of convulsions and body temperature ≥ 37.5 °C, with AOR of 4.3 and 3.0, respectively.
CHAPTER FIVE

5.0: DISCUSSION

The prevalence of hyperglycemia among children attending the Assessment Centre of Mulago hospital has not been described before. Few studies in Africa describe this metabolic disorder among children. Most of what is known about hyperglycemia in children is derived from the developed world.

5.1: Prevalence of Hyperglycemia

The proportion of children attending Assessment Centre, Mulago hospital with hyperglycemia was 28%. This is lower than what was reported by Apkon et al. (61.8%) and also Deepak et al (45%). These two later studies were carried out in more stressful environments of PICU and peri-operative with higher median ages of 38 months and 62.months, respectively (1, 4).

The fact that most of the participants in the present study were not very sick, with less stress of illness, they were more likely to have better sugar regulation than very sick children in PICU and inpatients hence a lower prevalence of hyperglycemia in this study.

In the present study, majority (68%) of the children with hyperglycemia were very sick thus making them similar to the participants reported by Apkon et al and Deepak et al.

Stress of illness is known to induce hyperglycemia by activation of neuro-endocrine phenomenon leading to activation of an inflammatory cascade causing the release of several hormones (e.g. cortisol) and inflammatory cytokines, humoral mediators leading to inhibition of insulin release and its peripheral insensitivity. This induces hyperglycemia and it is thought to be a protective mechanism in providing energy to the brain and other body tissues during stress.

Hyperglycemia increases glucose levels and oxidative stress in the brain leading to cerebral ischemic injury and neuronal apoptosis.

A small proportion of children in the current study had overt hyperglycemia (2.4%). This is comparable to other studies by Osier et al (2.9%) in Kenya and also Bhisikul et al in Virginia (3.9%). The study by Osier included patients in an inpatient setting with a median age of 19 months and used 10mmol/L value as hyperglycemia. Bhisikul et al obtained the prevalence in an
emergency setting with a participant’s median age of 62 months and a cut value of 10mmol/l for hyperglycemia. (5, 6).

5.2 Factors associated with hyperglycemia

**History of convulsions**

In this study, history of convulsions was associated with hyperglycemia and the association remained statistically significant on multivariate analysis. This finding is similar to Valerie et al and Osier et al who reported that convulsions were associated with hyperglycemia. Other studies have also described an association between CNS disease and hyperglycemia (4, 5, 14).

Hyperglycemia is also thought to cause osmotic diuresis with hypovolaemia, electrolyte abnormalities and hyperosmolar non-ketotic coma. These derangements can actually cause convulsions.

**Body Temperature ≥37.5°C**

In this study, a temperature ≥ 37.5°C was associated with hyperglycemia and the association remained significant on multivariate analysis. This finding is similar to that reported by Bhisikul et al in 1994 where he found that the higher the temperature, the greater the risk of hyperglycemia. Valerio et al in 2001 also found that hyperglycemia was 14% versus 4% among children with temperature ≥39.0°C and <39.0°C, respectively.

Fever mainly due to infection is known to increase metabolism, activate the inflammatory cascade and cause the release of several hormones (e.g. cortisol) that oppose the action of insulin leading to impaired uptake of glucose hence hyperglycemia.

**Other findings**

**Socio demographics**

Female sex showed an association with hyperglycemia at bivariate but not at multivariate analysis whereas age showed no association with hyperglycemia. These are contrary to a study in Washington by Deepak et al in 2008 and another by Klein et al in New York in 2008, where they found a strong association between Age, sex and hyperglycemia. They reported that younger
children less than 4 years and female children were more likely to have hyperglycemia. (4, 7). The 2 studies enrolled older children, with median ages of 63 and 92 months, respectively. The two studies also had a larger sample size compared to the current study.

**Factors known to be associated with hyperglycemia.**

Family history of diabetes mellitus and maternal gestational Diabetes mellitus had no association with hyperglycemia in the current study. This is Contrary to a study by Keu et al in Canada in 2002 who reported an association between hyperglycemia and a family history of Diabetes (12)

**Disease severity**

This study found an association between hyperglycemia with features of severe disease including Chest indrawing, convulsions and dehydration. This is similar to other studies which described frequencies of hyperglycemia in various disease conditions including respiratory failure 10.8%, coma 11.8%, other CNS diseases 9.1%, and severe illness 50% (1, 4, 5, 7, 11).

