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**UNIVERSITE DE YAOUNDE I**
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**FACULTE DE MEDECINE ET DES SCIENCES BIOMEDICALES**
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**DEPARTMENT OF INTERNAL MEDICINE**
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DEPARTMENT OF INTERNAL MEDICINE AND SPECIALTIES

# EFFECT OF TYPE 1 DIABETES ON HEALTH-RELATED QUALITY OF LIFE AND ACADEMIC PERFORMANCE AMONG CHILDREN AND ADOLESCENTS IN TWO HOSPITALS IN YAOUNDE

Thesis written in partial fulfilment of the requirements for the award of the *Medicinae Doctor* (MD) degree by:

**MATATEYOU KADIJE**
**19M1138**

**Supervisor**

**Pr. Etoa Ndzie Martine Claude Epse Etoga**
Associate Professor of Endocrinology And Metabolic Disease

**Co-supervisors**

**Dr. Mossus Tatiana**
Senior lecturer
Health Promotion

**Dr. Dehayem Yefou Mesmin**
Senior lecturer
Endocrinology



***Academic year 2025-2026***

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DEPARTMENT OF INTERNAL MEDICINE AND SPECIALTIES

# EFFECT OF TYPE 1 DIABETES ON HEALTH-RELATED QUALITY OF LIFE AND ACADEMIC PERFORMANCE AMONG CHILDREN AND ADOLESCENTS IN TWO HOSPITALS IN YAOUNDE

Thesis written in partial fulfilment of the requirements for the award of the *Medicinae Doctor* (MD) degree by:

**MATATEYOU KADIJE**
**19M1138**
Defence Date :

**THESIS JURY**

**President of the jury**

……

**Examiner**

……

**Members**

……

**SUPERVISORY TEAM**

**Director**

Pr. Etoa Ndzie Martine Claude Epse Etoga

**Co-directors**

Dr. Mossus Tatiana

Dr. Dehayem Yefou Mesmin

***Academic year 2025-2026***

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# DEDICATION

**To my lovely parents**

***Mr. NDAM MAMA OUSMAN***

***and***

***Mrs. NDAM FAGNI MARIAMA***

# ACKNOWLEDGEMENTS

First and foremost, we give thanks to ALLAH the almighty for life, strength and guidance throughout this journey. Without Him, this work would not have been possible

- We express our sincere gratitude to our teacher and supervisor Pr. ETOA épouse ETOGA Martine Claude for having accepted to supervise this work and for her constant availability, guidance, kindness, patience, and attentiveness throughout our training. Her mentorship was a cornerstone for the realization of this work.
- We are equally grateful to Dr. MOSSUS Tatiana whose gentle guidance, methodological rigor, constructive feedback, and calm encouragement helped us stay focused and determined.
- Our heartfelt thanks goes to Dr. DEHAYEM YEFOU Mesmin for his patience, availability, and insightful advice. His presence at every stage of this work was a source of motivation and greatly contributed to its completion.
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- We express our appreciation to the honorable members of the jury, for their interest in our work, their constructive criticisms, and valuable contributions aimed at improving the quality of this thesis.
- We extend our sincere thanks to the entire teaching staff of the faculty of medicine and biomedical sciences, UYI, for the knowledge and experience generously shared throughout these years of training.
- We are grateful to the Directors, medical and nursing staff of the Yaounde central hospital and the mother and child center of the Chantal Biya foundation for their warm welcome and cooperation during data collection process.
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- We are thankful to the MAPI Research Trust for the authorization of the use of the pediatric quality of life inventory 3.2 type 1 diabetes module and the pediatric generic core 4.0.

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- To my best friend and sister ABDOUL KADRI koulsoumi, thanks for every moments.
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- We acknowledge the support of both paternal and maternal family members throughout this journey.
- Our gratitude also goes to our academic seniors, Dr NDAM Alpha, Dr MEDJO Bryan, Dr Nji BABA Hassan, Dr Manjeli Mohammed, Dr Manjeli Njifit Ahmed for their guidance and encouragement throughout this journey.
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- We extend our sincere thanks to all the medical doctors who participated in this study, for their trust and collaboration, without which this research would not have been possible.
- To everyone who contributed in ways big and small, may God bless you abundantly.

# THE ADMINISTRATIVE AND TEACHING STAFF OF THE FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

## 1. ADMINISTRATIVE STAFF

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**Materials Accountant**: Mr. MOUMEMIE NJOUNDIYIMOUN MAZOU

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**Coordinator of the Internship Program**: Prof ONGOLO ZOGO Pierre

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**Coordinator of Continuing Education**: Prof KASIA Jean Marie

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Prof NGU LIFANJI Jacob (1983–1985)

Prof CARTERET Pierre (1985–1993)

***HONORARY DEANS OF FMSB***

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Prof NDUMBE Peter (1999–2006)

Prof TETANYE EKOE Bonaventure (2006–2012)

Prof EBANA MVOGO Côme (2012–2015)

Prof ZE MIKANDE Jacqueline (2015–2024)

## 2. TEACHING STAFF

**Table I:** teaching staff of FMBS UYI

| | NAMES AND SURNAMES | GRADE | DISCIPLINE |
|---|---|---|---|
| **DEPARTMENT OF SURGERY AND SPECIALITIES** | | | |
| | NDJOCK Louis Richard (HOD) | P | ENT-CFS |
| | DJIENTCHEU Vincent de Paul | P | Neurosurgery |
| | ESSOMBA Arthur | P | General Surgery |
| | EYENGA Victor Claude | P | Surgery /Neurosurgery |
| | GUIFO Marc Leroy | P | General Surgery |
| | HANDY EONE Daniel | P | Orthopedic Surgery |
| | MOUAFO TAMBO Faustin | P | Pediatric Surgery |
| | NGO NONGA Bernadette | P | General Surgery |
| | BAHEBECK Jean | AP | Orthopedic Surgery |
| | BANG GUY Aristide | AP | General Surgery |
| | NGO YAMBEN Marie Ange | AP | Orthopedic Surgery |
| | TSIAGADIGI Jean Gustave | AP | Orthopedic Surgery |
| | BELLO FIGUIM | SL | Neurosurgery |
| | BIWOLE BIWOLE Daniel Claude Patrick | SL | General Surgery |
| | EPOUPA NGALLE Frantz Guy | SL | Urology |
| | FONKOUE Loïc | SL | Orthopedic Surgery |
| | FOSSI KAMGA GACELLE | SL | Pediatric Surgery |
| | FOUDA Jean Cédrick | SL | Urology |
| | MEKEME MEKEME Junior Barthelemy | SL | Urology |
| | MULUEM Olivier Kennedy | SL | Orthopedic-Traumatology |
| | MVE MVONDO Charles | SL | Thoracic Surgery |
| | NWAHA MAKON Axel Stéphane | SL | Urology |
| | NYANIT BOB Dorcas | SL | Pediatric Surgery |
| | OUMAROU HAMAN NASSOUROU | SL | Neurosurgery |
| | SAVOM Éric Patrick | SL | General Surgery |
| | AHANDA ASSIGA | L | General Surgery |
| | ARROYE BETOU Fabrice Stéphane | L | Thoracic and Cardiovascular Surgery |
| | BIKONO ATANGANA Ernestine Renée | L | Neurosurgery |
| | BWELE Georges | L | General Surgery |

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|---|---|---|---|
| | MBELE Richard II | L | Thoracic Surgery |
| | MFOUAPON EWANE Hervé Blaise | L | Neurosurgery |
| | MOHAMADOU GUEMSE Emmanuel | L | Orthopedic Surgery |
| | MVONDO ONANA Pierre | L | Viceral and digestive surgery |
| | NYANKOUE MEBOUINZ Ferdinand | L | Orthopedic and Traumatology Surgery |
| | NGO YON Laurence Carole | L | Thoracic Surgery |
| | ELA BELLA Amos Jean-Marie | AL | Thoracic Surgery |
| | EYA MVONDO Eric Stéphane | AL | General Surgery |
| | FOLA KOPONG Olivier | AL | General Surgery |
| | KOUNA TSALA Irène Nadine | AL | Chirurgie Pédiatrique |
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| | ZE MINKANDE Jacqueline (HOD) | P | Anesthesia and Intensive Care |
| | OWONO ETOUNDI Paul | P | Anesthesia and Intensive Care |
| | BENGONO BENGONO Roddy Stéphan | AP | Anesthesia and Intensive Care |
| | JEMEA Bonaventure | AP | Anesthesia and Intensive Care |
| | AMENGLE Albert Ludovic | AP | Anesthesia and Intensive Care |
| | KONA NGONDO François Stéphane | SL | Anesthesia and Intensive Care |
| | IROUME Cristella Raïssa BIFOUNA épouse NTYO'O NKOUMOU | L | Anesthesia and Intensive Care |
| | NDIKONTAR KWINJI Raymond | L | Anesthesia and Intensive Care |
| | GOUAG | L | Anesthesia and Intensive Care |
| | NGOUATNA DJEUMAKOU Serge Rawlings | AL | Anesthesia and Intensive Care |
| **DEPARTMENT OF INTERNAL MEDECINE AND SPECIALITIES** | | | |
| | SINGWE Madeleine épse NGANDEU (HOD) | P | Internal Medecine/Rhumatology |
| | ANKOUANE ANDOULO Firmin | P | Internal Medecine / Hepatogastro-enterology. |
| | ASHUNTANTANG Gloria Enow | P | Internal Medecine /Néphrology |
| | BISSEK Anne Cécile | P | Internal Medecine /Dermatology |
| | HAMADOU BA | P | Internal Medecine /Cardiology |
| | KAZE FOLEFACK François | P | Internal Medecine /Nephrology |
| | KUATE TEGUEU Calixte | P | Internal Medecine /Neurology |
| | KOUOTOU Emmanuel Armand | P | Internal Medecine /Dermatology |

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|---|---|---|---|
| | MENANGA Alain Patrick | P | Internal Medecine /Cardiology |
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| | FOUDA MENYE Hermine Danielle | AP | Internal Medecine /Nephrology |
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| | NGAH KOMO Elisabeth | SL | Internal Medecine /Pneumology |
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| | OWONO NGABEDE Amalia Ariane | SL | Internal Medecine / Interventional cardiology |
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| | EBENE MANON Guillaume | L | Internal Medecine /Cardiology |
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| | FOJO TALONGONG Baudelaire | L | Internal Medecine /Rhumatology |
| | KAMGA OLEN Jean Pierre Olivier | L | Internal Medecine /Psychiatrics |
| | KUABAN Alain | L | Internal Medecine /Pneumology |
| | MANDENG Nadia Jacqueline | L | Internal Medecine / Internal Medecine |
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| | NSOUNFON ABDOU WOUOLIYOU | L | Internal Medecine /Pneumology |
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| | NTYO'O NKOUMOU Arnaud Laurel | L | Internal Medecine /Pneumology |
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| | TSAGUE KENGNI Hermann Nestor | L | Internal Medecine /Cardiology |
| | ANABA MELINGUI Victor Yves | AL | Internal Medecine /Rhumatology |
| | BELINGA EDIMA Victor Fabrice | AL | Internal Medecine /Neurology |
| | BELINGA KYE ESSOMBI Olivia Constance | AL | Internal Medecine /Pneumology |
| | BIWOLE SIDA Ghislaine Rachel | AL | Internal Medecine /Endocrinology |
| | DOUN FOUDA Anne Stéphanie Elodie | AL | Internal Medecine /Rhumatology |
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| | KOLLO NZIMA Brice Kevin | AL | Internal Medecine /Rhumatology |
| | NKECK Jan René | AL | Internal Medecine /Rhumatology |
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| | TONYE Lydienne Alida | AL | Internal Medecine /Cardiology |
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| | MOIFO Boniface | P | Radiology/Medical Imaging |
| | ONGOLO ZOGO Pierre | AP | Radiology/Medical Imaging |
| | SAMBA Odette NGANO | AP* | Biophysics/ Medical Physics |
| | MBEDE Maggy épouse ENDEGUE MANGA | SL | Radiology/Medical Imaging |
| | NWATSOCK Joseph Francis | SL | Radiology/Medical Imaging Nuclear Medecine |
| | ABO'O MELOM Adèle Tatiana | L | Radiology/Medical Imaging |
| | MEKA'H MAPENYA Ruth-Rosine | L | Radiotherapy |
| | SEME ENGOUMOU Ambroise Merci | L | Radiology/Medical Imaging |
| | ZE NGBWA MIMI-Flore épouse PENDA MOMASSO | L | Radiology |
| | ALLA TAKAM Clémence épouse TAKOUDA | AL | Nuclear Medecine |
| | AWOUDOU II Christian Junior | AL | Nuclear Medecine |
| | MBONO EDOA Doriane Murielle | AL | Radiology/Medical Imaging |
| **DEPARTMENT OF GYNECOLOGY AND OBSTETRICS** | | | |
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| | KASIA JEAN MARIE | P | Gynecology and Obstetrics |
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| | MBOUDOU Émile | P | Gynecology and Obstetrics |
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| | TEBEU Pierre Marie | P | Gynecology and Obstetrics |

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| | METOGO NTSAMA Junie Annick | SL | Gynecology and Obstetrics |
| | NSAHLAI Christiane JIVIR FOMU | SL | Gynecology and Obstetrics |
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| | TOMPEEN Isidore | SL | Gynecology and Obstetrics |
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| | MPONO EMENGUELE Pascale épouse NDONGO | L | Gynecology and Obstetrics |
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| | NGONO AKAM Marga Vanina | L | Gynecology and Obstetrics |
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| | KUTNJEM IBRAHIM BELLO MONKAREE | AL | Gynecology and Obstetrics |
| | MOL Henri Léonard Chatelein | AL | Gynecology and Obstetrics |
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| | NGASSAM KETCHATCHAM Anny Nadège | AL | Gynecology and Obstetrics |
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| | ÉPÉE Émilienne épouse ONGUENE | P | Ophtalmology |
| | KAGMENI Gilles | P | Ophtalmology |
| | KOKI Godefroy | P | Ophtalmology |
| | NJOCK Richard | P | ENT |
| | OMGBWA EBALE André | P | Ophtalmology |
| | BILLONG Yannick | AP | Ophtalmology |
| | MINDJA EKO David | AP* | ENT/ Maxillo-Facial Surgery |

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| | ANDJOCK NKOUO Yves Christian | SL | ENT-CFS |
| | ATANGA Léonel Christophe | SL | ENT-CFS |
| | MEVA'A BIOUELE Roger Christian | SL | ENT-CFS |
| | MOSSUS Yannick | SL | ENT-CFS |
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| | NANFACK NGOUNE Chantal | SL | Ophtalmology |
| | NGO NYEKI Adèle-Rose épouse MOUAHA-BELL | SL | ENT-CFS |
| | NOMO Arlette Francine | SL | Ophtalmology |
| | ASMAOU BOUBA Dalil | L | ENT |
| | BOLA SIAFA Antoine | L | ENT |
| | MOUANGUE Louise épouse MBONDJO | L | ENT-CFS |
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| | CHELO David | P | Pediatrics |
| | MAH Evelyn | P | Pediatrics |
| | NGUEFACK Séraphin | P | Pediatrics |
| | NGUEFACK épouse DONGMO Félicitée | P | Pediatrics |
| | NGO UM KINJEL Suzanne épse SAP | P | Pediatrics |
| | MBASSI AWA | P | Pediatrics |
| | KALLA Ginette Claude épse MBOPI KEOU | AP* | Pediatrics |
| | NOUBI N. épouse KAMGAING M. | AP* | Pediatrics |
| | EPEE épouse NGOUE Jeannette | SL | Pediatrics |
| | KAGO TAGUE Daniel Armand | SL | Pediatrics |
| | MEGUIEZE Claude-Audrey | SL | Pediatrics |
| | MEKONE NKWELE Isabelle | SL | Pediatrics |
| | TONY NENGOM Jocelyn | SL | Pediatrics |
| | ELOUNDOU ODI Eugène Bertrand | AL | Pediatrics |

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| | NYEMB MBOG Grâce Joëlle Thérèse | AL | Oncology Pediatrics |
| **DEPARTMENT OF MICROBIOLOGY, PARASITOLOGY, HEMATOLOGY AND INFECTIOUS DISEASES** | | | |
| | MBOPI KEOU François-Xavier (HOD) | P | Bacteriology/ Virology |
| | ADIOGO Dieudonné | P | Microbiology/Virology |
| | GONSU née KAMGA Hortense | P | Bacteriology |
| | MBANYA Dora | P | Hematology |
| | TAYOU TAGNY Claude | P | Microbiology/Hematology |
| | LYONGA Emilia ENJEMA | AP* | Medical Microbiology |
| | CHETCHA CHEMEGNI Bernard | AP* | Microbiology/Hematology |
| | TOUKAM Michel | AP* | Microbiology |
| | NGANDO Laure épouse MOUDOUTE | SL | Parasitology |
| | NDOUMBA NKENGUE Annick épouse MINTYA | AP* | Hematology |
| | VOUNDI VOUNDI Esther | AP* | Virology |
| | ANGANDJI TIPANE Prisca épouse ELLA | L | Clinical Biology /Hematology |
| | BOUM II YAP | L | Microbiology |
| | BEYALA Frédérique | L | Infectious diseases |
| | ESSOMBA Réné Ghislain | L | Immunology and infectious diseases |
| | FOKAM Joseph | L | Microbiology |
| | MBOUYAP Pretty Rosereine | L | Pharmacology |
| | MEDI SIKE Christiane Ingrid | L | Clinical Biology |
| | NGOGANG Marie Paule | L | Clinical Biology |
| | NSA'AMANG Carolle-Snelle épouse EYEBE | L | Clinical Biology |
| | Georges MONDINDE IKOMEY | AL | Immunology |
| **DEPARTMENT OF PUBLIC HEALTH** | | | |
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| | EYEBE EYEBE Serge Bertrand | L | Public Health/Epidemiology |
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| | KWEDI JIPPE Anne Sylvie | L | Epidemiology |
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| | MBA MAADJHOU Berjauline Camille | L | Public Health/ Nutritional Epidemiology |
| | MOSSUS Tatiana née ETOUNOU AKONO | L | Health Promotion Expert |
| | NAAMBOW ANABA Edwige Christelle | L | Medical Anthropology |
| | NKENGFACK GERMAINE SYLVIE | L | Nutrition |
| | ONDOUA MBENGONO Laure Julienne | L | Psychologist |
| | ABBA-KABIR HAAMIT-M | AL | Pharmacist |
| | AMANI ADIDJA | AL | Public Health |
| | EFA Salomon Francis | AL | Health and Environment |
| | MELINGUI Bernard Fortune | AL | Epidemiologist |
| | NDIBI ABANDA Jean | AL | Epidemiologist |
| | NGAKO PAMEN épouse BOUBA Haman Joëlle Nounouce | AL | Health Economics |
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| | AZABJI KENFACK Marcel | AP* | Physiology |
| | EBELL'A DALLE Ernest Remy Hervé | L | Human Physiology |
| | **DEPARTMENT OF PHARMACOLOGY AND TRADITIONAL MEDECINE** | | |
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| | NDIKUM Valentine | L | Pharmacology |
| | ONDOUA NGUELE Marc Olivier | AL | Pharmacology |
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| | EDOUMA BOHIMBO Jacques Gérard | SL | Stomatology and Maxillofacial Surgery |
| | NOKAM TAGUEMNE M.E. | AP* | Oral Surgery |

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| | NKOLO TOLO Francis Daniel | AL | Oral and Maxillofacial Surgery |
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| | NIBEYE Yannick Carine Brice | L | Dental Surgeon (Periodontology) |
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|---|---|---|---|
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| | NYANGONO NDONGO Martin | SL | Pharmacy |
| | MBOLE Jeanne Mauricette épse MVONDO M. | L | Quality Management<br>Quality Control of Health Products and Food |
| | FOUMANE MANIEPI NGOUOPIHO Jacqueline Saurelle | L | Pharmacology |
| | MINYEM NGOMBI Aude Périne épouse AFUH | L | Pharmaceutical Regulation |
| | SOPPO LOBE Charlotte Vanessa | L | Drug Quality Control |
| | ABA'A Marthe Dereine | AL | Quality Management<br>Quality Control of Health Products and Food |
| | EMANDA EKOUDI Martin Gogonet | AL | Pharmacy |
| | FOE ESSOMBA Joseph Rodrigue | AL | Biotechnology |
| | NDAM NDJITOYAP MOLUH Yvon Daniel Arouna | AL | Pharmaceutical Regulation and Inspection |
| | NKO'O NTYAM David Lionel | AL | Pharmacy |

**KEY:**

**HD:** Head of Department

**P:** Professor

**AP:** Associate Professor

**AP*:** Assistant professor

**SL**: Senior Lecturer

**L**: Lecturer

**AL:** Assistant lecturer

# PHYSICIAN'S OATH

The declaration of Geneva, adopted by the Geneva Assembly of the World Medical Association in Geneva, Switzerland, September 1948 and amended by the 22nd World Medical Assembly, Sydney, Australia, August 1968.