Positive malaria slides and diarrhea at bivariate analysis were associated with hyperglycemia in this study contrary to the Kenyan study by Osiers who found no associations. (5). the current study identified similar relations but higher prevalence of hyperglycemia among specific diagnostic categories i.e. Severe Pneumonia and severe malaria and meningitis. Although it was not possible to make a valid conclusion because of small numbers. Some previous studies especially by Kinsley et al and also Osier et al found that hyperglycemia was more prevalent among participants with malaria (49.4%), gastroenteritis (12.9%-14.9%), respiratory infection 11.8%-15.8% cardiac 29.6%, and Central Nervous System diseases 13.2% (5, 11).

**5.3 Strengths**

The present study describes the prevalence and factors associated with hyperglycemia among children in Assessment Centre of Mulago National Hospital.

It provides a base for future studies about hyperglycemia among children in Uganda.

**5.4 Study limitations**

Selection Bias. We used the registry serial numbers which could be assigned to the discretion of the health worker registering study children, therefore introduce bias in selection. Recall bias for
some of the factors associated with hyperglycemia like birth weight, family history of diabetes mellitus was also likely to occur.

In this study, it was not possible to use more reliable tests such as glucose tolerance, especially among the high risk groups such as obese children. However, we carried out early morning blood sugar testing for the participants with high random blood sugar to confirm persistent hyperglycaemia and identify high risk patients for diabetes mellitus for appropriate follow up care.

Some signs and symptoms associated with diabetes mellitus e.g. polyuria and polydipsia are difficult to assess among the very young children. Most care takers expressed ignorance about features of diabetes mellitus in children. This was unlikely to affect the results of this study since children with hyperglycemia had both urine dipstick and fasting sugar testing done, therefore less likely to be missed if they were diabetic.
6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

- A high prevalence of hyperglycemia was observed among children attending the Assessment Centre of Mulago hospital.
- The factors associated with hyperglycemia were; history of convulsions and body temperature greater than or equal to 37.5 °C.

6.2 Recommendations

- Clinicians should have high index of suspicion of hyperglycemia in children with history of convulsions and also children with body temperature $\geq 37.5^0C$ especially when considering administration of intravenous or oral glucose in sick children. This would lead to avoidance of unnecessary glucose infusions in these children.
- Further studies should evaluate the pattern of subsequent blood sugar measurements in sick children with hyperglycemia and its effects on the prognosis of sick children.
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APPENDICES

Appendix I: Questionnaire

Study title: THE PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENTCENTRE OF MULAGO HOSPITAL

Study no .................................. Date..................................
Age, Sex M [ ] F [ ]
Care taker……………………………… School attendance………………………….

Systemic symptoms

Fever Yes [ ] No [ ], Duration .............

Central Nervous system

Headache yes [ ] No [ ] Convulsions Yes [ ] No [ ] Loss of consciousness yes [ ] No [ ]
Ear Nose Throat

Ear pain/discharge Yes [ ] No [ ], Throat pain Yes [ ] No [ ]

Respiratory

Cough Yes [ ] No [ ] Duration of cough < 3weeks [ ] >3 weeks [ ]

Difficulty in breathing Yes [ ] No [ ]

Gastrointestinal tract system

Vomiting yes [ ] No [ ] Diarrhea yes [ ] No [ ] Oral sores yes [ ] No [ ]
Abdominal pain yes [ ] No [ ] Abdominal distension yes [ ] No [ ]

Duration since last meal < 2hrs [ ] >2hrs [ ] Dental carries Yes[ ] No [ ]

Cardiovascular system

Exertional dyspnoea Yes [ ] No [ ] Othopnea Yes [ ] No [ ], Body swelling Yes [ ] No [ ]
Genital urinary system

Urine frequency Normal [ ] abnormal [ ] (specify), Amount, Normal [ ] abnormal [ ] specify........ Color normal [ ] abnormal [ ] specify......... Pain full urination yes [ ] No [ ]
Nocturia Yes [ ] No [ ]

Musculoskeletal system

Skin rash yes [ ] No [ ], Joint pains yes [ ] No [ ], swelling yes [ ] No [ ]

Symptoms of Hyperglycemia

Polyuria yes [ ] No [ ] Duration ........ Polydipsia yes [ ] No [ ] Duration ......

Bluring of Vision Yes [ ] No [ ] .................

Polyphagia yes [ ] No [ ] duration ................, Weight loss yes [ ] No [ ]

Recurrent Candida infection Yes [ ] No [ ]. Extreme weakness Yes [ ] No [ ]

Past medical History

Illness (fever, sore throat, common cold diarrhea) in the last 3 months Yes [ ] no [ ], Known Diabetic mellitus case yes [ ] No [ ] any other chronic illness Yes [ ] No [ ] specify.............. Recurrent illnesses Yes [ ] No [ ] specify..........................

Per Vaginal discharge/itchy yes [ ] No [ ]

Family history of diabetes mellitus yes [ ] No [ ] specify relation .........................

Maternal gestational diabetes mellitus yes [ ] No [ ] unknown [ ]

Birth weight<1.5kg [ ] 1.5-2.5kgs [ ] >2.5kgs [ ], unknown [ ]

Duration of breast feeding < 12 months [ ] >12months [ ]

Drug history yes [ ] No [ ] specify..................HIV status Positive [ ] negative [ ]
Physical Examination

Weight............., length/height..............

Jaundice none[ ] mild[ ] moderate[ ] severe[ ] Pallor none[ ] mild[ ] moderate[ ] severe[ ]
Dehydration none[ ] some[ ] severe[ ] Temperature......... thrush (groin, mouth) yes[ ] No[ ]

Oedema grade none [ ] 1[ ] 2[ ] Anasarca [ ]

Conscious [ ] unconscious [ ], meningism Yes [ ] no [ ]

Neurological deficit Yes [ ] No [ ].

Respiratory

Rate -…… high [ ] normal [ ] low [ ] In drawing yes [ ] No [ ]

Crackles Yes [ ] No [ ] Rhonchi Yes [ ] No [ ]

Cardiovascular system

CVS- PR......... high [ ] Normal [ ] low [ ]

Bp..... High [ ] normal [ ] low [ ] Heart sounds normal [ ] abnormal [ ]

Abdominal

Size Distended [ ] Normal [ ] scaphoid [ ] liver................. spleen size.......... 

Ascitis Yes [ ] No [ ], Kidneys size ....... tenderness.......... 

Laboratory

Random Blood Sugar...........mmol.(mg/dl)

Urine sugar...............ketones..................Glucose ..................proteins........ 

Diagnosis

1).................................

2).................................
3)…………………………………..

4)…………………………………

Appendix II –Consent and Assent Forms

Title; PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENTCENTRE OF MULAGO HOSPITAL

Introduction and purpose

I am Dr Geriga Fadhil of the department of paediatrics and child health college of health sciences makerere university P.O. Box 7072 Kampala , +256 772 825025 gerigafahdil@yahoo.co.uk.

I am carrying out a study to learn more about how common abnormally high blood sugar is among children and what factors are associated with it among children attending assessment centre . This information will help find out if abnormally high blood sugar is a common problem among children in our society and suggest ways of identifying and helping them.

You are being requested to participate in this study by allowing your child to participate in the study and by answering some question about your child.

Procedure

You will be asked about your child’s current illness, past medical history, birth, dietary, physical activity and your family’s medical history especially Diabetic history, the child will be physically examined. A blood sample will be taken from your child to test for the child’s plasma blood glucose, and a urine test will be done using a dipstick for proteins, ketones, and glucose, if your child’s blood glucose is abnormally high.

Risks and benefits
There are no risks for your child for participating in this study though he/she may experience some anxiety while answering some questions. Your child may also suffer some pain while drawing some blood for the test.

The laboratory tests will be done free of charge. You will receive the results of your child’s measurements and if necessary be given further information to improve my child’s health if his/her blood glucose is abnormally high (>120mg/dl) and additionally your child will be requested to have a further evaluation at the pediatric diabetes clinic in Mulago Hospital.

Confidentiality
Only the researcher, authorized study personnel, institutions (Makerere and Mulago), you and the medical team managing your child will know the information obtained. Names will not be listed.

Your rights as a research volunteer
This is entirely voluntary and you are free to take part or withdraw at any time with no penalty and without affecting your child’s health seeking or future participation in research in any way.

In case of any questions related to this study please contact me or any my supervisors on the contacts below

Prof Grace Ndeezi  +256 0772-453191

Dr  Eric Wobudeya  +256 0712-846163

In case of any questions on your right in this study contact the chairman Makerere university research and ethics committee on +256 0414-530355

Consent statement
The purpose and nature of study has been explained to me. I understand that my participation is voluntary and no consequences will result if I refuse to participate; I also understand by signing of this consent form I indicate that I have been informed about the research study in which I am voluntarily agreeing for my child to participate.
Name of parent/ care taker | Signature/thumbprint | Date

Name of investigator /authorised representative
APPENDIX: III ASSENT FORM

Title; PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENT CENTRE OF MULAGO HOSPITAL.

Introduction and purpose

I am Dr Geriga Fadhil of the department of paediatrics and child health college of health sciences makerere university P.O. Box 7072 Kampala, +256 772 825025 gerigafahdil@yahoo.co.uk.