***On admission into the medical profession;***

***I will solemnly pledge myself to consecrate my life to the service of humanity***

***I will give my teachers the respect and gratitude which is their due***

***I will practice my profession with conscience and dignity***

***The health of my patients will be my first consideration***

***I will respect secrets confided in me even after the patient has died***

***I will maintain by all means in my power the honour and noble tradition of the medical profession***

***My colleagues will be my brothers***

***I will not permit considerations of religion, nationality, race, political party or social standing to intervene between my duty and my patient***

***I will maintain the utmost respect for human life from the time of conception***

***Even under threat I will not use my medical knowledge contrarily to the laws of humanity***

***I make these promises solemnly, freely and upon my honor***

# ABSTRACT

**Background:** Type 1 diabetes mellitus (T1DM) is a chronic disease associated with many challenges that may negatively affect the physical, emotional, social, and academic well-being of children and adolescents. In addition to metabolic disturbances, children with T1DM may experience difficulties in daily disease management, potentially impairing their health-related quality of life and academic performance. Data on these outcomes remain limited in Cameroon.

**Objective:** We aimed to evaluate the effect of T1DM on health-related quality of life (HRQOL) and academic performance among children and adolescents in two hospitals in Yaoundé.

**Methods:** A case control study was conducted among children and adolescents including 82 diabetic children and 168 non-diabetic controls (matched according to age, sex, school type, level of education, parent's sector of activity) recruited in two hospitals and secondary schools in Yaoundé. Sociodemographic and clinical data were collected using structured questionnaire. HRQOL was assessed using the PedsQL™ Generic Core 4.0 Scale and the PedsQL™ 3.2 Diabetes Module. Academic performance was evaluated using school absenteeism during first term/days and first term averages/20 scores. Descriptive and comparative analyses were performed, followed by bivariate analyses to determine the association between glycated hemoglobin (HbA1c) and diabetes-specific HRQOL, and academic performance. Statistical significance was set at $p < 0.05$.

**Results:** the median age for both groups was 15 years old [IQR: 14-17] years. Poor glycemic control (HbA1c >7%) was observed in 90.2% of patients, with a mean HbA1c of 10.51% ± 2.47%. Hyperglycemic counts (>180 mg/dl) were reported by 97.6% of patients, with a median of 10 [6–13] counts per week, while hypoglycemic counts (<70 mg/dl) occurred in 76.5%, with a median of 3 [2–4] counts per week. Most diabetic children reported delayed insulin injection and missed glucose monitoring at school due to school hours and injection-related embarrassment. The total score of the PedsQL Diabetes Module was 58.84, with the worry domain being the most affected (33.33). Compared with controls, diabetic participants had significantly lower HRQOL scores across all PedsQL Generic Core domains, including total score (64.13 vs 82.61) with the most affected domain being school functioning followed by emotional functioning. Median first term average was also significantly lower in diabetic patients (10.98 vs 11.5, $p = 0.002$), with higher absenteeism (4.0 vs 2.0 $p < 0.001$), mainly due to routine visits. HbA1c was negatively correlated with total diabetes HRQOL (= -0.249, p =

0.024), and first term average (r=-0.376, p<0.001), and was positively associated to absenteeism (=0.338, p=0.0059) in bivariate analysis.

**Conclusion:** Children and adolescents with T1DM in Yaoundé exhibited poor glycemic control, impaired health-related quality of life, and poorer academic performance compared with non-diabetic peers. These findings highlight the importance of diabetes care integrating affordable self-monitoring supplies, psychosocial support and structured diabetes education programs for children, and their caregivers, Establish a supportive school environment.

**Key words**: Children and adolescents, type 1 diabetes, health-related quality of life, academic performance.

# RESUME

**Contexte :** Le diabète de type 1 (DT1) est une maladie chronique associée à de nombreuses difficultés pouvant affecter négativement le bien-être physique, émotionnel, social et scolaire des enfants et des adolescents. En plus des troubles métaboliques, les enfants atteints de DT1 peuvent rencontrer des difficultés dans la gestion quotidienne de leur maladie, ce qui peut altérer leur qualité de vie liée à la santé (QVLS) et leurs performances scolaires. Les données sur ces aspects restent limitées au Cameroun.

**Objectif :** Nous avons cherché à évaluer l'effet du DT1 sur la qualité de vie liée à la santé et les performances scolaires des enfants et adolescents suivis dans deux hôpitaux de Yaoundé.

**Méthodes :** Une étude cas-témoins a été menée auprès de 82 enfants et adolescents atteints de DT1 et de 168 témoins non diabétiques (appariés selon l'âge, le sexe, le type d'école, le niveau d'études et le secteur d'activité des parents) recrutés dans deux hôpitaux et deux établissements secondaire à Yaoundé. Les données sociodémographiques et cliniques ont été recueillies à l'aide d'un questionnaire structuré. La qualité de vie liée à la santé a été évaluée à l'aide de l'échelle PedsQL Generic Core Scale et du module PedsQL 3.2 Diabètes. Les performances scolaires ont été évaluées par l'absentéisme scolaire et les moyennes académiques du premier trimestre de l'année 2025-2026. Des analyses descriptives et comparatives ont été réalisées, suivies d'analyses bi variées afin d'établir les corrélations entre l'hémoglobine glyquée et la qualité de vie spécifique au diabète et aux performances scolaires. Le seuil de significativité statistique a été fixé à $p < 0,05$.

**Résultats :** L'âge médian était de 15 ans [IQR:14-17] ans. Un mauvais contrôle glycémique (HbA1c > 7 %) a été observé chez 90,2 % des patients, avec une HbA1c moyenne de 10.51% ± 2.47% déviation standard. Des épisodes d'hyperglycémie (>180 mg/dl) ont été rapportés par 97,6 % des patients, avec une médiane de 10 [6–13] épisodes par semaine, tandis que des épisodes d'hypoglycémie (<70 mg/dl) sont survenus chez 76,5 %, avec une médiane de 3 [2–4] épisodes par semaine. La plupart des enfants diabétiques ont rapporté des retards d'injection d'insuline et des omissions de surveillance glycémique à l'école en raison des horaires scolaires et de la gêne liée aux injections. Le score médian du PedsQL Diabètes Module était de 58,84, le domaine le plus affecté étant celui des inquiétudes avec un score médian de 33,33. Comparés aux témoins, les participants diabétiques présentaient des scores de QVLS significativement plus faibles dans tous les domaines du PedsQL Generic Core, y compris le score total (64,13 vs 82,61), le domaine le plus affecté étant le fonctionnement scolaire suivi du fonctionnement

émotionnel. La moyenne du premier trimestre était également significativement plus faible chez les patients diabétiques avec une médiane de (10,98 vs 11,5 p = 0,002), avec un taux d'absentéisme plus élevé (4,0 vs 2,0, p < 0,001), principalement dû aux visites de routine. L'HbA1c était négativement associée au score total de QVLS spécifique au diabète (r = -0,249 ; p = 0,024) et à la moyenne du premier trimestre (r = -0,376 ; p < 0,001), et positivement associée à l'absentéisme (r = 0,338 ; p = 0,0059).

**Conclusion :** Les enfants et adolescents atteints de DT1 à Yaoundé présentaient un mauvais contrôle glycémique, une qualité de vie liée à la santé altérée et des performances académiques plus faibles que leurs pairs non diabétiques. Ces résultats soulignent l'importance d'une prise en charge du diabète intégrant un accès abordable aux fournitures d'auto surveillance glycémique, un soutien psychosocial et des programmes structurés d'éducation thérapeutique destinés aux enfants et à leurs aidants, ainsi que l'établissement d'un environnement scolaire favorable.

**Mots-clés :** Enfants et adolescents, diabète de type 1, qualité de vie liée à la santé, performances académiques

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# LIST OF ABBREVIATIONS

**ADA**: American Diabetes Association

**BMI:** Body Mass Index

**CDiC**: Changing Diabetes in Children

**CGM:** Continuous Glucose Monitoring

**CRC:** Convention on the Right of a Child

**CSII**: Continuous Subcutaneous Insulin Infusion

**DKA**: Ketoacidosis

**FPG**: Fasting Plasma Glucose

**GBHSY:** Government Bilingual High School Yaoundé

**GBHS:** Golden Bilingual High School

**HbA1c**: Glycated Hemoglobin

**HRQOL**: Health Related Quality of Life

**IDF**: International Diabetes Federation

**MDI:** Multiple Daily Injections

**MNT:** Medical Nutrition Therapy

**OGTT** Oral Glucose Tolerance Test

**PedsQL:** Pediatric Quality of Life Inventory

**SMBG**: Self-Monitoring Blood Glucose

**T1D:** Type 1 Diabetes

**T1DM:** Type 1 Diabetes Mellitus

**WHO**: World Health Organization

**YCH:** Yaoundé Central Hospital

# CHAPTER I: INTRODUCTION

## I.1. Background

Type 1 diabetes (T1D) is a chronic metabolic disease characterized by persistent hyperglycemia leading to constant dependence on external insulin therapy[1]. According to the World Health Organization (WHO), T1D represents about 5 - 10% of all diabetes case globally and it accounts for 85% of all types of diabetes in individuals under 20 years of age [2]. The incidence of T1D shows substantial variation across regions and countries, with a rapidly increasing trend, particularly in low-income settings. This rise is largely attributed to improved diagnostic capacity, reduced mortality rate, and the effects of population growth and ageing [3], making Type 1 diabetes an emerging public health concern worldwide. According to the International Diabetes Federation (IDF) 2025 estimates, approximately 9,5 million individuals worldwide are living with T1D, including about 1.8 million aged under 20 years of age [3]. In Africa including Cameroon, the observed low prevalence of type 1 diabetes is mainly due to delayed diagnosis and worsened by high mortality in children and adolescents, who frequently present with severe complications such as ketoacidosis [4].

Living with Type 1 diabetes affects considerably the daily life of young people. The demanding nature of disease management including frequent blood glucose monitoring, insulin administration, strict dietary control, and the risk of acute complications place a heavy psychological and social burden on young patients and their families [5]. These challenges often compromise various dimensions of quality of life including physical well-being, emotional functioning, and social relationships [6]. Furthermore, the effects of Type 1 diabetes may extend into the academic domain. Recurrent hyperglycemia or hypoglycemia cause concentration difficulties, absenteeism, frequent medical appointments and fatigue, which collectively influence academic performance [7]. Several studies worldwide including Africa, have reported that children living with Type 1 diabetes may experience lower school achievements, mainly due to metabolic instability and limited access to diabetes management resources [8–10].

Despite the implementation of free diabetes care in Cameroon, children and adolescents still face daily life challenges due to their condition [11]. Understanding the relationship between glycemic control and quality of life/academic outcomes is therefore essential for improving both clinical and educational support for children and adolescents with Type 1 diabetes in low- resource settings such as Cameroon.

## I.2. Rationale

Type 1 diabetes is a growing public health issue in Cameroon, affecting many children, adolescents, and young adults and limited evidence exists on how the disease impacts quality of life and school performance in our context. The Changing Diabetes in Children project centers in Cameroon receives diabetes patients from both rural and urban areas. Understanding these effects is essential to improve patient follow-up, family and school support, and to strengthen care within programs such as the Changing Diabetes in Children (CDiC) clinic in Cameroon. This study will therefore provide local evidence to guide comprehensive and context-appropriate management of young people living with T1D.

## I.3. Research question

What is the effect of T1D on health-related quality of life and academic performance in children, and adolescents in two hospitals in Cameroon?

## I.4. Research hypothesis

The research hypothesis:

- Children with type 1 diabetes in Yaoundé have lower overall health related quality of life and academic performance than their healthy peers.
- Higher glycated hemoglobin (HbA1c) levels are associated with poorer diabetes specific quality of life among diabetic patients.

## I.5. Objectives

### I.5.1. General objective

To study the effect of T1D on health-related quality of life (HRQOL), and academic performance among children and adolescent in two hospitals in Yaoundé.

### I.5.2. Specific objectives

The specific objectives are to:

1) Assess glycemic control
2) Evaluate and compare generic HRQOL and academic performance between diabetic patients and healthy peers.
3) Determine the correlation between HbA1c and disease-specific quality of life.
4) Establish the correlation between HbA1c and academic performance in diabetic patients.

## I.6. Definition of operational terms

- **Type 1 diabetes**: A metabolic disorder characterized by chronic hyperglycemia due to absolute insulin deficiency resulting from the destruction of the pancreatic B-cells [12].
- **Health related quality of life (HRQOL)**: Is a specific dimension of quality of life that focuses on the impact of health status, disease, and treatment on individuals daily functioning and overall sense of well-being. It is multidimensional construct, consisting at the minimum of the physical, psychological (including emotional and cognitive), and social health dimensions clearly described by the WHO [13].
- **Academic performance:** Refers to the extent to which a student achieves their learning objectives or attains the educational outcomes expected by an educational institution over a specific period of time [14].
- **Child:** Is a person below the age of 18 years, by the convention on the rights of t child (CRC), [15].
- **Adolescent:** Is an individual aged between 10 to 19 years (WHO, 2023).

# CHAPTER II: LITERATURE REVIEW

# II.1. Background knowledge on T1D

## II.1.1. Definition

Type 1 diabetes is a metabolic disorder characterized by chronic hyperglycemia due to absolute or near-absolute insulin deficiency resulting from the destruction of the pancreatic B-cells [12]. This condition has been considered an autoimmune disease, but recent evidence shows that non-autoimmune (idiopathic) forms also exist. The American Diabetes Association (ADA, 2024), classifies T1D into Type 1A (autoimmune) and Type 1B (idiopathic) [16].

## II.1.2. Epidemiology

The number of new and existing type 1 diabetes cases is rising worldwide due to increasing incidence and reduced mortality. Approximately 9.5 million people live with T1D worldwide in 2025, of these, about 1.8 million under 20 years, including 1.0 million children younger than 15 years [3]. While the global Incidence of T1D is rising at a rate of 3-4% each year, highest incidences are noted in high income countries compared to lower and middle income countries. Highest annual incidence is seen in Northern European countries with Finland at the top of the list [3].

Epidemiological data across Africa remains fragmented and underestimated due to late diagnosis and high mortality rate. However new data from Sub-Saharan Africa have shown low incidence rate [14,17].

In Cameroon, it is estimated that about 2578 children and adolescents under 20 years live with type 1 diabetes in 2025 [3].

# II.2. Recall

## II.2.1. Anatomy

### II.2.1.1. The pancreas

Macroscopically, the pancreas is a soft, elongated hammer shaped, retroperitoneal organ that is located behind the stomach in the left abdomen [18]. It measures about 12-20cm in length, and 3-5 cm in height and 1-3 cm in thickness weighing approximately 80-100g in adults [19]. It is divided into four parts, the head, neck, body and tail [18]. The pancreas is a complex gland composed of both exocrine and endocrine part (also called the Islet of Langerhans) which secrets pancreatic juice and hormones respectively [20].

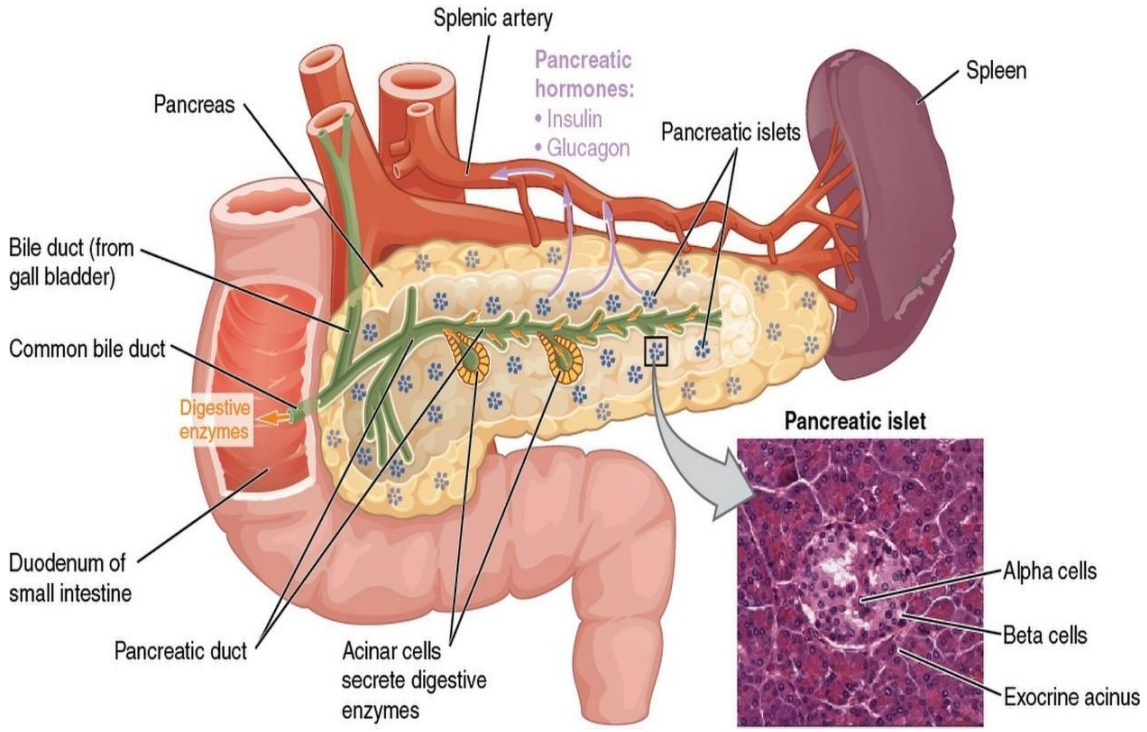


**Figure 1***:*anatomy of the pancreas

Microscopically, the endocrine portion constitutes 1-2% of the human pancreatic mass [21]. It is made up of five types of cells [22], which are:

**Alpha cells** (approximately 30% of islets cells): produce and secrete glucagon.

**Beta cells** (> 60% of islet cells): produce and secrete insulin

**Delta cells**: secretes somatostatin.

**Gamma cells:** secretes pancreatic polypeptides.

**Epsilon cells:** ghrelin.

The exocrine portion occupies > 95% of the pancreas, consists of acinar cells that secrete digestive enzymes into ducts [22].

### II.2.2. Physiology [23]

- Normal blood glucose levels are maintained between 70-110 mg/dl (3.9-6.1mmol/l) through insulin and counter-regulator hormones (glucagon, cortisol, growth hormone).
- Insulin is a peptide hormone produced by B-cells of the pancreas.
- It is synthesized as pre proinsulin, converted to proinsulin, and then to insulin + C-peptide.
- After meals, blood glucose rises, this stimulates the secretion of both insulin and C-peptide in equal amount Note that even though C-peptide is secreted alongside with

insulin, it has no metabolic effect, but used clinically to measure endogenous insulin secretion [24].

- Insulin then increases glucose uptake by muscles and fat via Glucose Transporter
- Type 4 (GLUT-4), glycogen synthesis and fat storage.
- During fasting: Blood glucose falls stimulating glucagon secretion, which in turn stimulates glycogenesis, gluconeogenesis. As a result, glucose supply and demand remain balanced to ensure energy homeostasis

**Table II**: glucose homeostasis

| Hormones | Liver | Muscles | Adipose tissue |
|---|---|---|---|
| Insulin | ↑ glycogen synthesis<br>↑ glycolysis<br>↓ glycogenolysis<br>↓ gluconeogenesis<br>↓ ketogenesis | ↑ glucose uptake<br>↑ amino acid uptake<br>↓ proteolysis | ↑ glucose uptake<br>↑ free fatty acid uptake<br>↓ lipolysis |
| Glucagon | ↑ gluconeogenesis<br>↑ ketogenesis<br>↑ glycogenolysis | Minimal action | Minimal action |
| Cortisol | ↑ glycogenolysis<br>↑ gluconeogenesis | ↓ amino acid uptake<br>↑ proteolysis<br>↓ insulin action | ↑ lipolysis<br>↓ insulin action |
| Growth hormone | ↑ gluconeogenesis | ↑ amino acid uptake<br>↓ glucose uptake | ↑ lipolysis<br>↓ glucose uptake |
| Epinephrine | ↑ glycogenolysis<br>↑ glyconeogenesis<br>↑ ketogenesis | ↑ glycogenolysis<br>↓ insulin action | ↑ lipolysis<br>↓ insulin action |
| Thyroid hormones | ↑ gluconeogenesis | ↑ proteolysis | ↑ lipolysis |

### II.2.3. Pathophysiology

The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. Type 1 diabetes is caused by an

autoimmune process, with underlying cause unknown but believed to be a combination of genetic susceptibility [25], and environmental factors, such as beta cells stress, early nutrition, increased hygiene, or viral infections [26]. Type 1 diabetes has been considered an autoimmune disease, but recent evidence shows that Non- autoimmune disease (idiopathic) forms also exist [27]. It is the consequence of the destruction of pancreatic B-cells of the islet of Langerhans by mostly an autoimmune process in genetically predisposed patient leading to absolute deficiency. The factors involved are;

**II. 2.3.1 Genetic susceptibility** [28]

T1D has a clear genetic component, meaning that it can run in families. In rare cases, it results from a single gene mutation such as Autoimmune regulator or genes, but most cases are polygenic, involving several genes that affect the immune system especially the Human Leucocyte Antigen (HLA) genes on chromosome 6, which plays a major role in determining genetic predisposition to T1D. The HLA genes are responsible for producing proteins that help the immune system distinguish the body`s own cells from foreign substances. Certain HLA types particularly HLA-DR3 and HLA-DR4 are strongly associated with higher risk of developing T1D, while others, such as HLA-DR2 and HLA-DR7, appear to provide protection. Although these genetic markers are common in the general population, their presence alone does not cause diabetes; environmental triggers are usually needed to start the immune attack on the pancreas.

**II. 2.3.2 Environmental triggers** [29]

Although genetics play a major role in T1D, environmental factors are often necessary to initiate or accelerate the autoimmune destruction of pancreatic B cells. Viruses may act either directly with cytolysis effect, or by triggering autoimmune process leading gradually to Beta cells destruction. These viruses include mainly Enteroviruses and others are Rotavirus, Cytomegalovirus, Mumps, Rubella, Retrovirus

**II. 2.3.3 Autoimmune cascade**

T1D develops over many years (5 to 10) years or even more. T lymphocyte, CD4+ and CD8+ infiltrate the pancreatic islets of Langerhans targeting autoantigens such as, Proinsulin (mIAA), Insulinoma-Associated Antigen-2 (IA-2), glutamic acid decarboxylase 65 (GAD65), and zinc transporter 8 (ZnT8) [30]. This triggers plasma B cells to produce four different, markers autoantibodies namely: anti-insulin, glutamic acid decarboxylase antibodies (GADA), tyrosine phosphatase (IA2), islet cell antibodies (ICA), and zinc transporter 8 (anti-

ZnT8) [31]. The autoimmune reaction causes insulitis (inflammation of the islet), leading to beta-cell destruction.

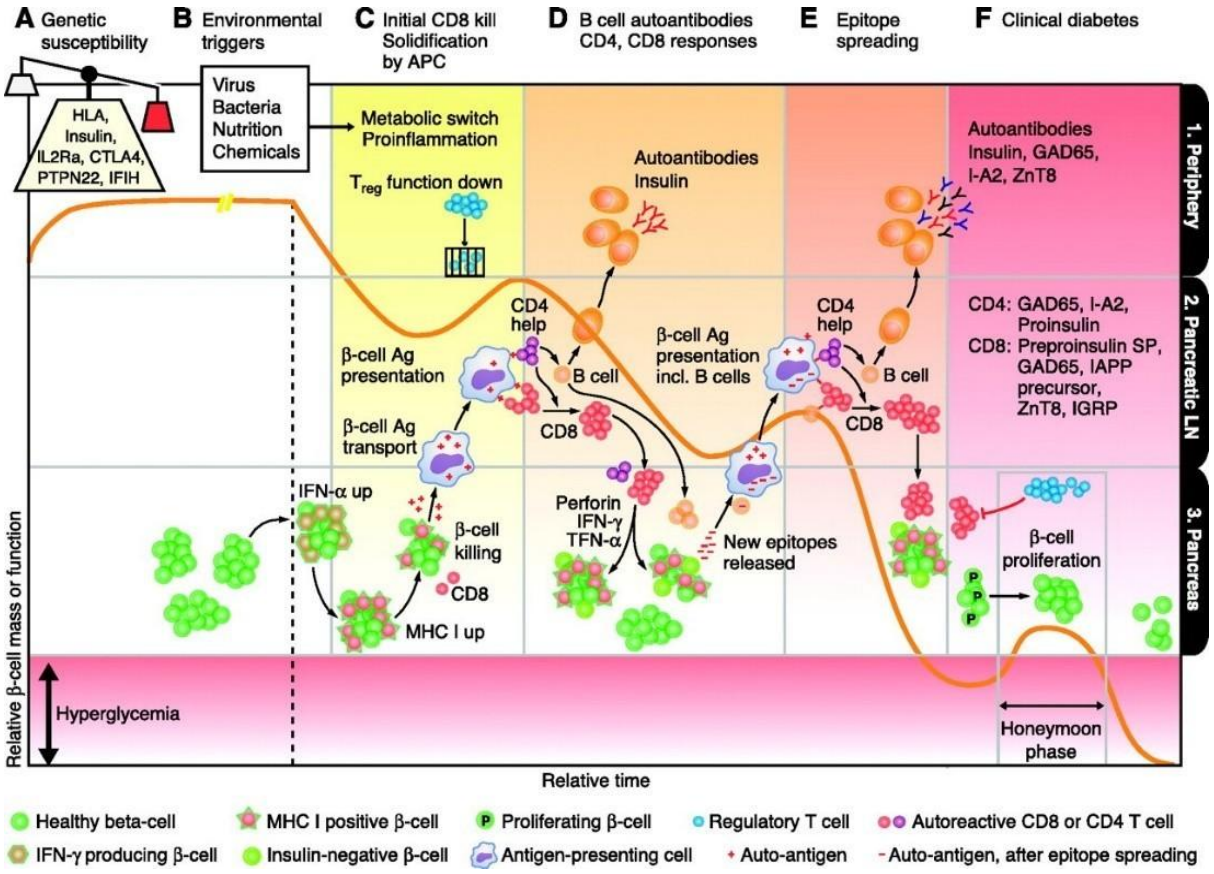


**Figure 2:** pathophysiology of T1D [30]

### II.2.3.4 Risk factors

**Genetic factors:** genetics accounts for about 50% of the risk of T1D, at least in children. The concordance is about 40% in monozygotic twins and about 8% in dizygotic twins. The risk is twice as high if the father has T1D compared to the mother. The genetic background involves polygenic susceptibility, with multiple genes belonging to the major histocompatibility complex (MHC), specifically class II antigens known as HLA. The risk of developing Type 1 diabetes is higher in individual carrying the HLA-DR3, HLA-DR4 alleles and it is strongly associated to T1D [32].

**Infections:** viral infections have long been implicated in the etiology of T1D, and several potential mechanisms have been proposed Mostly enteroviruses especially coxsackieviruses that can cause precipitation of T1D [33,34].

**Hygiene hypothesis**; progressively more sterile environment may disturb the normal development of the immune system reduce exposure to microorganism during childhood, limits the immune system training [35].

**Nutritional factors:** early cow`s milk introduction is a predisposing as opposed to prolonged duration of breastfeeding [36,37]. Vitamin D is a protective factor, so low vitamin D levels lower in plasma from T1D patients around onset [38].

**Dietary factors:** could as well initiate T1D pathogenesis and/or accelerate or inhibit its progression. The mechanisms are not known, but could involve specific food antigens or non-antigenic aspects of diet (calories, dietary toxins), also early exposure to cow`s milk may increase risk by ~1,5 times [39,40].

**Gut microbiota**: generally, the gut microbiota of T1D subjects is less diverse and less stable. Studies have shown that compared to healthy subject, patients with T1D had lower gut concentrations of Actinobacteria and Firmicutes [41].

### II. 2.3.5 Progression Stages

Recent evidence indicates that the disease develops progressively through three distinct stages with beta cells loss occurring at variable rates, becoming clinically apparent when about 60% to 90% of these cells have been destroyed [42].

- Stage 0 has been added: normal beta cells function.
- Stage 1: the presence of Beta cells autoimmunity with normoglycemia and no clinical symptoms.
- Stage 2: progression to dysglycemia while remaining asymptomatic.
- Stage 3: the onset of symptomatic hyperglycemia and clinical diabetes.

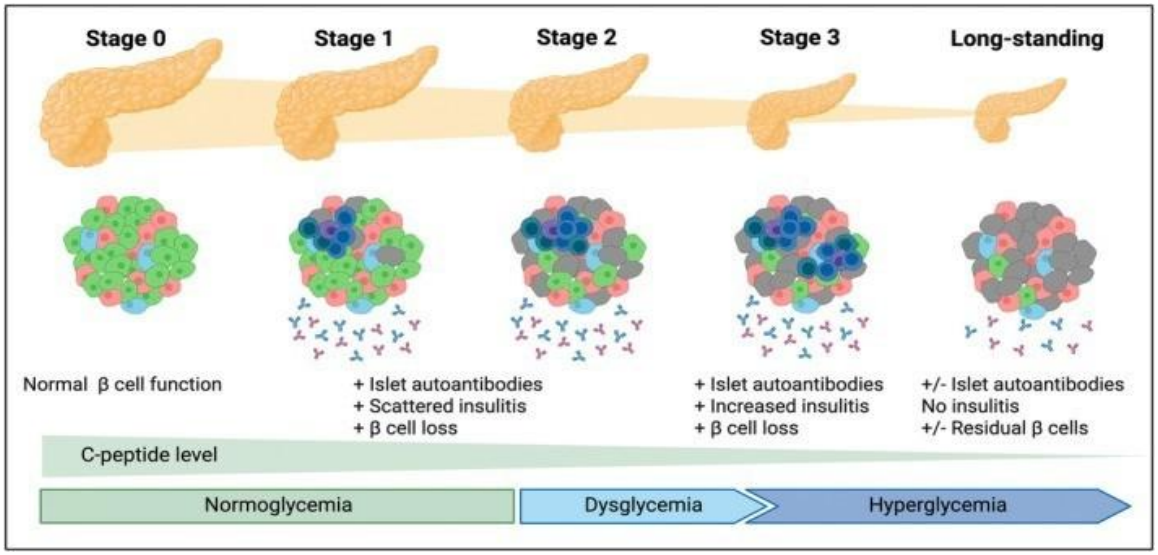


**Figure 3**: pathogenesis of T1D [42]

### II. 2.4. Diagnosis [43]

#### II. 2.4.1 Clinical presentation

Individuals with T1D typically have classic symptoms of polyuria, polyphagia, weight loss, polydipsia. These symptoms are often accompanied by ketosis and, particularly in pediatric cases, diabetic ketoacidosis [44].

- Polyuria**:** abnormally increased urine output daily.
- Polyphagia: abnormally increased hunger.
- Weight loss: unintended loss of body weight.
- Polydipsia**:** intense thirst.
- Dehydration signs**:** dry mouth, decreased skin turgor, sunken eyes.
- Signs of complications**:** like nausea, vomiting, abdominal pain especially in children, confusion, coma, and decreased in visual acuity.

#### II. 2.4.2 Biological diagnosis

Below is the diagnosis criteria according to ADA [43]

- Glycated hemoglobin (HbA1c) ≥ 6.5%: reflect blood glucose over the past 2-3 months (test should be done in laboratory using a method that is certified by the National Glycohemoglobin Standardization Program (NGSP) and standardized to the Diabetes Control and Complications Trial (DCCT) assay.
- Fasting Plasma Glucose (FPG) ≥ 126 mg/dl (7.0mmol/L). Fasting as no caloric intake for at least 8 hours.
- Two-hours plasma glucose ≥ 200 mg/dl (11.1mmol/L) during an Oral Glucose Tolerance Test (OGTT).
- Random plasma glucose ≥ 200 mg/dl (11.1mmol/L), in a patient with classic symptoms of hyperglycemia or hyperglycemic crises.

**NB:** The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water in the absence of unequivocal hyperglycemia, criteria 1-3 should be confirmed by repeat testing.

#### II.2.4.3 Etiological diagnosis

- Type 1 diabetes is divided into two based on their etiologies, immune mediated (presence of autoantibodies) and idiopathic T1D (type 1B) with unknown cause [43]
- Autoantibodies: anti-GAD, anti-IA2, anti-Insulin, anti-ZnT8, the presence of one or more of these autoantibodies confirms autoimmune mediated T1D (type 1A).

- C-peptide: suggests Beta cells failure and helps differentiate between types of diabetes. Low in T1D, normal or high in Type 2 or MODY (maturity-onset diabetes of the young).

### II.2.5. Management [45]

#### II. 2.5.1. Aims

- Maintain blood glucose levels within normal.
- Promote and maintain day to day clinical and psychological well-being.
- Provide diabetes self-management education.
- Prevent both acute and chronic complication.

#### II. 2.5.2. Methods

##### II. 2.5.2.1. Therapeutic lifestyle changes.

➢ **Medical Nutrition Therapy (MNT)**

This is to improve overall health by teaching patients to eat a diet containing different types of foods in appropriate amount to help manage body weight, glucose, lipid, and blood pressure.

- Consultation with a dietitian develop medical plan is encouraged.
- Evaluate height, weight and body mass index (BMI), and nutrition plan annually.
- Calories should be adequate for growth and stop if overweight.

➢ **Physical activity**

Regular physical activity is recommended for patients with type 1 diabetes; however, individuals on insulin therapy should be educated about acute and chronic effects of exercise on blood glucose levels. They must learn how to adjust insulin doses and food intake to maintain good glycemic control before, during, and after exercise, in order to prevent significant hypoglycemia or hyperglycemia. The ADA 2021, recommends more than or equals 75minutes/week of physical activity in younger individuals.

##### II.2.5.2.2. Pharmacological treatment

The management of T1D requires the use of insulin therapy. The goal is to mimic normal insulin patterns through physiological insulin secretion that is regimens that combine basal and prandial insulin (Basal bolus insulin regimens). These regimens commonly involve the following options;

- Multiple Daily Injections (MDI): this approach includes 1-2 injections of basal insulin each day to maintain glucose levels between meals and overnight, along with rapid-acting insulin given by injection or inhalation before meals to control post-meal glucose.

- Continuous subcutaneous insulin infusion (CSII): also known as insulin pump therapy, this method delivers rapid-acting insulin continuously in as a basal rate with programmable boluses at mealtime helping achieve better glucose control and reducing the risk of hypoglycemia.
- Most physician treating diabetes mellitus in children use MDI regimens and when appropriate. Some use morning Neutral Protamine Hagedorn (NPH) insulin when it is difficult for the child to receive or administer a midday injection. CSII is also commonly used in infants and toddlers who eat often, as insulin pumps make their care easier and more convenient for patient.
- Twice-daily or three-times-daily mixed insulin regimens: using premixed combination (such as NPH and regular insulin) may be use, although these offer less flexibility and less physiologic control compared to basal-bolus therapy.
- Insulin is typically individualized based on age, lifestyle, glycemic targets, risk of hypoglycemia, and available resources. Also, the use of insulin requires frequent blood glucose monitoring daily.