I am carrying out a study to learn more about how common abnormally high blood sugar is among children and what do these children normally present with. This information will help find out if abnormally high blood sugar is a common problem among children in our society and suggest ways of identifying and helping them. You are being requested to participate in this study.

Procedure

You will be asked about your current health, past illness, family’s medical history especially Diabetes history your legal care taker will be asked about your birth history, you will be physically examined. A blood sample to test for your blood glucose level, and urine test will be done only if the blood sugar is abnormally high.

Risks and benefits

There are no risks on you for participating in this study though you may experience some pain while drawing blood for the tests, mentioned above. The laboratory tests will be done free of charge and you will receive the results immediately and if necessary be given further information to improve your health. If your blood glucose is abnormally high (120mg/dl), you will be requested to have a further evaluation at the pediatric diabetes clinic.

Confidentiality

Only the researcher, authorized study personnel, institutions (Makerere and Mulago hospital), you and the medical team managing you will know the information obtained. Names will not be listed.
Your rights as a research volunteer

This is entirely voluntary and you are free to take part or with draw at any time with no penalty and without affecting your health seeking or future participation in research in any way.

In case of any questions related to this study please contact me or any my supervisors on the following contacts

Prof Grace Ndeezi    +256  0772 -453119

Dr Eric Wobudeya  +256  0712846163

In case of any questions about your right in this study, contact the chairman Makerere university research and ethics committee on +256-414530-020

Consent statement

The purpose and nature of study has been explained to me. I understand that my participation is voluntary and no consequences will result if I refuse to participate, I also understand by signing of this consent form, i indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me on request.

............................................             ........................................         ...................
Name of parent/ care taker            Signature/thumbprint             Date

Name of investigator /authorized representative
APPENDIX II-CONSENT FORM

Title; PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENT CENTRE OF MULAGO HOSPITAL

Okwanjula Ne Ekigendelerwa

Nze Dr Geriga Fadhil owa department of paediatrics and child health college of health sciences makerere university P.O. Box 7072 Kampala , +256 772 825025 gerigafahdil@yahoo.co.uk.

Nkola okunonyereza okumanya okulabikalabika kwa endwadde ya sukari omunji mu baana ne ebyo ebigyetolode mu baana abajanjabibwa mu assessment centre. Ebiinava mu kunonyereza kuno bija kuyamba okumanya oba sukari ayitiridde kizibu ekilabikalabika mu baana bomukitundu kya ffe nokulowoza kungeri yokubamanya no okubayamba.

Osabibwa okwegatta mu kunonyereza kuno nga okiliza omwana wo okwenyigira mu kunonyereza ku no era nga odamu ebimu kubibuzo ebikwata ku mwana wo.

Emitendera

Oja kubuzibwa kubikwatagana no obulwadde bwo omwana wo, ebyo obulamu bwe obwe emabega, okuzalibwa kwe, endya ye, okubelawo kwe, ebyo obulamu bwa family yo dala ku kye endwadde ya sukari, omwana aja keberwa omubiri gwe. Omwana aja kugirwako omusayi gukebezebwe sukari agulimu no omusulo gwo omwana gujja kebezebwa ekimu kubilala sukari agulimu, bwekiba nti mumusayi gwo omwana wo sukari mungi ayitiride.

Ebibi ne Ebirungi
Temuli kibi kisubirwa kutuka ku mwana wo nga yenyize mukunonyereza kuno naye ayinza okufunamunu okweralikilila nga adamu ebibuzo. Omwana wo era ayinza okuwulira obulumi nga agibwako omusayi ogwokebezebwa.

Okukebezebwa kwona kujja kuba kwa bwerere. Oja kuweebwa ebinaba bivudde mu kebezebwa kwo omwana wo era bwekinaba kyetagisa obulirwe kunker yoi kulabilila omwana wo bwaaba nga sukari we mumusayi munji ayitilide era omwana wo aja kusabibwa okubeera nga ajanjabibwa mu clinic ya aba sukari eya abato mu dwaliro lya mulago

Obwekusifu

Omunonyerezi yeka nabamuyambako, amatendekero[Makerere ne Mulago], gwe nabasawo abalabilila omwana wo mwe mujja okumanya ebinaaba bivudde mukunonyezebwa. Amany tegajja kutimbibwa.

Obuyinza bwo nga ayewedyo okuba mukunonyereza ku no

Kino kya kuyamba buyambi era olina olukusa okukiriza okubamu mukunonyereza kuno oba okuvamu ku budde bwona nga tobonezebwa oba omwana wo okutawana okujanjabibwa mu maaso oba okwenyigira mukunonyezebwa okulala mu biseera bye mumaaso mungeri yonna.