**Table III:** types of insulin

| Insulin types | Examples | Onset of action | Peak (hours) | Duration (hours) | Use in Regimes | Key characteristics |
|---|---|---|---|---|---|---|
| Rapid-acting insulin | Lispro, Aspart, Glulisine | 10–20 min | 1–2 | 3–5 | Bolus/ prandial; basal–bolus; insulin pump | Controls post- meal glucose; taken immediately before meals; used in pumps |
| Short- acting insulin | Regular insulin | 30–60 min | 2–4 | 6–8 | Bolus/ prandial; mixed regimens | Less flexible; taken 30 min before meals |
| Interm ediate-acting insulin | NPH insulin | 1–3 hours | 4–8 | 12–18 | Basal in older regimens; premixed | Variable absorption; risk of nocturnal hypoglycemia |
| Long- acting insulin | Glargine, Detemir | 1–2 hours | Minimal/ No peak | 20–24 | Basal in basal–bolus | Stable background insulin; once or twice daily |

| Insulin types | Examples | Onset of action | Peak (hours) | Duration (hours) | Use in Regimes | Key characteristics |
|---|---|---|---|---|---|---|
| Ultra- long-acting insulin | Degludec | 1 hours | No significant peak | >42 | Basal; basal–bolus | Very stable; lowest hypoglycemia risk; flexible dosing |
| Premixed insulin | 70/30, 75/25, 50/50 | Varies | Dual peaks | Varies | Twice- or thrice-daily mixed regimens | Combines basal + bolus; less flexible; requires consistent meals |

#### II.2.5.2.3. Indications

In children, adolescents: intensive insulin regimens, life style modifications, and therapeutic education.

### II.2.5.3. Follow up

- Blood glucose levels at least four times daily.
- Glycated hemoglobin every 3 months (target < 7.5% in children and adolescents).
- Blood /urinary ketone monitoring
- Body mass index.
- Psychological assessment should be done during routine follow-up.
- Screening for chronic complication. Should be initiated after 5 years of duration with T1D.

## II.2.6. Complications

Despite significant advances in diabetes treatment and technology, T1D continues to be associated with significant complication both acute and chronic. In the acute setting, complications associated with T1D include hypoglycemia and ketoacidosis. Chronic complications can be divided in to Microvascular and Macro vascular. Microvascular complications most commonly manifest as retinopathy, neuropathy, and nephropathy. while macro vascular complications include various types of cardiovascular disease such as coronary artery disease, cerebrovascular disease, and peripheral vascular disease.

### II.2.6.1. Acute complications

#### II.2.6.1.1. Ketoacidosis

It is a common acute and life-threatening condition that occurs mostly in people with T1D. It is characterized by hyperglycemia leading to osmotic diuresis that result in dehydration,

metabolic acidosis and excessive ketone production. About 20 to 40% of pediatric cases of T1D initially present with DKA [46].

Diagnosis: blood glucose: > 200 mg/dl, pH< 7,3 or bicarbonate <15 moll/l, ketonuria and ketonemia [47].

#### II.2.6.1.2. Hypoglycemia

The American diabetes association (ADA) work group defines iatrogenic hypoglycemia in people with T1D as all episodes of abnormally low plasma glucose concentration that expose the individual to potential harm. A single threshold for plasma glucose concentration that defines hypoglycemia in diabetes cannot be assigned, however the work group suggested the following classifications [48]. Severe hypoglycemia: an event requiring assistance of another person to actively administer carbohydrate, glucagon, or take other corrective actions. Documented symptomatic hypoglycemia: an event during which typical symptoms of hypoglycemia (trembling, sweating, palpitation, anxiety, hunger, blurred vision, fatigue, dizziness) are accompanied by measured plasma glucose concentration less than or equal to 70mg/dl. Asymptomatic hypoglycemia: no typical symptoms of hypoglycemia associated to plasma glucose concentration less than or equals to 70mg/dl. Probable symptomatic hypoglycemia: patient symptomatic but blood glucose was not measured; it is assumed to be less than or equals to 70mg/dl. Pseudo symptomatic: patient symptomatic but measured blood glucose > 70mg/l.

**Others acute complications are:** Hyperosmolar hyperglycemia state (HHS): seen mainly in Type 2 diabetes, characterized by severe hyperglycemia > 5g/l without ketosis. Lactic acidosis: iatrogenic complication related to biguanide therapy, characterized by elevated blood lactate levels.

### II.2.6.2. Chronic complication

#### II.2.6.2.1. Microvascular complications

Retinopathy: one of the more disabling complications affecting quality of life of individuals with diabetes. The development of diabetic retinopathy is related to glycemic control duration of diabetes and age of onset [49].

#### II.2.6.2.2. Macro vascular complications

- Diabetic nephropathy.
- Diabetic neuropathy.
- Stroke.
- Coronary artery disease (ischemic heart disease).

These complications both acute and chronic may affect both quality of life and academic performance.

## II.3. General knowledge on HRQOL and academic performance

### II.3.1. Health related quality of life

Quality of life (QOL) is a multidimensional concept that reflects an individual's perception of their overall wellbeing. According to the WHO, 1994, QOL is defined as "***an individual's perception of their position in life within the context of the culture and value system in which they live, and in relation to their goals, expectations, standards, and concernsi, it is a broad concept influenced in a complex way by physical health, psychological state, level of independence, social relationships, personal beliefs, and the environment"*** [13].

In health sciences, the concept is refined into health-related quality of life (HRQOL), which focuses on the aspect of QOL that are affected by health. HRQOL is defined as ***"those aspects of self-perceived well-being that are related to or affected by the presence of the disease or the treatment"*** [50]. HRQOL takes into account physical domains (autonomy and physical activity), psychological domains (anxiety, depression, emotions), and symptomatic domains (impact of the disease and its treatment). HRQOL is assessed using either Generic scales or disease specific score scales (diabetes in our case). The use of both scales enables to capture overall HRQOL. Patients with T1D require continuous intensive insulin therapy to achieve optimal glycemic control. This demands substantial and ongoing effort from patient, including insulin injections, frequent blood glucose monitoring, regular physical activity, and healthy eating habits. Giving these daily challenges, it is reasonable to question the impact of such intensive disease management on patient's quality of life, especially among children and adolescents. Many factors are associated to HRQOL, including sociodemographic factors (age, sex, socioeconomic status, family support, education level. Clinical factors (disease duration, glycemic control, frequency of hypoglycemia, use of insulin analogue, daily insulin dose, intense insulin therapy, frequency of insulin administration and blood glucose monitoring [51]. Pediatric health related quality of life is assessed using a variety of validated generic and diabetes-specific instruments which include:

**PedsQL 4.0 Generic Core Scale** [52]

The PedsQL 4.0 Generic Core Scale is one of the most widely used instruments for assessing health-related quality of life in pediatric populations. It is designed for children aged 2 to 25 years old and exists in both child self-report and parent report. and parent-proxy versions

(2 to 4 years). The scale contains 23 items organized into four domains: **physical, emotional**, **social,** and **school functioning**. **Psychosocial health summary score** is the sum of all items in the emotional, social, and school functioning domains over the total number of items, and the **physical health summary score** is the physical functioning scale score. Each item asks the child or parent to report the frequency of problems experienced over the past month. Scores are transformed to a 0–100 scale, where higher scores indicate better HRQOL. A total score is obtained by averaging all items, while domain-specific scores reflect functioning in specific areas of life. The PedsQL is valued for its strong psychometric properties, age-appropriate wording, and capacity to compare healthy children with those living with chronic conditions. Available in 52 languages including English and French, and permission must be granted before use. **Interpretation and analysis:** if more than 50% of the items in the scale are missing, the scale score should not be computed and if 50% or more items are completed, impute the mean of the completed items in a scale.

**KIDSCREEN, 10, 27, and 52 versions**

The KIDSCREEN instrument measures global and multidimensional quality of life in children and adolescents aged 8 to 18 years. It is available in three lengths KIDSCREEN-10, KIDSCREEN-27, and KIDSCREEN-52 allowing researchers to choose the level of detail required. The longer versions (27 and 52 items) assess a comprehensive set of HRQOL domains, including physical well-being, psychological well-being, moods and emotions, autonomy, parent–child relationships, peers and social support, school environment, self-perception, and social acceptance (bullying). KIDSCREEN is available in both child self- report and parent-proxy forms. Scores are transformed into T-scores, standardized with a mean of 50 and a standard deviation of 10. Higher scores indicate better perceived quality of life. KIDSCREEN is recognized for its cross-cultural development, making it especially suitable for international studies or multicultural settings.

**DQOLY (Diabetes Quality of Life for Youth)** [53]

The Diabetes Quality of Life for Youth (DQOLY) is a disease-specific instrument developed to assess the impact of type 1 diabetes on the daily lives of adolescents. It is adapted from the original adult DQOL but modified to reflect the developmental, emotional, and social realities of young patients. The DQOLY is intended for adolescents aged approximately 11 to 18 years and is administered as a self-report questionnaire. It contains three major domains: satisfaction, which evaluates how content young people are with various aspects of living with diabetes; impact, which captures how diabetes interferes with daily

activities, school, social life, and routines; and worries, which assesses concerns about future complications, hypoglycemia, or long-term consequences. The scale includes around 50 items (depending on the validated version used), scored so that higher scores indicate poorer quality of life, meaning more problems, more worries, or lower satisfaction. The DQOLY is particularly useful for capturing the subjective emotional and psychosocial burden of diabetes during adolescence, a period marked by increased autonomy, diabetes self-management responsibilities, and vulnerability to treatment fatigue.

**PedsQL™ 3.2 Diabetes Module** [54]

The PedsQL 3.2 Diabetes Module is a disease-specific instrument designed to measure the quality of life of children and adolescents living with diabetes mellitus, particularly type 1 diabetes. It is intended for children aged 2 to 18 years, young adult offering child self-report versions for ages 5–18 and parent-proxy versions for ages 2–18 and young adults. The module is composed of 28 items, grouped into five core domains that reflect the multidimensional challenges of living with diabetes: diabetes symptoms (physical signs and discomfort associated with high or low glucose), treatment barriers (practical or emotional difficulties in following the prescribed regimen), treatment adherence (extent to which the child can reliably complete insulin injections, glucose monitoring, or dietary recommendations), worry (concerns about complications, hypoglycemia, or long-term outcomes), and communication (ease and clarity of discussing diabetes-related issues with caregivers, teachers, and healthcare providers). Items are scored on a five-point scale and reverse-scored, then transformed to a 0–100 scale, with higher scores representing better diabetes-related HRQOL. The PedsQL Diabetes Module is widely used in both clinical and research settings because it aligns well with pediatric care structures, integrates seamlessly with the PedsQL Generic Core Scale, and provides sensitive measurement of diabetes-specific burdens across different age groups.

### II.3.2. Academic performance

Refers to the extent to which a student achieves their learning objectives or attains the educational outcomes expected by an educational institution over a specific period of time. It is commonly measured quantitatively through grades, classroom assessment, completion of learning objective, standardized test scores, and teacher's evaluation. Many factors like glycemic control, duration of diabetes, school absenteeism, psychological, economic and social factors may influence academic performance [10,55–57].

## II.4. Review of studies

### In Asia

Abdul-Rasoul et al. 2013 [58] in Kuwait aimed to evaluate the health-related quality of life (HRQOL) of children and adolescents with type 1 diabetes mellitus (T1D) in Kuwait using the Pediatric Quality of Life Inventory (PedsQL) 3.0 and Pediatric Generic Core Scale 4.0. A total of 436 patients aged 2–18 years with T1D completed self-reports, alongside 389 healthy controls. The mean age at diabetes onset was 6.1 ± 4.2 years, and the mean disease duration was 5.37 ± 2.8 years. The mean HbA1c was 8.0 ± 1.6%, with 14% of patients on 1–2 daily insulin injections, 68.3% on 3–4 injections, and 17.7% using an insulin pump. HbA1c values increased with age, significantly in adolescents (7.1 ± 1.2 in 5–7 years vs. 8.9 ± 1.4 in 13–18 years, $p < 0.001$). The mean total score of the PedsQL Diabetes Module was 70.2 ± 9.8, with lower scores in younger children and those with longer diabetes duration ($p <0.001$). Boys generally had higher HRQOL scores than girls, although girls scored better on treatment barriers and adherence. Higher HbA1c values were associated with lower HRQOL scores ($p < 0.0001$). Compared to healthy controls, children with T1D reported lower generic HRQOL, particularly in physical and emotional domains. The study highlights the impact of T1DM on HRQOL and emphasizes the need for interventions to support children's well- being.

Meo et al. conducted a cross-sectional study in Saudi Arabia, 2012 [59], with the objective of examining the effect of type 1 diabetes on academic performance. The study recruited ethnically Saudi students with type 1 diabetes from eight schools in Riyadh, matched with non-diabetic control classmates of the same age, sex, ethnicity, and socioeconomic status. A total of 72 students were included 36 with type 1 diabetes (80.6% male; mean age 17.02 ± 0.53 years; mean disease duration 6.11 ± 0.65 years; mean HbA1c 8.37 ± 0.21%) and 36 nondiabetic controls (80.6% male; mean age 17.85 ± 0.41 years). Academic performance was assessed through overall grades derived from written examinations in English, mathematics, physics, chemistry, biology, and humanities, collected directly from school administration offices. Results showed that students with type 1 diabetes obtained significantly lower mean examination scores compared to their nondiabetic classmates (86.58 ± 1.48% vs. 90.62 ± 1.36%, $p = 0.02$). The authors attributed this decline in academic performance to diabetes-related cognitive dysfunction, encompassing impairments in intelligence, memory, attention, information processing, and executive function. They concluded that overall academic

performance is significantly lower in students with type 1 diabetes compared to their nondiabetic peers, while acknowledging the limitations of a small sample size and short study duration, and calling for larger, longer-duration studies to confirm these findings.

## In America

Garcia et al. in 2023, Bogota, D. C., Colombia [60] aimed to evaluate the health-related quality of life (HRQOL) in children and adolescents with type 1 diabetes. The study included 25 school-attending patients (72% male; mean age 13.2 years) with a mean disease duration of4.39 ± 3.04 years and mean HbA1c of 8.16 ± 1.67%. HRQOL was assessed using the PedsQL 4.0 Generic Core Scale and PedsQL 3.2 Diabetes Module. Overall, the mean diabetes-specific HRQOL score was 73, with males reporting slightly better scores than females. Patients using insulin pumps had higher HRQOL scores in the barriers, compliance, concern, and communication domains compared to those on multiple daily injections, with a statistically significant difference in the overall diabetes-specific score. Glycemic control was associated with HRQOL, as patients with HbA1c <9% reported better overall HRQOL, whereas those with HbA1c >9% had lower perceived HRQOL. For the generic HRQOL, the overall mean score was 78.68, with the emotional functioning domain being the lowest. These findings highlight that both glycemic control and type of insulin therapy influence perceived quality of life in pediatric patients with T1DM.

McCarthy et al in 2002 in the United states [57], conducted a cross-sectional study among 244 children and adolescents aged 8 to 18 years with type 1 diabetes, followed across five clinics in a rural Midwestern state of the United States. The cohort comprised 130 boys and 114 girls, with a mean age of 14.8 ± 3.2 years, a mean age at diabetes onset of 8.3 ± 3.7 years, and a mean disease duration of 7.1 ± 3.9 years. The study aimed to examine academic achievement in children with diabetes and to identify its predictors, using school-administered standardized tests (ITBS/ITED), grade point averages (GPAs), school absences, behavioral assessments, and HbA1c values. Children were categorized into three metabolic control groups: good control (HbA1c < 8%), average control (HbA1c 8–10%), and poor control (HbA1c > 10%). Results showed that children with poor metabolic control had significantly lower reading scores and GPAs compared to those with good or average control. Children hospitalized for hyperglycemia performed worse on overall achievement scores, while a small subgroup with tight metabolic control and hypoglycemic hospitalizations scored particularly low. Socioeconomic status and parental ratings of behavioral problems were the strongest predictors of academic performance,

with medical variables including HbA1c adding only modestly to predictive precision. The authors concluded that while poor metabolic control and serious hypoglycemia represent a concern for a subset of children, socioeconomic and behavioral factors remain the primary determinants of academic achievement in the pediatric T1D population.

## In Europe

Samardzic et al. in 2016, Montenegro [6] evaluated health-related quality of life (HRQOL) in children \and adolescents with type 1 diabetes (T1D) compared with age and gender matched healthy controls. Children with T1DM and their parents completed the PedsQL 4.0 Generic Core Scales (GCS) and PedsQL 3.0 Diabetes Module, while healthy controls completed the PedsQL 4.0 GCS. The study found that children and adolescents with T1DM had lower HRQOL in the psychosocial health and school functioning domains compared to healthy peers ($p = 0.008$ and $p \leq 0.001$, respectively). Lower glycosylated hemoglobin (HbA1c) values were associated with fewer worries and better perceived health by both children and parents. No significant differences were observed between boys and girls, and HRQOL was similar across age groups. Parents consistently reported a greater impact of the illness on their children's lives than the children themselves. These results indicate that lower HbA1c is linked to better HRQOL in children and adolescents with T1D.

Fleming et al in 2019 in the United Kingdom [61], conducted a large-scale population-based cohort study using record linkage of nine Scotland-wide databases, covering a cohort of 766,047 singleton children who attended Scottish schools between 2009 and 2013. Of these, 3,330 children (0.47%) were identified as having type 1 diabetes based on insulin dispensing records, and their health and educational outcomes were compared to those of their peers, with adjustment for sociodemographic, obstetric, and maternal confounders. The study aimed to determine the association between childhood type 1 diabetes and a broad range of educational and health outcomes, including school absenteeism, exclusion, special educational need, academic attainment, post-school unemployment, hospitalization, and mortality. showed that children with type 1 diabetes were significantly more likely to be hospitalized (adjusted HR 3.97), to die (adjusted HR 3.84), to be absent from school (adjusted IRR 1.34), and to have learning difficulties (adjusted OR 1.19) compared to their peers. Crucially, within the type 1 diabetes subgroup, higher mean HbA1c particularly in the highest quintile (mean 11.1%) was independently associated with greater absenteeism (adjusted IRR 1.75), increased school exclusion (adjusted IRR 2.82), poorer academic attainment (adjusted OR 3.52), and higher risk

of post-school unemployment (adjusted OR 2.01), all compared to children in the lowest HbA1c quintile. The authors concluded that children with type 1 diabetes fare worse than their peers across both health and educational domains, with poor glycemic control being a key driver of these disparities, and called for targeted interventions to minimize school absence and protect long-term educational and professional outcomes in this population.

## In Africa

A cross-sectional study conducted in Sudan in 2021 by Asaad Ahmed Mohammed Ahmed et al. [10], assessed the impact of diabetes status and metabolic control on academic performance among 122 children and adolescents with T1DM (mean age 13.2 ± 2.8 years). Glycemic control was generally poor, with an average HbA1c of 11.2 ± 2.7% and 63.1% of participants presenting HbA1c levels above 9.5%. Although most children had access to glucometers, only half monitored their glucose regularly. Poorer glycemic control was significantly associated with lower household income and lower parental educational level. Academic performance was strongly affected by diabetes control, as children with poorer glycemic control and longer duration of illness had significantly lower academic scores. Moreover, higher HbA1c values and longer diabetes duration were negatively correlated with school performance, while chronic complications showed no significant impact on academic outcomes. This study highlights the link between inadequate glycemic control and reduced academic performance, reinforcing the importance of optimal diabetes management in school aged youth.

A qualitative study by Owusu BA et al. 2024 [7] in Ghana examined the impact of type 1 diabetes on schooling among young people aged 14–25 years, providing insights relevant to school functioning and psychosocial aspects of HRQOL. Data were extracted from a qualitative project on lived experiences of T1DM in southern Ghana involving 28 young persons with T1DM and 12 caregivers, purposively recruited using maximum variation and snowball sampling. Semi-structured interviews were conducted in support group centers, homes, or healthcare facilities. Most participants were students with a mean disease duration of eight years, and many reported that T1DM interfered with their schooling through concentration difficulties, class disruptions caused by glycemic fluctuations, frequent clinic visits, and diabetes-related symptoms. Both youth and caregivers described emotional strain, fear of hypoglycemia, and stigma within the school environment, all of which contributed to reduced academic engagement and poorer psychosocial wellbeing. Overall, the study highlighted that

T1DM can negatively influence school participation and daily functioning, supporting evidence that the condition impacts key domains of HRQOL among young people (7).

Moronkola et al. (2024) in Nigeria [62], aimed to evaluate the health-related quality of life (HRQOL) of children and adolescents with type 1 diabetes mellitus (T1DM) at Lagos University Teaching Hospital using the PedsQL 4.0 Generic Core Scales and PedsQL 3.0 Diabetes Module. A total of 50 children with T1DM aged 10–17 years (mean 13.4 ± 3.6) and 50 healthy controls (non-chronic conditions or healthy siblings) were recruited. The mean HbA1c was 8.9 ± 2.8%, with 64% of patients having poor glycemic control. The mean total generic HRQOL score in T1DM children was 73.0 (11.8), significantly lower than controls at 86.5 (10.4) ($p < 0.001$). All four generic core subscales physical functioning (75.6 vs. 85.7, $p = 0.003$), emotional functioning (81.0 vs. 96.6, $p < 0.001$), social functioning (76.8 vs. 87.9, $p < 0.001$), and school functioning (71.3 vs. 88.4, $p < 0.001$) were significantly lower in T1DM children compared to healthy controls. School functioning was the most impaired domain, while emotional functioning was the least impaired. Poor glycemic control, higher HbA1c levels, and lower socioeconomic status were significantly associated with worse HRQOL. The study concludes that T1DM significantly impairs HRQOL across all generic core domains in Nigerian children, underscoring the need for holistic management beyond glycemic control alone.

A study by Lontchi-Yimagou et al. 2017 [11], in Cameroon evaluated the effect of free diabetes care on metabolic control and health-related quality of life (HRQOL) in 104 youth with type 1 diabetes (T1D), aged 9–18 years (mean 16±2), recruited from Yaoundé Central, Bamenda Regional, and Bafoussam Regional hospitals. The mean BMI was 21.3±3.9 kg/m², the mean duration of diabetes was 5±3 years, and the mean baseline HbA1c was 11.4% ±2.7%. In the 3 months preceding inclusion, 27 patients experienced severe hypoglycemia and 31 experienced ketoacidosis. After one year of enrollment in the Changing Diabetes in Children (CDiC) project, glycemic control improved significantly (mean HbA1c 11.4%±2.7% at baseline vs 8.7%±2.4% after one year, $p=0.001$), and the number of patients with hypoglycemia or ketoacidosis decreased significantly (hypoglycemia: 27/104 vs 15/104, $p=0.01$; ketoacidosis: 31/104 vs 7/104, $p<0.0001$). The internal consistency of the PedsQL 3.0 DM questionnaire was acceptable ($\alpha=0.75$), indicating reliable measurement in this population. Despite improvements in metabolic control, there was no significant change in the total HRQOL score after one year (61.9±15.5 at baseline vs 61.5±15.4, $p=0.66$), though diabetes associated symptoms scores decreased significantly (62.2±14.5 vs 59.1±15.5, $p=0.02$). Subgroup analysis showed that only children from the Yaoundé clinic reported significant

improvement in diabetes-related symptom scores (62.3±16.3 vs 57.7±16.1, p=0.02), while those from Bafoussam and Bamenda clinics showed no significant change. No significant associations were observed between total HRQOL and age, duration of diabetes glycemic control, level of education, or the occurrence of severe hypoglycemia or ketoacidosis. The study highlighted that free diabetes care improves metabolic outcomes and reduces acute complications but may not directly translate into overall HRQOL improvements within one year.

Djonou et al. conducted a cross-sectional study in 2013 [63],across seven centers of the Changing Diabetes in Children (CDiC) program in Cameroon, with the objective of describing the prevalence of glycemic control and its associated factors in Sub-Saharan African children and adolescents with type 1 diabetes. The CDiC program is a public-private partnership designed to improve diabetes care delivery in resource-poor settings, providing enrolled patients with free insulin, glucose monitors, strips, and diabetes education. All children and adolescents aged 6 to 19 years with type 1 diabetes, followed in CDiC centers for at least one year, were eligible for inclusion after parental consent. A total of 95 participants were enrolled (50 males; mean diabetes duration 4.1 ± 2.9 years; mean daily insulin dose 0.79 ± 0.32 U/kg/day), with 68.4% receiving at least three insulin injections per day. The mean HbA1c was 9.2 ± 2.5%, and 67.4% of participants had poor glycemic control, defined as HbA1c above the glycemic target for age. On univariate analysis, three factors were significantly associated with glycemic control: the educational level of the patient ($p = 0.03$), healthy eating habits ($p < 0.001$), and diabetes duration ($p < 0.001$). On multivariate analysis, only diabetes duration remained independently associated with glycemic control, with patients diagnosed for more than two years showing significantly better control than those more recently diagnosed (OR 0.07, 95% CI 0.01–0.43, $p = 0.004$). The authors concluded that glycemic control remains very poor among children and adolescents with type 1 diabetes in Cameroon despite the implementation of a free diabetes care program, with diabetes duration being the principal determinant of glycemic outcomes. The main limitation acknowledged was the small sample size, though the authors noted that the sample was exhaustive and representative of all T1D patients enrolled in the CDiC program nationwide at the time of the study.

# CHAPTER III : METHODOLOGY

## III.1. Type of study

We carried out a case-control study

## III.2. Site of study

Our study was carried out in two hospitals and two secondary schools in Yaoundé

- The Yaoundé central hospital
- The Mother and child Center – Chantal Biya Foundation.
- Government Bilingual High School Yaoundé
- Golden Bilingual High School college

### III.2.1. Presentation of the study sites

Yaoundé Central Hospital

This reference hospital is located in the hearth of Yaoundé. It has the biggest and most specialized endocrinology unit. It hosts the Changing Diabetes in Children (CDiC) clinic in Cameroon. This program provides free and comprehensive care for children and young adults with T1D from the city and surrounding regions. These include; Free insulin and monitoring equipment, patients and family education, regular follow-up visits, which are scheduled on Wednesdays. It records about 30 children and adolescents visits weekly.

Mother and Child Center-Chantal Biya Foundation

The Mother and Child Centre of the Chantal Biya Foundation (MCC-CBF) is located in the 2nd district of Yaoundé. It is a tertiary healthcare facility operating that provide specialized services across several pediatric disciplines, including endocrinology. It is a recognized center within the Changing Diabetes in Children (CDiC) program. It records about 10 to 15 diabetic consultation week.

Government Bilingual High School

A large scale public institution located in the Yaoundé V. It represents the government-standard educational environment with high density and diverse student population. It was chosen to ensure the control group was representative of the general pediatric population.

Golden Bilingual High School College

A private institution located in Yaoundé V, offering a more control setting. It serves as the private-sector counterpart.

## III.3. Duration of study

This study was carried out over a duration of 8 months, from November 2025 to June 2026.

## III.4. Study population

**Case:** Children and adolescents from 8 to 18 years old diagnosed with T1DM (according to the ADA criteria) for at least six months and registered as formal school students with known academic results, attending both hospitals.

**Control:** Healthy peers matched for age (+/- 1), sex, level of education, type of school, and sector of activity of tutor.

### III.4.1. Target population

All young people aged 8 to 18 years enrolled in a school in Yaoundé, both those living with type 1 diabetes and their healthy peers.

### III.4.2. Inclusion criteria

- Young people aged 8-18 years old diagnosed (ADA) with T1D for at least six months and followed in the selected hospitals during our study period.
- Healthy peers with no known chronic physical or mental illness and not on any long-term medication.
- Currently enrolled in school with first term average available.
- Informed parent/tutor consent and assent from child.

### III.4.3. Exclusion criteria

- Diabetic children with other co-morbidities that could affects HRQOL or academic performance like epilepsy, severe psychiatric disorder
- Presence of severe cognitive impairment disorders that prevent reliable completion of questionnaire or affects academic performance.
- Presence of diabetes acute complication during data collection.

### III.4.4. Sampling

#### III.4.4.1. Sampling method

We used a consecutive sampling technique for diabetic patients and hospital based non-diabetic (healthy siblings accompanying their sick relatives) who presented during study period. An exhaustive approach was used for all eligible non-diabetic patients in selected schools to include all eligible non-diabetic patients. Controls were then matched at a 1:2 ratio to cases based on; age, sex, level of education, school of type, and parents' sector of activity.

#### III.4.4.2. Sample size

To determine the required sample size for this comparative cross-sectional study, a formula for comparing two independent means with an unequal allocation ratio of 1:2 (Group 1 to Group 2) was used. The sample size for the smaller group $n_1$ was calculated using the following adjusted formula for unequal group sizes:

$$n1 = \frac{(3(Za+Z\beta)*SD^2}{2\delta^2} \quad [64]$$

Where:

- $\boldsymbol{n_1}$ is the sample size required for Group 1.
- $\boldsymbol{Z_\alpha}$ is the standard normal deviate for the significance level (1.96 for a 95% confidence level).
- $\boldsymbol{Z_\beta}$ is the standard normal deviate for statistical power (0.84 for 80% power).
- $\boldsymbol{SD}$ is the anticipated pooled standard deviation, set at 14 from Varni et al [52].
- $\boldsymbol{\delta}$ is the minimum clinically important difference to be detected, set at 5.5. between the two comparison groups.

Based on these parameters, the minimum required sample size was calculated to be,

$n_1$ = **77** diabetic patients, $n_2$ = **154** healthy peers, Total N = **231.**

## III.5. Resources used

### III.5.1. Human resources

Principal investigator: Matateyou kadije

Supervisor and co-supervisors

Statistician

Trained medical personnel.

### III.5.2. Material used

A4 papers

Laptop

Smart phone

Writing materials (pen, pencil)

Internet connection

Software

## III.6. Procedure

### III.6.1. Administrative formalities

Firstly, we wrote and presented a research protocol that was approved by the supervisors, after which we obtained research authorizations from the directors of the hospitals, principals of the schools, and ethical clearance from the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I.

### III.6.2. Recruitment and data collection process

After obtaining ethical clearance and study authorizations, we met with the head of department, the Major, and the consultant endocrinologists, who then introduced us to the endocrinology unit in the selected hospitals. We then carried out a prospective and consecutive method to identify all eligible patients during their clinical visits. After securing parental consent and child assent, we conducted a face to face interview to administer the questionnaire in a private setting and retrieved clinical data from medical records.

The control group was established by recruiting primary school children directly from the hospital's outpatient services, while for older participants, an exhaustive survey was conducted across all class levels of the two selected secondary schools. From this student pool, participants were specifically selected to form a 1:2 control group, while the additional questionnaires were not included.

## III.7. Variables

Data was collected at enrolment using a structured data collection form, divided in to 4 parts which are:

1. **Sociodemographic variables**: age, sex, school type and level of education, and profession of parents
2. **Clinical data**
   - Patients were examined and vitals noted: blood pressure, weight, height
   - The most recent HbA1c was obtained from patient's files.
   - Frequency of hypoglycemia/hyperglycemia from logbooks over a period of 1 week and each value was classified according to standard thresholds [47]; Hypoglycemia (< 70 mg/dl), and hyperglycemia (> 180 mg/dl).
3. **Academic performance**: Was assessed using a multidimensional approach;
   - **School results:** child's first term average was obtained for current academic year extracted from report card. Averages on a scale of 20 as use in Cameroon.
   - **School attendance:** total number of missed classes during first term was recorded.
4. **Health related quality of life (HRQOL)**

- **The PedsQL Diabetes Module (PedsQL DM 3.2) inventory** [54]**:** Disease-specific tool, made up of 33 questions divided into five domains;

- Diabetes symptoms (15 questions)
- Treatment barriers (5 questions)
- Treatment adherence (6)
- Worry (3)
- Communication (4 questions).

- **The Generic Core Scale 4.0 (PedsQL Generic core)** [52]**:** Evaluate overall HRQOL for both diabetic patients and healthy peers, composed of 23 questions divided into four domains;

- Physical functioning (8 questions)
- Emotional functioning (5)
- Social functioning (5)
- School functioning (5)

**Interpretation and analysis**

Each question is scored on a 5-point Likert scale, ranging from 0 (never a problem) to 4 (almost always a problem) and then transformed to a 0-100 scale (0=100, 1=75, 2=50, 3=25,4=0), with **higher scores indicating better quality of life**.

## III.8. Data analysis

Data collected was entered into kobotoolbox electronic database and analyzed using the Statistical Package for the Social science (SPSS) software version 27.0 (IBM Corp., Armonk, NY, USA), Excel was used for graphs and tables.

### i. Descriptive analysis

Continuous variables were summarized with mean and standard deviation (SD) if normally distributed or median (interquartile range, IQR) if skewed (not normally distributed). Categorical variables presented as frequencies (counts) and percentages. Results were illustrated with tables, graphs (bar charts, pie chart, boxplots) for clear visualization.

### ii. Bivariate analysis

Associations between HbA1c and PedsQL scores and academic performance were explored using Mann-Whitney U tests for two-group comparisons, Chi-square tests for categorical variables, and Spearman correlation coefficients for continuous variables, given the non-normal distribution of the data.

## III.9. Ethical considerations

This study was carried out according to the principles stated in the 1964 Declaration of Helsinki. After validation by our supervisor and co-supervisors, our research proposal was submitted to the Institutional Review Board (IRB) of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I in order to obtain ethical clearance. We went further to obtain authorization from our study sites. Potential participants in our study and their guardians was duly informed of the importance, procedure and risks of the study before obtaining their consent to participate. They were not forced to participate in the study. The identification and personal information of participants was kept under strict confidentiality through the use of anonymous questionnaires.

# CHAPTER IV: RESULTS

## IV.1. Diagrammatic representation of recruitment process

A total of 93 T1D individuals were approached, 11 were excluded (4 for no first term averages and 7 hospitalized for acute complications), yielding a final T1D sample of 82 participants (YCH: 49; CBF: 33). Of the 887 controls initially approached, 179 were included and 11 excluded due to incomplete questionnaires. We retaining 168 controls (GBHSY: 81; GBHS: 75; CBF: 12), bringing the total study sample to 250 participants.

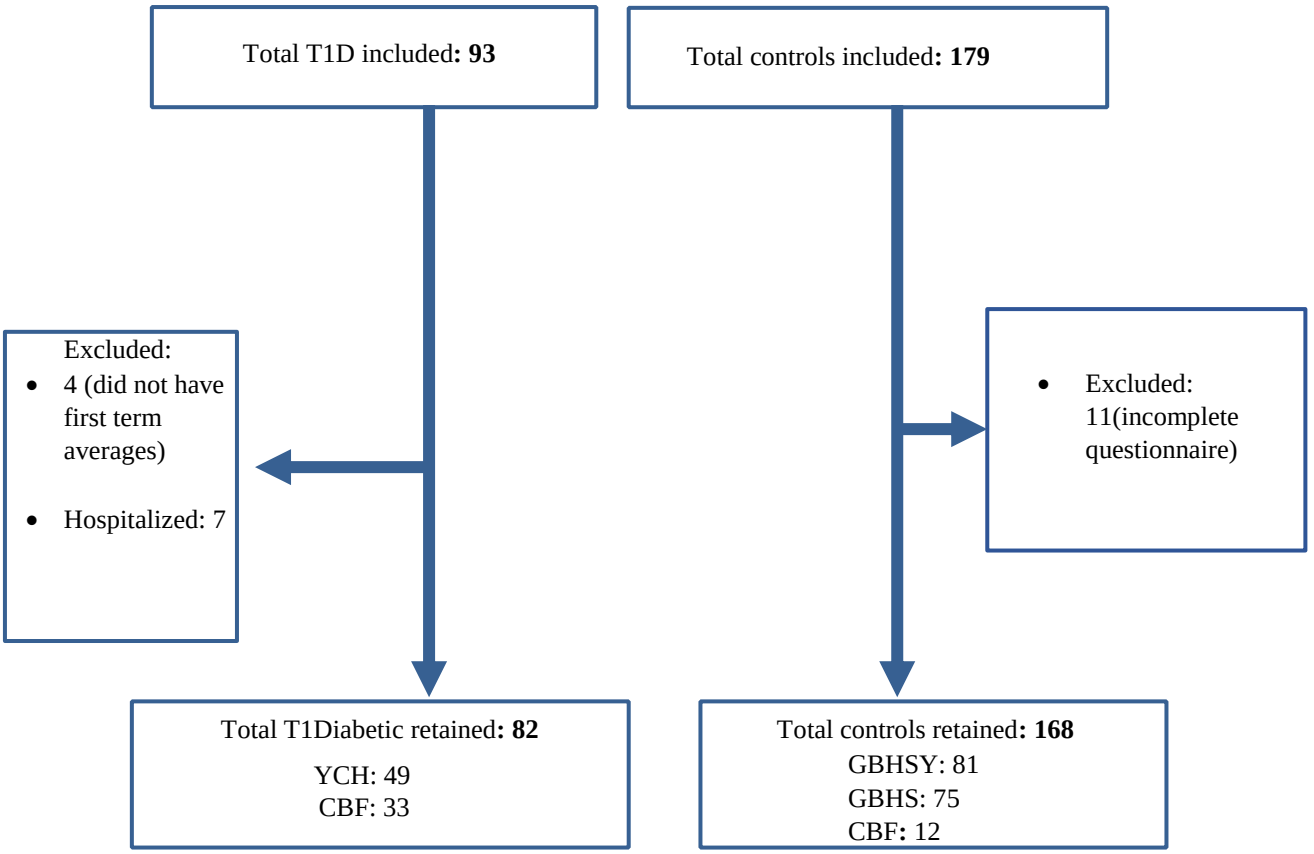


**Figure 4**: participant flow diagram

The 12 non-diabetic participants recruited from Chantal Biya Foundation were healthy children accompanying their sick siblings to the hospitals, and were all primary school children.