Bwooba nga oyina ebibuzo ebikwata kukunonyereza kuno, nkubila essimu oba omu kuba supervisors bange ku number zzino wansi.

Prof Grace Ndeezi +256 0772-453191

Dr Eric Wobudeya +256 0712-846163

Bwooba nga oyina ebibuzo kubuvunanyizibwabwo mukunonyereza kuno kubila chairman Makerere university Research and Ethics committee on +2560414530355

Consent statement

Ekigendererwa nengeri yokunonyezebwa kuno enynyonyodwa. Ntegedde nti okwenyigila kwange sikwa buwaze era tewali kiyinza kubawo singa sikiliza, era ntegedde nti bwe ntekako omukono gwa nge ndaga nti nyinyodwa kukunonyereza ku no kwe mpadeyo omwana wange okwenyigiramu.
Name of parent/ care taker  Signature/thumbprint  Date

Name of investigator /authorised representative
APPENDIX: III ASSENT FORM

Title: PREVALENCE AND FACTORS ASSOCIATED WITH HYPERGLYCEMIA AMONG CHILDREN ATTENDING ASSESSMENT CENTRE OF MULAGO HOSPITAL.

Okwanjula ne ekigendererwa

Nze Dr Geriga Fadhil owa department of paediatrics and child health college of health sciences makerere university P.O. Box 7072 Kampala , +256 772 825025 gerigafahdil@yahoo.co.uk.

Nkola okunonyereza okumanya okulabikalabika kw endwadde ya sukari omungi mu musayi mu baana ne embela ki abaana bano gye bagiramu mu dwaliro. Ebinava mukunonyereza kuno bijja kuyamba okumanya oba sukari omungi mu musayi kizibu ekilabika labika mu baana bomu kitundu kyaffe nokulowoza kungeri eyokubamanya nokubayamba. Osabibwa okwegata mu kunonyezebwa kuno.

Emitendera

Ojja kubuzibwa kubikwata kubulamu bwo obwakati , obulamu bwo ebwe emabega, obulamu bwa family yo dala ku kyendwadde ya sukari, akulabilila aja kubuzibwa ku byo okuzalwa kwo, oja kukeberewa omubili gwo, Ojja kugirwako omusayi gukeberwe sukari no omusulo gwo gukeberwe sukari ne ebilala ku oyo alina sukari omungi mu musayi.

Ebibi ne Ebirungi

Tewali kibi kina kutuuka ko olwa okwenyigira mu kunonyereza kuno naye oycinza okuwulila obulumi nga ogibwako omusayi ogwo okukebezebewa ogwogedwako wagulu,. Okukebererwa kwona kwa bwelele era ojja kuweebwa ebivudde mu kebezebewa amangu dala bwekinaaba kyetagisa owabulirwe ku ngeri yokulabililamu obulumu bwo bwoba nga oyna sukari omungi mu musayi era osabibwe okujanjabibwa nga mu clinic ya sukari eya abato.

Obwekusifu

Omunonyerezi yeka naabamuyambako, amatendekero [Makerere ne Mulago hospital], gwe naabasawo abakujanjaba mwe muja okumanya ebivudde mu kunonyereza. Amany tegajja kutimbibwa. O
Obuyinza bwo nga gwe ayewadeyo okuba mukunonyereza kunos

Kino kya kuyamba buyambi era oli wadembe okwenyigira mu kunonyereza kuno era oli wadembe okuvamu obudde bwona nga tewali kubonerezebwa kwona oba okutawanyizibwa mu byokujanjabibwa oba okwenyigira mukunonyereza mu biseera byomaso mungeri yona.

Bwooba nga oyina ebibuuzo ebikwata kukunonyereza kuno, nkubila essimu oba omu kuba supervisors bange ku number zzino wansi.

Prof Grace Ndeezi  +256 0772-453191

Dr Eric Wobudeya  +256 0712-846163

Bwooba nga oyina ebibuuzo kubuvunanyizibwabwo mukunonyereza kuno kubila chairman Makerere university Research and Ethics committee on +2560414530355

Consent statement
Ekigendererwa nengeri yokunyezebwa kuno enyinyonyodwa. Ntegedde nti okwenyigila kwange sikwa buwaze era tewali kiyinza kubawo singa sikiliza, era ntegedde nti bwe ntekako omukono gwaenge ndaga nti nyinyodwa kukunonyereza ku no kwe mpadeyo omwana wange okwenyigiramu

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Name of parent/ care taker                      Signature/thumbprint               Date

Name of investigator /authorised representative