## IV. 2. Sociodemographic profile of study population

The tables (IV and V) below describe and compare the sociodemographic profiles of our study population, both diabetic and non-diabetic

**Table IV**: sociodemographic profile of the study population

| Variables | Diabetic N=82; n(%) | Non-diabetic N=168; n(%) | P-value |
|---|---|---|---|
| **Age in years** | | | 0.977 |
| [8-10[ | 3 (3.7) | 7 (4.2) | |
| [10-15[ | 27 (32.9) | 56 (33.3) | |
| [15-18] | 52 (63.4) | 105 (62.5) | |
| **Median age -years [IQR]** | 15 [14 -17.75] | 15 [14 – 17] | 0.746 |
| **Sex** | | | 1.000 |
| Male | 41 (50.0) | 84 (50.0) | |
| female | 41(50.0) | 84 (50.0) | |
| **Education** | | | 0.960 |
| Primary | 6 (7.3) | 12 (7.1) | |
| secondary | 76 (92.7) | 156 (92.9) | |
| **Cycle** | | | 0.826 |
| 1 cycle | 32(39.0) | 68(40.5) | |
| 2 cycle | 50(61.0) | 100(59.5) | |
| **School type** | | | 0.791 |
| Public | 41(50.0) | 81(48.2) | |
| Private | 41(50.0) | 87(51.8) | |
| **Residence** | | | 0.690 |
| Urban | 77(93.9) | 165(98.2) | |
| Rural | 5(6.1) | 3(1.8) | |

The median age was 15 years old in both diabetic and control groups. The sex distribution was equal among diabetic patients, with a balanced proportion of males and females (50.0% each). Regarding school type, diabetic participants were evenly distributed between public and private schools (50.0% each), a pattern closely mirrored by the non-diabetic control group (48.2% public vs. 51.8% private; p = 0.791)."The majority of participants were enrolled in secondary education (92.7%). Most participants resided in urban areas.

**Table V:** sociodemographic profile of study population (continuation)

| Variables | Diabetic N=82; n(%) | Non diabetic N=168; n(%) | P-value |
|---|---|---|---|
| **Male guardian's** | | | 0.775 |
| Private | 20 (24.4) | 40 (23.8) | |
| Civil servant | 19 (23.2) | 47 (28.0) | |
| Informal sector | 39 (47.6) | 76 (45.2) | |
| Unemployed | 4 (4.9) | 5 (3.0) | |
| **Female guardian's** | | | 0.158 |
| Private sector | 13 (15.9) | 39 (23.2) | |
| Civil servant | 25 (30.5) | 29 (17.3) | |
| Informal sector | 33 (40.2) | 78 (46.4) | |
| Housewife | 11 (13.4) | 22 (13.1) | |
| **Male guardian's education** | | | 0.631 |
| Primary | 4(4.9) | 4 (2.4) | |
| Secondary | 45 (54.9) | 98 (58.3) | |
| Higher | 31 (37.8) | 64 (38.1) | |
| None | 2 (2.4) | 2(1.2) | |
| **Female guardian's** | | | 0.775 |
| Primary | 9 (11.0) | 14 (8.3) | |
| Secondary | 45 (54.9) | 102 (60.7) | |
| Higher | 27 (32.9) | 52 (31.0) | |
| None | 1 (1.2) | 0 (0.0) | |
| **Legal guardian** | | | 0.552 |
| father | 1 (1.2) | 8 (4.8) | |
| Mother | 8 (9.8) | 18 (10.7) | |
| Father and mother | 63 (76.8) | 125 (74.4) | |
| Grandparents | 3 (3.7) | 8 (4.8) | |
| Others | 7 (8.5) | 9 (5.4) | |

Regarding family characteristics, 76.8% lived with both parents, and informal sector employment was the most common occupation among both male (47.6%) and female (40.2%) guardians. No statistically significant differences were observed between the diabetic and

control group regarding sociodemographic characteristics used for matching (age, sex, school type, parent's sector of activity)**.**

## IV.3. Prevalence, clinical characteristics and glycemic control of diabetic patients (n=82)

During the study period, 82 children with type 1 diabetes were identified among 1627 pediatric consultations recorded in the two study hospitals, corresponding to a hospital-based prevalence of **5.04%.** The median age at diagnosis was 12.0 [IQR:10.0-14.0] years and a median disease duration of 3.0 [IQR: 2.0-5.5] years. A total of 75 children were hospitalized at least once, and 28 had at least one episode of ketoacidosis.

**Table VI:** clinical characteristics of diabetic patients

| **variables** | **T1DM** |
|---|---|
| Age at diagnosis, years, median [IQR] | 12 [10-14] |
| Disease duration, years, median [IQR] | 3 [2-5] |
| BMI, $Kg/m^2$, median [IQR] | 20.9 [18.4-23.4] |
| Hospitalization, last 6 months (≥1hospitalization) | 75 (91.5%) |
| DKA episodes, last 6 months (≥1 episode) | 28 (34.1%) |

All patients were on multiple daily insulin injection(MDI) regimen consisting of a long-acting insulin administered every 12 hours and a rapid-acting insulin three times daily. A 10% corrective bolus of rapid-acting insulin was given for hyperglycemia. Adherence to injection timing was suboptimal. Most reported not taking their insulin on time or checking their blood glucose levels during school hours. The main reason was being at school when these tasks were due, while some also felt embarrassed to inject insulin in front of their classmates.

**Glycemic control in diabetic patients**

Glycemic control was markedly poor, with a mean HbA1c of 10.51% ± 2.47% ranging from 5.6–14.0%. Only 9.8% of patients achieved adequate control (HbA1c ≤ 7%), while 90.2% remained uncontrolled (HbA1c> 7%).

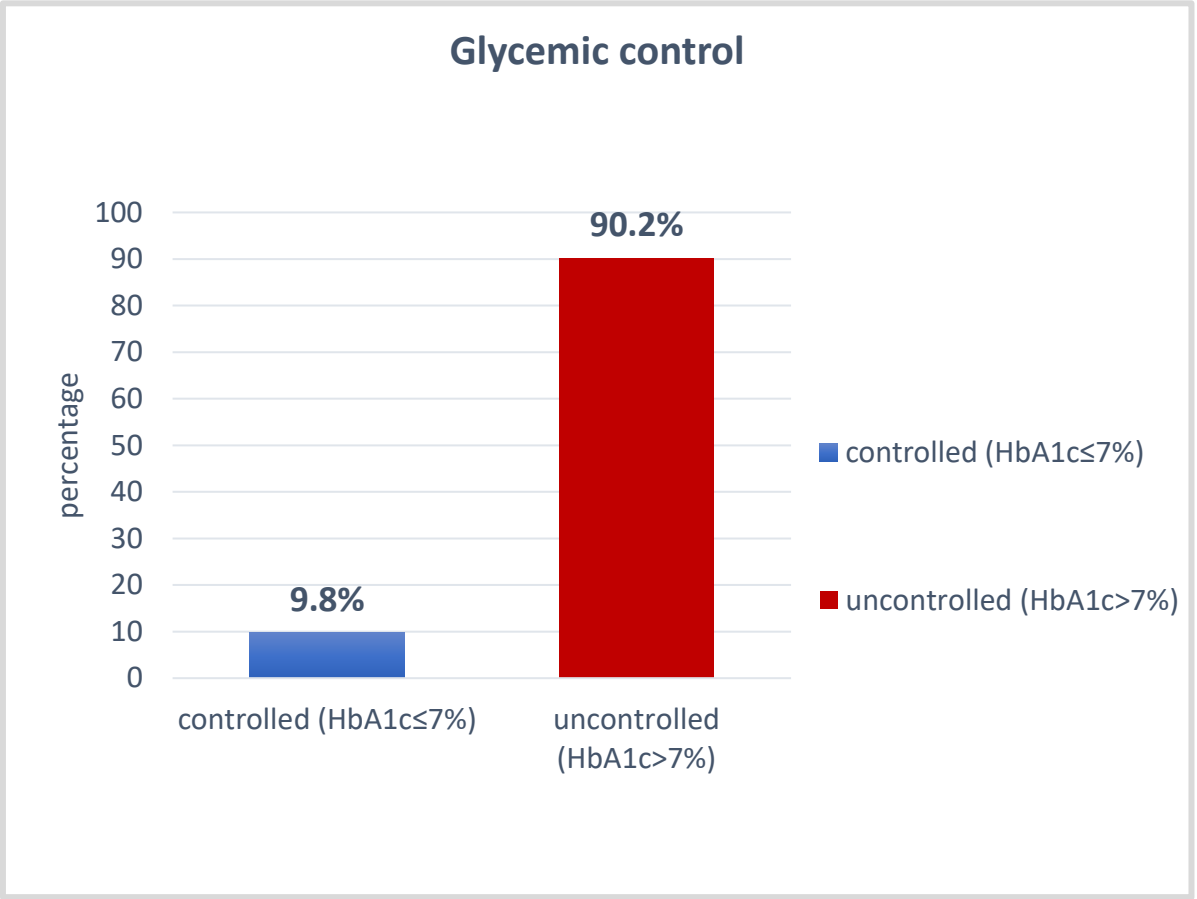


**Figure 5**:glycemic control in population

Hypoglycemic episodes (<70 mg/dl) were reported in **76.5%** of patients, with a median frequency of 3.0 [2.0-4.0] episodes per week. Hyperglycemic episodes (>180 mg/dl) were nearly universal (**97.6%),** with a median weekly frequency of **10.0 [6.0-13.0]** episodes.

Overall, the diabetic population was characterized by suboptimal metabolic control and marked glycemic instability.

## IV.4. Generic health-related quality of life comparison between diabetics and non-diabetics

Diabetic patients scored significantly lower than healthy peers across all domains. The greatest difference was observed in school functioning followed by emotional functioning. Also diabetic children missed two times more school days and achieved lower grade averages during the first trimester.

**Table VII:** generic quality of life and academic outcomes comparison

| Variable | Diabetic | Non-diabetic | p-value |
|---|---|---|---|
| | Median [IQR] | Median [IQR] | |
| Physical functioning | 75.0 [59.38-84.38] | 87.5 [81.25-96.88] | <0.001 |
| Emotional functioning | 52.5 [41.25-70.0] | 75.0 [65.0-90.0] | <0.001 |
| Social functioning | 75.0 [60.0-90.0] | 85.0 [70.0-95.0] | 0.006 |
| School functioning | 50.0 [40.0-63.75] | 80.0 [75.0-85.0] | <0.001 |
| TOTAL score | 64.13 [53.26-73.64] | 82.61 [76.09-89.13] | <0.001 |
| School average/first term | 10.98 [9.77-12.0] | 11.5 [10.15-13.0] | 0.002 |
| Number of missed school absence days/first term | 4.0 [3.0-7.0] | 2.0 [1.0-4.0] | <0.001 |

## IV.5. Specific health-related quality of life in diabetic patients

Among diabetic participants, the lowest PedsQL Diabetes Module score was observed in the worry domain, with a median score of 33.33 [25.0-50.0], indicating that worries related to diabetes were the most affected aspect of diabetes-specific quality of life. The highest scores were observed for treatment adherence/management and communication. The total PedsQL Diabetes Module median score was 58.84 [50.76-66.67], suggesting a moderate impairment of diabetes-specific quality of life in this population. The table below shows details

**Table VIII:** diabetes-specific HRQOL of diabetic patients

| PedsQL Diabetes Module domain | Median [IQR] | Minimum | Maximum |
|---|---|---|---|
| Diabetes symptoms | 59.17 [45.0-68.33] | 21.67 | 81.67 |
| Treatment barriers | 60.0 [40.0-70.0] | 10.0 | 95.0 |
| Treatment adherence / management | 66.67 [58.33-79.17] | 16.67 | 100.0 |
| Worry | 33.33 [25.0-50.0] | 0.0 | 100.0 |
| Communication | 68.75 [50.0-81.25] | 31.25 | 100.0 |
| TOTAL score | 58.84 [50.76-66.67] | 32.58 | 80.3 |

## IV.6. Correlation between glycemic control and total diabetic health related quality of life score

A statistically significant negative correlation was observed between HbA1c and the total PedsQL Diabetes Module score (r = -0.249, p = 0.024). This indicates that as HbA1c increases, diabetes-specific quality of life tends to decrease. Figure below shows this.

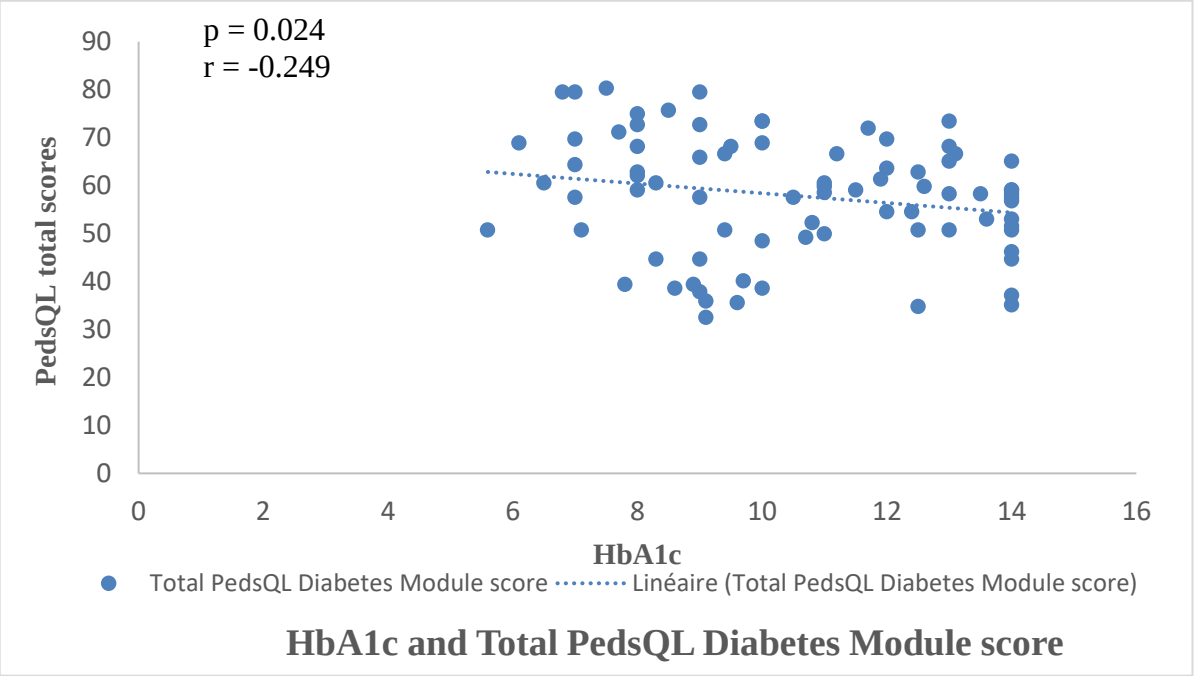


**Figure 6**: correlation between glycated hemoglobin and total diabetic-HRQOL

## IV.7. Correlation between glycemic control and first term average

A significant negative correlation (r = -0.376; p<0.001) was found between HbA1c and first term average in diabetic group. This finding suggests that students with poorer glycemic control tended to have lower academic average

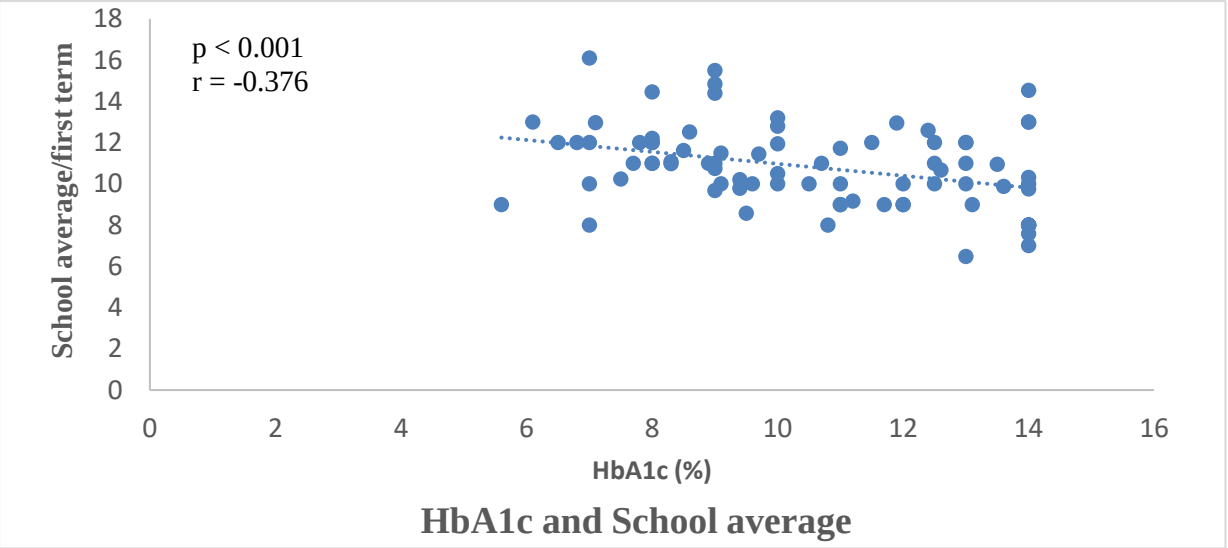


**Figure 7**: correlation between glycated hemoglobin and first term average.

## IV.8. Correlation between glycemic control and number of missed school days

A positive correlation (r=0.338, p=0.0059) between HbA1c and missed school days during first term was found. This means that poorer glycemic control was associated with increased school absenteeism.

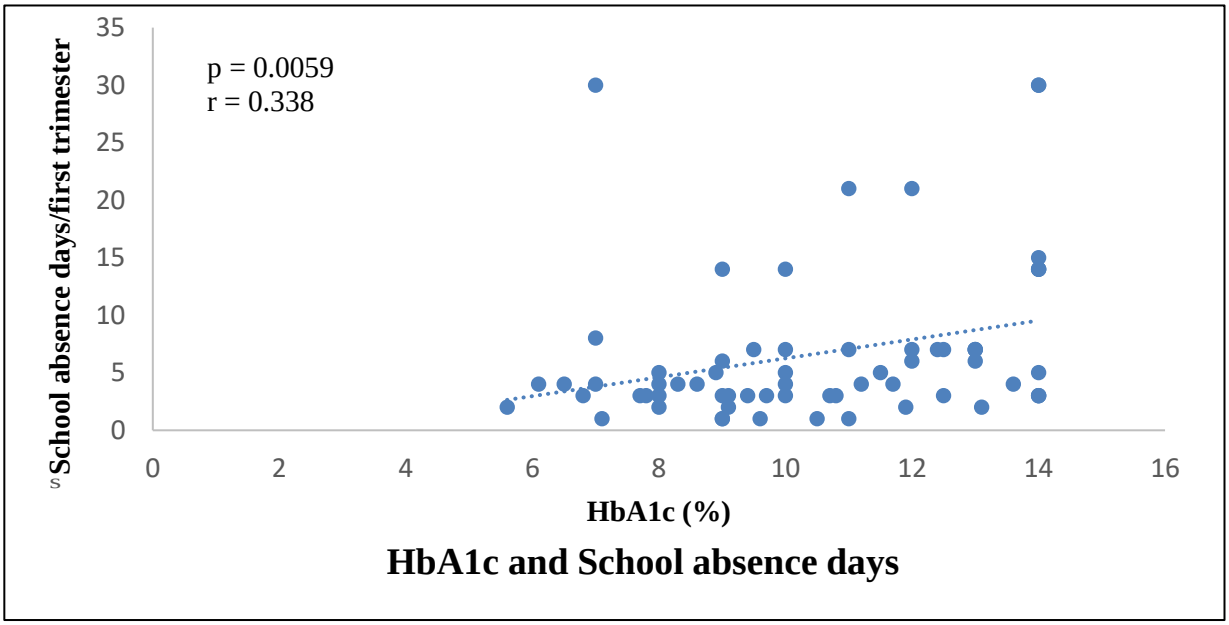


**Figure 8:** correlation between missed school days and glycated hemoglobin

# CHAPTER V: DISCUSSION

This study aimed to evaluate the effect of Type 1 diabetes mellitus (T1DM) on health-related quality of life (HRQOL) and academic performance of children and adolescents. To demonstrate this effect, a case-control study was conducted comparing children and adolescents with T1DM to their matched healthy peers. In addition, subgroup comparisons and correlation analyses were performed within the diabetic group to assess the relationship between glycemic control and diabetes-specific health-related quality of life. The findings demonstrated that glycemic control among diabetic participants was generally poor. Compared with their non-diabetic peers, diabetic participants recorded significantly lower scores across all domains of generic HRQOL. In addition, diabetic children showed poorer academic outcomes, evidenced by a lower average school score and a substantially higher number of school absences during the first trimester. Regarding diabetes- specific HRQOL, the worry domain was the most negatively affected, and poorer glycemic control was significantly associated with lower diabetes-specific quality of life total score, school average and absences.

**Limits and strength**

This study had some limitations.

- Its cross-sectional design did not allow causal relationships to be established between diabetes, HRQOL, and academic performance, however clearly defined inclusion and exclusion criteria, matching cases and controls, and validated tools were used.
- Hypoglycemic and hyperglycemic weekly frequency was collected from patients' logbooks which may have introduced information bias, however objective and standardized tools (HbA1c measures) were used.
-

**Comparability of the Study Groups**

The diabetic and non-diabetic groups were matched on key sociodemographic variables, which reduced the likelihood of confounding and strengthened the validity of comparisons made between the two groups. These characteristics, included age, sex, level of education, school type, and parental occupation and education level. No statistically significant differences were observed between the groups in any of these variables (all p-values > 0.05). This was possible because of the large (887) control group we recruited.

## V.1. Glycemic Control in Diabetic Patients

Glycemic control in our diabetic population was markedly poor with a mean HbA1c 10.51% ± 2.47%**.** with Only 9.8% achieving HbA1c ≤ 7%, while 90.2% had uncontrolled diabetes. These results are higher than those reported by Djonou et al in 2019 [63], in Cameroon, who found a mean glycated hemoglobin of 9.2 and 67.4% uncontrolled. This poorer glycemic control in our study can be explained by the predominance of adolescents in the cohort, a period characterized by increased insulin resistance and suboptimal treatment adherence, limited access to glucose monitoring supplies, patients also reported delaying insulin injections during school hours due to embarrassment and lack of private space. Notably, Lontchi-Yimagou et al. 2017 [11], found that most participants remained above glycemic targets despite access to free diabetes care and self-monitoring supplies, highlighting the influence of factors beyond healthcare access alone.

These challenges are reflected in the marked glycemic instability observed, with nearly all participants (97.6%) experiencing hyperglycemic count and 76.5% of hypoglycemic count weekly, highlighting the difficulty of achieving stable blood glucose level in our context.

## V.2. Generic Health-Related Quality of Life comparison

Children and adolescents with T1DM in this study had significantly lower HRQOL than their non-diabetic peers across all PedsQL Generic Core Scale domains, with the greatest impairments observed in school and emotional functioning domains, and a total score of (64.13 vs. 82.61; p <0.001), highlighting the negative impact of T1DM on both and school participation and psychological well-being.

Similarly Moronkola et al. (2024) in Nigeria [62], reported lower HRQOL in T1Diabetic children across all domains compared to controls and school functioning the most impaired domain. Samardzic et al in 2016 in Montenegro [6], consistently showed poorer quality of life, particularly in school and emotional functioning through glycemic fluctuations, frequent absenteeism. The greater impairment observed in our study compared with some of these settings may be explained by the poor metabolic control of our cohort, characterized by the mean HbA1c of 10.51%, frequent hypoglycemic and hyperglycemic episodes, a high prevalence of diabetic ketoacidosis [4]. Lower school and emotional functioning scores among diabetic children can be explained by the combined effect of glycemic fluctuations, school absences and the burden of daily diabetes management and fear of complications, which can

negatively affect learning, concentration and participation in school activities. Highlighting the need of psychosocial support for children with type 1 diabetes. Similar results have been reported in Ghana by Owusu et al. 2024 [7].

Physical and social functioning were also significantly reduced, though to a lesser degree, suggesting that the psychosocial impact of T1D is more pronounced than its physical limitations in this pediatric population. This is in line with those of Mambo et al in 2023 [65]. This can be explained by Poor glycemic control, diabetes-related symptoms, and social stigma, while family and peer support may help preserve social functioning.

## V.3. Academic Performance comparison between both groups

Diabetic children achieved significantly lower school grades (median 10.98 vs 11.50; p=0.002/20) and missed two times more school days than their healthy peers (4.0 vs 2.0, p<0.001). These findings are consistent with the broader literature documenting the negative impact of Type 1 diabetes on academic outcomes, including studies like**,** Meo et al in 2013 in Saoudi Arabia [59], who reported significantly lower academic grades in T1D students compared to non-diabetic classmates (86.58% vs. 90.62%, p=0.02). Also Owusu et al. in 2024 [7], found that young people with Type 1 diabetes experienced frequent absences, reduced concentration, delayed educational progression, and occasional school dropout**.** These findings are supported by the literature, which suggests that chronic glycemic instability may adversely affect cognitive functions such as attention, memory, and processing speed, thereby impairing school performance Frequent school absences for medical appointments may further contribute to academic difficulties.

However, Cooper et al. in 2015 [66], found no significant difference in academic performance despite lower attendance among diabetic students. These discrepancies may reflect differences in healthcare access, diabetes management, educational support, and socioeconomic conditions. Although statistically significant, the grade difference in our study was small, suggesting that many children with diabetes remain academically resilient.

## V.4. Diabetes-Specific Health-Related Quality of Life

The total PedsQL Diabetes Module score was 58.84 [50.76-66.67], indicating a moderate level of diabetes-specific HRQOL impairment. Among all domains of the Diabetes Module, the worry domain recorded the lowest median score 33.33 [25.0-50.0], while treatment

adherence/management and communication recorded the highest scores (66.67 [58.33-79.17] and 68.75 [50.0-81.25], respectively).

The finding that worry was the most impaired domain is in line with result reported by lontchi Yimagou et al in 2017 [11], where the worry domain also recorded the lowest mean score among all Diabetes Module domains. This can be explained fear of hypoglycemic episodes, anxiety about long-term complications, and worry about disease management in social settings such as school represents a universal and under addressed dimension of the burden of T1D in children in our context. In low-resource settings such as Cameroon, where diabetes monitoring tools are often limited and healthcare access is irregular, this anxiety may be further amplified by uncertainty about disease outcomes and the unpredictability of glycemic control. Conversely, the relatively higher scores in treatment adherence and communication suggest that despite suboptimal metabolic outcomes, these children and their families demonstrate a degree of engagement with the treatment process. This apparent paradox high treatment effort alongside poor glycemic control is not uncommon in pediatric T1D and may reflect the inadequacy of available treatment tools rather than a lack of adherence motivation. The absence of insulin analogs, glucometers, or continuous glucose monitoring devices in many Cameroonian healthcare settings may limit the effectiveness of adherence behaviors, even when these behaviors are present.

## V.5. Relationship Between Glycemic Control (HbA1c) and Specific HRQOL

A weak but statistically significant negative correlation was observed between HbA1c and the total PedsQL Diabetes Module score, indicating that poorer glycemic control was associated with lower diabetes-specific HRQOL.

This is contrary to the finding of longtchi-Yimagou et al [11], who reported that there was no association between HbA1c and specific health related quality of life. This can be due to the fact that we used the updated version of the PedsQL diabetes module scale. Similarly, some studies have found no significant association between HbA1c and HRQOL, suggesting that subjective well-being may be partially independent of objective metabolic markers. HRQOL is shaped by multiple factors beyond glycemic control, including family support, individual coping strategies, disease duration, and the broader psychosocial environment. Our finding of a statistically significant but weak correlation supports this understanding: HbA1c is an important determinant of HRQOL, but it is only one component of a multidimensional

construct. Future studies should employ multivariate analysis to quantify the relative contribution of glycemic control alongside psychosocial and environmental factors in our context.

## V.6. Relationship Between Glycemic control (HbA1c) and academic performance

In the present study, HbA1c showed a significantly negative correlation with first- term average scores and a significantly positive correlation with school absenteeism, indicating that higher HbA1c levels were associated with lower grades and more missed school days. These findings are consistent with results by McCarthy et al in 2003 in the United states [57], who reported that reading scores and grade point averages were significantly lower in children with poor metabolic control. Similarly, Fleming et al in 2019 [61], in the United Kingdom found that diabetic children with higher glycated hemoglobin had significantly poorer academic achievement and greater absenteeism scores among diabetic children.

. This can be explained by the literature showing that poor glycemic control and chronic hyperglycemia causes cognitive impairment, such as attention, memory, and concentration. Fatigue and frequent medical visits, directly lowering academic performance and increasing absenteeism. These finding underscore the importance of optimizing glycemic control in children living with type 1 diabetes. However, the weak negative correlation between HbA1c and academic performance suggests that glycemic control is only one of several factors influencing educational outcomes. Other factors, including family support, socioeconomic conditions, individual abilities, and the school environment, may also play important roles in determining academic performance These finding underscore the importance of optimizing glycemic control in children living with type 1 diabetes.

# CONCLUSION AND RECOMMENDATIONS

# CONCLUSION

At the end of this study, which aimed to evaluate the effect of Type 1 diabetes mellitus on health-related quality of life and academic performance among children and adolescents, the following conclusions can be drawn:

- Glycemic control was generally poor, with most participants failing to achieve recommended HbA1c targets and experiencing frequent glycemic fluctuations.
- Children and adolescents with Type 1 diabetes mellitus had significantly lower health- related quality of life than their non-diabetic peers, particularly in school and emotional functioning. The worry domain was the most affected aspect of diabetes-specific quality of life.
- Diabetic participants had poorer academic performance, characterized by lower school averages and higher absenteeism.
- Poorer glycemic control was associated with lower diabetes-specific quality of life, increased absenteeism, and poorer academic performance.

# RECOMMENDATIONS

Following our study, we kindly recommend:

**To children and adolescents with Type 1 diabetes mellitus and their caregivers**

• To adhere to prescribed treatment plans, including insulin administration, blood glucose monitoring, and scheduled follow-up visits.

**To health personnel**

• To integrate routine psychological assessment and counseling into diabetes care, with particular attention to diabetes-related worries and emotional well-being.

**To schools**

• To promote collaboration between teachers, parents, and healthcare providers to support students living with Type 1 diabetes.

**To health authorities and hospitals**

• To improve access to diabetes management resources, including insulin, blood glucose monitoring supplies, and specialized diabetes care services.

**To researchers**

• To investigate other factors influencing health-related quality of life and academic outcomes, including psychological, familial, and socioeconomic determinants.

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# APPENDIX

## Appendix 1: ETHICAL CLEARANCE FMBS

UNIVERSITÉ DE YAOUNDÉ I
FACULTÉ DE MÉDECINE ET DES SCIENCES BIOMÉDICALES
COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE
Tel/ fax : 22 31-05-86 22 311224
Email: decanatfmsb@hotmail.com

THE UNIVERSITY OF YAOUNDE I
FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES
INSTITUTIONAL ETHICAL REVIEW BOARD

25 MAI 2020

Ref. : N° 092 /UY1/FMSB/VDRC/DAASR/CSD/CSDA/emr

**CLAIRANCE ÉTHIQUE**
***ETHICAL CLEARANCE***

Le COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE (CIER) de la FMSB a examiné
The INSTITUTIONAL ETHICAL REVIEW BOARD (IERB) of FMBS Examined

La demande de clairance éthique soumise par :
The Request of Ethical Clearance submitted by

M.Mme: MATATEYOU Kadije Matricule: 19M1138
*Mr.Miss :* *Registration:*

Titre du projet de Recherche :
*Title of research project:* ***Effect of type 1 diabetes on health-related quality of life and academic performance among young people at the Yaoundé Central Hospital***

Equipe d'encadrement:
*Supervision Team:* *Pr ETOA NDZIE Claude Martine*
*Dr MOSSUS Tatiana*
*Dr DEHAYEM Mesmin*

Les principales observations sont les suivantes

| | |
|---|---|
| Evaluation scientifique/*Scientific Evaluation* | |
| Evaluation de la convenance institutionnelle/*Institutional Convenience Evaluation* | |
| Equilibre des risques et des bénéfices/*Benefits and Risks balance* | |
| Respect du consentement libre et éclairé/*Respect of Free and informed consent* | |
| Respect de la vie privée et des renseignements personnels (confidentialité) :*Respect of privacy and Confidentiality* | |
| Respect de la justice dans le choix des sujets/*Respect for justice in subject choice* | |
| Respect des personnes vulnérables : *Respect of vulnerable persons* | |
| Réduction des inconvénients/optimalisation des avantages/*Reduction of Inconveniences/Optimization of advantages* | |
| Gestion des compensations financières des sujets | |
| Gestion des conflits d'intérêt impliquant le chercheur | |

Pour toutes ces raisons, le **CIER** émet un avis **favorable** sous réserve des modifications recommandées dans la grille d'évaluation scientifique.
L'équipe de recherche est responsable du respect du protocole approuvé et ne devra pas y apporter d'amendement sans avis favorable du CIER. Elle devra collaborer avec le CIER lorsque nécessaire, pour le suivi de la mise en œuvre dudit protocole.
La clairance éthique peut être retirée en cas de non - respect de la réglementation ou des recommandations sus évoquées.
En foi de quoi la présente clairance éthique est délivrée pour servir et valoir ce que de droit

*LE PRESIDENT DU COMITE ETHIQUE*

UNIVERSITE DE YAOUNDE I
Pr. OLINA M. T. Rép.
PEDIATRE

**Appendix 2: RESEARCH AUTHORIZATION, YCH**

REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DE LA SANTE PUBLIQUE

DIRECTION HOPITAL CENTRAL YAOUNDE

BUREAU DES STAGES

N° 391 /MINSANTE/SG/DHCY/CM/SG/BS

REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF PUBLIC HEALTH

DIRECTORATE OF YAOUNDE CENTRAL HOSPITAL

INTERNSHIP UNIT

Yaoundé, le 17 FEV 2026

## AUTORISATION DE RECHERCHE

Je soussigné, **Professeur Agrégé ONGOLO ZOGO Pierre**, Directeur de l'Hôpital Central de Yaoundé, accorde une autorisation de recherche, sous la Direction du *Pr ETOA Epse ETOGA Martine Claude et la Codirection des Docteurs MOSSUS Tatiana et DEHAYEM YEFOU Mesmin* à **M. /Mme MATATEYOU KADIJE**, sur le thème : «***Effect of type 1 Diabetes on health-related quality of life and academic performance among children and adolescents in two hospitals in Yaounde***». **Du 23 février au 23 mai 2026.**

L'intéressé(e) est tenu(e) au strict respect du règlement intérieur de l'Hôpital Central de Yaoundé et s'engage à déposer au service des stages, un exemplaire dudit mémoire après correction.

En foi de quoi, la présente autorisation lui est délivrée pour servir et valoir ce que de droit. /-

**Pour le Directeur et par ordre**
**Le Conseiller Médical**

Le Conseiller Médical

Dr. Mekeme Mekeme Junior Barthélémy

**Appendix 3: RESEARCH AUTHORIZATION, FCB**

FONDATION CHANTAL BIYA
Centre Mère et Enfant
YAOUNDE

Yaoundé, le 12 Mai 2026

# AUTORISATION DE RECHERCHE

Je soussigné, Directeur du Centre Mère et Enfant de la Fondation Chantal BIYA, autorise **Madame MATATEYOU KADIJE,** étudiante en 7ème année en Médecine Générale à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I, à effectuer la recherche au Centre Mère et Enfant de la Fondation Chantal BIYA, dans le cadre de son travail de thèse intitulé : **«EFFECT OF TYPE I DIABETES ON HEATH-RELATED QUALITY OF LIFE AND ACADEMIC PERFORMANCE AMONG CHILDREN AND ADOLESCENTS IN TWO HOSPITALS IN YAOUNDE».**

Autorisation dûment établie en respect des exigences éthiques.

Le Directeur du Centre Mère et Enfant
dela Fondation Chantal BIYA

**Professeur Paul KOKI NDOMBO**

## Appendix 4: RESEARCH AUTHORIZATION FROM THE DIVISIONAL DELEATION OF SECONDARY EDUCATION

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie
****************
MINISTERE DES ENSEIGNEMENTS SECONDAIRES
****************
DELEGATION REGIONALE POUR LE CENTRE
****************
DELEGATION DEPARTEMENTALE DU MFOUNDI
****************
CONSEILLER PEDAGOGIQUE DE L'ENSEIGNEMENT SECONDAIRE GENERAL
BP 33097 Tél. : 222 22 84 68 / 222 22 84 70
Courriel ddesmfoundi21@gmail.com

DDES MFOUNDI

REPUBLIC OF CAMEROON
Peace – Work – Fatherland
****************
MINISTRY OF SECONDARY EDUCATION
****************
CENTRE REGIONAL DELEGATION
****************
MFOUNDI DIVISIONAL DELEGATION
****************
PEDAGOGIC ADVISOR FOR GENERAL SECONDARY EDUCATION
P.O. Box 33097 Tel 222 22 84 68 / 222 22 84 70
e-mail ddesmfoundi21@gmail.com

*Yaoundé, le* 06 MARS 2026

N°533/26/L/MINESEC/DRES-CE/DDES-MF/CPESG

*Le Délégué Départemental*
*A*
Mesdames et Messieurs les Chefs d'Etablissements ci-après :

-Lycée Bilingue Yaoundé;
-Golden Bilingual High School.

***Objet : Autorisation d'accès.***

Dans le cadre de ses travaux de recherche portant sur le thème : « ***Effect of types 1 diabetes on health-related quality of life and academic performance among children and adolescents in yaounde*** », madame MATATEYOU Kadije, étudiante inscrite en 7ème année de médecine générale à la Faculté de Médecine et de Sciences Biomédicales de l'Université de Yaoundé I, sollicite un accès dans vos établissements, de mars à mai 2026.

Vous voudrez bien prendre toutes les dispositions nécessaires afin de lui permettre de mener à bien ses investigations dans la limite des informations qui pourraient lui être communiquées.

*Le Délégué Départemental*
*Jean Louis M.*
*Nama Essomba*
PLET - Hors Echelle

**Appendix 5: INFORMATION NOTICE, ENGLISH VERSION**

Dear parents/guardians, we invite you to allow your child participate in our research project, which aims to improve the quality of care and life of children living with diabetes in Cameroon

**Title of the Study**: "Effect of Type 1 Diabetes on Health-Related Quality of Life and Academic Performance in Children and Adolescents Followed up at the Yaoundé Central Hospital"

**Researcher: Matateyou Kadije**, 7th-Year Medical Student, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I. Supervisor: **Pr. ETOA** and co-supervised by **Dr. DEHAYEM, and Dr. MOSSUS**

**Purpose of the Study**: The study aims to understand how Type 1 Diabetes affects the quality of life and academic performance of children and adolescents.

**Period of study:** from January to may 2026

**Place of study**: Yaoundé Central Hospital

**Procedures:** If you agree, your child will be asked to complete a short questionnaire about their health, diabetes management, and school performance. No medical tests or treatments are required.

**Confidentiality:** All information will be kept confidential and anonymous. Only the research team will have access to the data.

**Voluntary Participation**: Your child's participation is completely voluntary. You may refuse or withdraw at any time without affecting your child's medical care.

**Benefits and Risks**: There is no direct benefit or significant risk to your child. The study may help improve care for children living with Type 1 Diabetes in Cameroon.

**Cost:** everything is free of charge

For more informations, you can contact the reseacher via the number: 658551048 and the email adresse: khadijamatateyou@gmail.com.

**Appendix 6: INFORMATION NOTICE, FRENCH VERSION**

Chers parents/tuteurs, nous vous invitons à permettre à votre enfant de participer à notre projet de recherche qui a pour but d'améliorer la qualité des soins, vie des enfants vivant avec le diabète au Cameroun.

***Titre*** : « Effet du diabète de type 1 sur la qualité de vie et les performance scolaire chez les enfants diabétique »

**Investigatrice principale : MATATEYOU Kadije**, étudiante en 7e année de médecine générale à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I. **Superviseurs :Pr. ETOA, endocrinologue,**

**Dr. DEHAYEM, endocrinologue**,

**Dr. MOSSUS : santé publique**

**But de l'étude :** Déterminer l'impact du diabète sur la qualité de vie et la performance scolaire de vos enfants.

**Lieu de l'étude :** Hôpital Centrale de Yaoundé

**Durée de l'étude** : Cette étude se déroulera du mois de janvier 2026 au mois de mai 2026.

**Procédure :** Après un entretien avec vous et votre enfant, au cours duquel il vous sera expliqué et donné toutes les informations nécessaires pour l'étude, nous remettrons un questionnaire anonyme à remplir sur place.

**Bénéfices :** Cette étude aidera à améliorer les soins et le suivi en milieu scolaire de votre enfant. **Inconvénients et risques:** Cette étude ne comporte aucun risque pour votre enfant. **Confidentialité** : Les fiches de collecte de données seront codifiées afin de garder l'anonymat de votre enfant. Seule l'équipe de recherche aura accès au questionnaire.

**Coût :** Votre participation ne sera pas rémunérée et aucun frais supplémentaire ne vous sera demandé par la suite. Tout est gratuit.

Pour plus d'informations vous pouvez contacter l'investigateur de l'étude au numéro de téléphone 658551048 et à l'adresse mail khadijamatateyou@gmail.com.

**Appendix 7: Informed Consent Form**

I, the undersigned,

Mr/Mrs……

……

……

……

……

Declare that my child and I have been invited to participate in the research project entitled "effect of type 1 diabetes on health-related quality of life and academic performance among children and adolescents in two hospitals in Yaounde"

- I have understood the information notice that was given to me.
- I have received all the answers to the questions I have asked
- I understand that I am free to accept or

refuse to participate I freely agree to my child

participation in this research project Done in

……. on the…….

Principal investigator signature

Parent signature:

Child signature:

## Appendix 8: Description and Scoring of the Diabetes Module (PedsQL 3.2)

| Dimensions | Number of Items | Cluster of Items | Reversed Scoring | Direction of Dimensions |
|---|---|---|---|---|
| Diabetes Symptoms | 15 | 1-15 | 1-15 | Higher scores =Better HRQOL and fewer problems or symptom |
| Treatment I | 5 | 1-5 | 1-5 | |
| Treatment II | 6 | 1-6 | 1-6 | |
| Worry | 3 | 1-3 | 1-3 | |
| Communication | 4 | 1-4 | 1-4 | |

**SCORING OF DIMENSIONS:**

| | |
|---|---|
| **Item Scaling** | 5 -point scale from: 0 (Never) to 4 (Almost always) |
| **Weighting of Items** | No |
| **Extension of the Scoring Scale** | Scores are transformed on a scale from 0 to 100 |
| **Scoring Procedure** | **Step 1: Transform Score**<br><br>Items are reverse scored and linearly transformed to a 0-100 scale as follows: 0=100, 1=75, 2=50, 3=25, 4=0<br><br>**Step 2: Calculate Scores by Dimensions**<br>• If more than 50% of the items in the scale are missing, the scale scores should not be computed<br>• Mean score = Sum of the items over the number of items answered<br><br>**Diabetes Symptoms Summary Score** = Diabetes Symptoms Scale Score<br><br>**Diabetes Management Summary Score** = Sum of the items over the number of items answered in the Treatment I, Treatment II, Worry, and Communication Scales<br><br>**Total Score**: Sum of all the items over the number of items answered on all the Scales |
| **Interpretation and** | If more than 50% of the items in the scale are missing, the Scale Scores |
| **Analysis of Missing Data** | should not be computed.<br>If 50% or more items are completed: Impute the mean of the completed items in a scale. |

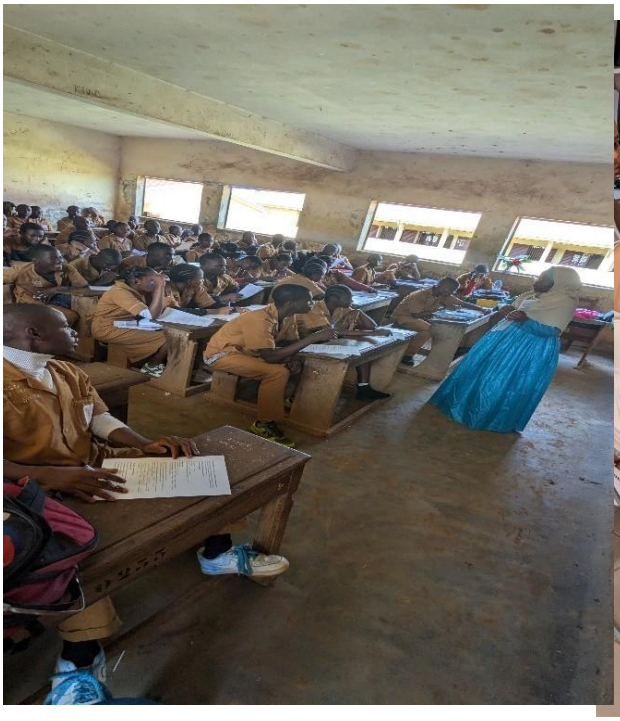
## Appendix 9: Description and Scoring of The Generic core (PedQsL 4.0)

| Dimensions | Number of Items | Cluster of Items | Reversed scoring | Direction of Dimensions |
|---|---|---|---|---|
| Physical Functioning | 8 | 1-8 | 1-8 | Higher scores = Better HRQOL |
| Emotional Functioning | 5 | 1-5 | 1-5 | |
| Social Functioning | 5 | 1-5 | 1-5 | |
| School Functioning | 5 | 1-5 | 1-5 | |

**SCORING OF DIMENSIONS:**

| | |
|---|---|
| Item Scaling | 5-point Likert scale from: 0 (Never) to 4 (Almost always) |
| Weighting of Items | No |
| Extension of the Scoring Scale | Scores are transformed on a scale from 0 to 100 |
| Scoring Procedure | Step 1: Transform Score<br><br>Items are reverse scored and linearly transformed to a 0-100 scale as follows: 0=100, 1=75, 2=50, 3=25, 4=0<br><br>Step 2: Calculate Scores Score by Dimensions:<br>• If more than 50% of the items in the scale are missing, the scale scores should not be computed<br>• Mean score = Sum of the items over the number of items answered<br><br>Psychosocial Health Summary Score = Sum of the items over the number of items answered in the Emotional, Social, and School Functioning Scales<br><br>Physical Health Summary Score = Physical Functioning Scale Score<br><br>Total Score: Sum of all the items over the number of items answered on all the Scales |
| Interpretation and Analysis of Missinm Data | If more than 50% of the items in the scale are missing, the Scale Scores should not be computed.<br>If 50% or more items are completed: Impute the mean of the completed items in a scale. |

## Appendix 10: Images Showing Data Collection in the Hospital and in School



## Appendix 11: Questionnaire

### Section 1: Sociodemographic informations

Identification code_____

1. Age (years)_____
2. Gender : ☐ male ☐ female
3. Class level:_____
4. Residence: ☐ urban ☐ rural
5. School type: ☐ private ☐ public
6. Profession of male tutor:_____
7. Profession of female tutor:_____
8. Level of education of male tutor: ☐ non ☐ primary ☐ secondary ☐ superior
9. Level of education female tutor: ☐ non ☐ primary ☐ secondary ☐ superior
10. With whom do you live?: ☐ father ☐ mother ☐ both parents ☐ grand parents
11. Others? _____

### Section 2: Clinical information

12. Age at diagnosis (in months/years)_____
13. Insulin regimen: ☐ multi-injections ☐ Bi-injection ☐ others

_____

14. Frequency of self-monitoring per day_____
15. The last two glycated hemoglobin values_____
16. Frequency of hyperglycemia (< 70mg/dl) weekly_____
17. Frequency of hypoglycemia (> 180mg/dl) weekly_____

### Section 3: academic performance

18. Number of school days missed during first term_____
19. Reasons for missed days: ☐ hypoglycemia/hypoglycemia ☐ routine visits others_____
20. Average grade for the first term_____/20
21. Do school hours or strict class schedules ever cause you to delay your insulin or miss checking your blood glucose ☐yes ☐No
22. Do you ever delay your insulin or miss checking your blood glucose because you feel embarrassed or self-conscious at school? ☐yes ☐No

## Section 4: Quality of life specific to type 1 diabetes (PedQL Diabetes Module 3.2)

| **DIABETES SYMPTOMS** ***(problems with…)*** | **Never** | **Almost Never** | **Some-times** | **Often** | **Almost Always** |
|---|---|---|---|---|---|
| 1. I feel hungry | 0 | 1 | 2 | 3 | 4 |
| 2. I feel thirsty | 0 | 1 | 2 | 3 | 4 |
| 3. I have to go to the bathroom too often | 0 | 1 | 2 | 3 | 4 |
| 4. I have tummy aches | 0 | 1 | 2 | 3 | 4 |
| 5. I have headaches | 0 | 1 | 2 | 3 | 4 |
| 6. I feel like I need to throw up | 0 | 1 | 2 | 3 | 4 |
| 7. My blood sugar goes down | 0 | 1 | 2 | 3 | 4 |
| 8. My blood sugar goes up | 0 | 1 | 2 | 3 | 4 |
| 9. I feel tired | 0 | 1 | 2 | 3 | 4 |
| 10. I get shaky | 0 | 1 | 2 | 3 | 4 |
| 11. I get sweaty | 0 | 1 | 2 | 3 | 4 |
| 12. I feel dizzy | 0 | 1 | 2 | 3 | 4 |
| 13. I feel weak | 0 | 1 | 2 | 3 | 4 |
| 14. I have trouble sleeping | 0 | 1 | 2 | 3 | 4 |
| 15. I get easily annoyed or grumpy | 0 | 1 | 2 | 3 | 4 |

| **TREATMENT - I (BARRIER)** ***(problems with…)*** | **Never** | **Almost Never** | **Some-times** | **Often** | **Almost Always** |
|---|---|---|---|---|---|
| 1. It hurts to get my finger pricked | 0 | 1 | 2 | 3 | 4 |
| 2. It hurts to get insulin injections | 0 | 1 | 2 | 3 | 4 |
| 3. I am embarrassed by my diabetes treatment | 0 | 1 | 2 | 3 | 4 |
| 4. My parents and I argue about my diabetes care | 0 | 1 | 2 | 3 | 4 |
| 5. It is hard for me to do everything I need to do to care for my diabetes | 0 | 1 | 2 | 3 | 4 |
| **TREATMENT - II (ADHERENCE) (*problems*** | Never | Almost Never | Some-times | Often | Almost Always |
| 1. It is hard for me to take blood glucose tests | 0 | 1 | 2 | 3 | 4 |
| 2. It is hard for me to take insulin injections | 0 | 1 | 2 | 3 | 4 |
| 3. It is hard for me to play or do sports | 0 | 1 | 2 | 3 | 4 |
| 4. It is hard for me to keep track of carbohydrates | 0 | 1 | 2 | 3 | 4 |
| 5. It is hard for me to carry a fast-acting | 0 | 1 | 2 | 3 | 4 |
| 6. It is hard for me to snack when my blood sugar goes down | 0 | 1 | 2 | 3 | 4 |

| **WORRY** ***(problems with…)*** | **Never** | **Almost Never** | **Some-times** | **Often** | **Almost Always** |
|---|---|---|---|---|---|
| 1. I worry about my blood sugar going down | 0 | 1 | 2 | 3 | 4 |
| 2. I worry about my blood sugar going up | 0 | 1 | 2 | 3 | 4 |
| 3. I worry about long-term complications from diabetes | 0 | 1 | 2 | 3 | 4 |
| **COMMUNICATION (*problems with…*)** | **Never** | **Almost Never** | **Some-times** | **Often** | **Almost Always** |
| 1. It is hard for me to tell the doctors and nurses how I feel | 0 | 1 | 2 | 3 | 4 |
| 2. It is hard for me to ask the doctors and nurses questions | 0 | 1 | 2 | 3 | 4 |
| 3. It is hard for me to explain my illness to other people | 0 | 1 | 2 | 3 | 4 |
| 4. I am embarrassed about having diabetes | 0 | 1 | 2 | 3 | 4 |

**Section 5 : Generic quality of life PedQL 4.0)**

| **About my health and activities** ***(problèmes avec…)*** | **Never** | **Almost never** | **Some-times** | **Often** | **Almost always** |
|---|---|---|---|---|---|
| **1. it is hard for me to walk more than one block** | 0 | 1 | 2 | 3 | 4 |
| **2. it is hard for me to run** | 0 | 1 | 2 | 3 | 4 |
| **3. it is hard for me to do sport activity or** | 0 | 1 | 2 | 3 | 4 |
| **4. it is hard for me to lift something heavy** | 0 | 1 | 2 | 3 | 4 |
| **5. it is hard for me to take a bath or shower by** | 0 | 1 | 2 | 3 | 4 |
| **6. it is hard for me to do chores around the** | 0 | 1 | 2 | 3 | 4 |
| **7. I hurt or ache** | 0 | 1 | 2 | 3 | 4 |
| **8. I have low energy** | 0 | 1 | 2 | 3 | 4 |

| **About my feelings** ***(problèmes avec…)*** | **Never** | **Almost never** | **Some-times** | **Often** | **Almost always** |
|---|---|---|---|---|---|
| 1. I feel afraid or scared | 0 | 1 | 2 | 3 | 4 |
| 2. I feel sad or blue | 0 | 1 | 2 | 3 | 4 |
| 3. I feel angry | 0 | 1 | 2 | 3 | 4 |
| 4. I have trouble sleeping | 0 | 1 | 2 | 3 | 4 |
| 5. I worry about what will happen to me | 0 | 1 | 2 | 3 | 4 |
| **How i get along with others** ***(problèmes avec…)*** | **Never** | **Almost never** | **Some-times** | **Often** | **Almost always** |
| 1. I have trouble gettin along with other children | 0 | 1 | 2 | 3 | 4 |
| 2. Other children do not want to be my friend | 0 | 1 | 2 | 3 | 4 |
| 3. Other children tease (mocked) me | 0 | 1 | 2 | 3 | 4 |
| 4. I cannot do things that others my age can do | 0 | 1 | 2 | 3 | 4 |
| 5. It is hard to keep up with peers | 0 | 1 | 2 | 3 | 4 |

| **About my studies** ***(problems avec…)*** | **Never** | **Almost never** | **Some-times** | **Often** | **Almost always** |
|---|---|---|---|---|---|
| 1.It is hard to pay attention at school | 0 | 1 | 2 | 3 | 4 |
| 2. I forget things | 0 | 1 | 2 | 3 | 4 |
| 3. I have trouble keeping up with my studies | 0 | 1 | 2 | 3 | 4 |
| 4. I miss school because of not feeling well | 0 | 1 | 2 | 3 | 4 |
| 5. I miss school to go to the doctor or hospital | 0 | 1 | 2 | 3 | 4 |