PREVALENCE AND MANAGEMENT OF INSULIN DEPENDENT DIABETES MELLITUS AMONG CHILDREN AND ADOLESCENTS ATTENDING THE UNIVERSITY TEACHING HOSPITAL

BY

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DECLARATION

I hereby declare that this dissertation represents my own work and has not been presented either wholly or in part for a degree at the University of Zambia or any other university.

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APPROVAL

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ABBREVIATIONS

DAZ : Diabetes Association of Zambia

HbA_{1C}: Glycosylated Haemoglobin

HIV : Human Immunodeficiency Virus

IDDM : Insulin Dependent Diabetes Mellitus

IDF : International Diabetes Federation

NIDDM: Non Insulin Dependent Diabetes Mellitus

U : International Unit

UTH : University Teaching Hospital

WHO : World Health Organisation

ZMK : Zambian Kwacha

CHAPTER ONE

1.0 INTRODUCTION/BACKGROUND

Diabetes is one of the leading health problems in the world and a major cause of morbidity and mortality[1]. It is estimated that globally at least 30 to 50 million people have diabetes 5 percent of whom have Insulin Dependent Diabetes Mellitus (IDDM) [1,2].

Evidence from the 1990's suggests that the overall worldwide prevalence of diabetes is on the increase[3]. In some populations, the incidence of IDDM has increased markedly during recent decades and an epidemic-like incidence has been reported[4].

Previously diabetes was considered a rare condition in tropical Africa[5] and consequently few reports are available on its prevalence in sub-Saharan countries like Zambia[6].

1.1 GENERAL HEALTH SITUATION

Zambia has a population of about 9.2 million people. This population has increased rapidly over the past decade [7] but this increase has not been paralleled by an increase in health service delivery. The number of hospitals has remained static over the same period[8].

Nearly half of the total population in Zambia is made up of children less than 15 years. In the period between mid 1992 and mid 1996 the child mortality rate (defined as the probability of dying between first birthday and fifth birthday) was estimated to be 98 per

1,000 children reaching one year of age and the infant mortality rate was 109 per 1,000 live births[7].

Non-communicable diseases such as asthma, epilepsy, hypertension, heart disease and diabetes are not among the top ten causes of morbidity and mortality in both children and adults in Zambia[7].

Over the past seven years, the Zambian Government has implemented user fees for services in government health care institutions. This now means that households play a significant role in the provision of health care. All able bodied Zambians with the capacity to earn an income are in principle expected to contribute to the cost of this service[9]. This measure was introduced at a time of a worsening economic situation.

The decline in the national economy has had its impact particularly on the social, health and educational sectors. The impact of this situation on the health sector has resulted in shortages of drugs, erosion of the health infrastructure and declining access to health care by the population[10]. This decline in economy has also resulted in a decline in employment levels and wages. A study done by Mutati (1997) found that the reported income ranges among Zambian workers were ZMK 51,000 (25 US$) to ZMK 100,000 (50 US$) per month. The mean medical expenditure was ZMK90, 000 per month per household[9].

1.2 DIABETES CARE IN ZAMBIA

Diabetic patients in Zambia are managed by physicians, paediatricians, and general practitioners. All diabetic patients attending government health facilities are supposed to be provided with free medical care. Thus insulin and syringes are issued free of charge when available but patients have to buy them from private pharmacies when not available.

Care for diabetics is only available in towns and cities, which may be distant and inaccessible for the greater portion of the population. Diabetics travel hundreds of kilometers to urban areas and at times are forced to settle in local townships, simply to obtain medical care which is non available in their local areas. The urban health centres and small hospitals are often ill equipped to provide the needed care.

In Lusaka, a diabetic clinic exists only at the University Teaching Hospital (UTH). This clinic caters for adolescent and adult patients. On the other hand, paediatric patients (defined as patients below the age of 15) attend the general paediatric specialist follow-up clinics where all conditions including diabetes are attended to. To compound this problem Zambia has only one qualified diabetologist who is based in Lusaka.

These clinics are responsible for monitoring the diabetics. Patients glycaemic control is assessed by urine testing and random or fasting blood glucose tests. However, due to financial problems, these facilities are rarely available even in hospitals. Self-assessment of glycaemic control in the homes is even rarer as majority of patients cannot afford this.

1.2.1 DIABETES ASSOCIATION OF ZAMBIA

The Diabetes Association of Zambia (DAZ) is a non-governmental organisation, which has been in existence since 1989. The associations' head quarter is in Lusaka with branches in Kitwe, Petauke, Chipata and Monze. Membership is comprised of diabetic patients, medical and allied staff, patients' relatives and businessmen.

The objectives of the Association are:

- To develop education methods designed to give diabetic patients a better understanding of the disease and educate the public on the importance of early recognition of diabetes mellitus;
- To promote free exchange of knowledge among health workers in order to improve standards of management of diabetes and encourage services that will enhance the welfare of diabetic patients;
- To promote research related to the disease; and
- To disseminate information on diabetes in Zambia.

Since its' formation DAZ, has been conducting teaching programmes which are in form of education seminars, counselling sessions and youth camp meetings. These programmes have sensitised patients and improved health care providers' knowledge on diabetes and its related problems.

To strengthen this local education programme, the association in conjunction with International Diabetes Federation (IDF) organises overseas training for health care providers. To supplement the services rendered by the UTH, DAZ recently established a cost sharing blood sugar testing scheme where diabetic patients are required to pay a 'token' fee for the services. With this scheme in place, patients are assured of a regular blood sugar check up.

However, despite the successes scored by this association it has also suffered a few setbacks. One of these is the absence of a secretariat and full-time personnel to co-ordinate the activities of the association. The other has been the failure by the association to supplement drugs and other requirements for diabetic patients.

1.3 STATEMENT OF THE PROBLEM

IDDM is a life long disease full of a myriad of complications, which results in reduced life expectancy. Management of IDDM is expensive with socio-economic consequences on the individual and society. IDDM is a disease in which molecular engineering research is making advances. Developments in medical science and technology have provided tools needed to manage diabetes effectively. Deaths and complications may be reduced or even prevented by better control of the diabetic state using the available tools for treatment and patient self-monitoring.

Health care planning requires accurate information on the distribution of various conditions within the general population. Few studies have published data on the

prevalence of IDDM or childhood diabetes in Zambia. A study done by Rolfe (1989) in a semi-private hospital run by the copper mines, showed that contrary to earlier reports from other African countries, childhood diabetes is not rare in Zambia. The reported prevalence of IDDM in this study was 9.5 percent among patients below 20 years of age and 1.8 percent in those below the age of 10 years[11]. This study was done a decade ago and thus because diabetes is a changing disease, there is need to update this information. Furthermore, because IDDM has been reported as a major cause of morbidity and mortality in parts of the world where it has been fully studied, this may also be true in Zambia.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

2.1 DIAGNOSIS AND CLASSIFICATION OF DIABETES MELLITUS

The majority of patients with diabetes present as diabetes mellitus. Diabetes mellitus is defined as, a group of metabolic diseases characterised by hyperglycemia resulting from defects in insulin secretion, insulin action or both[12]. Two main clinical types are recognised namely, type 1 and type 2.

Type 1 – Diabetes mellitus sometimes termed IDDM, is the most prevalent among children and adolescents,

Type 2- Diabetes mellitus also known as Non-insulin Dependent Diabetes Mellitus (NIDDM) commonly occurs in adults but more recently the incidence of NIDDM is increasing in children particularly in adolescents in developed countries.

In this study the diagnosis of diabetes mellitus was based on the WHO criteria namely: -

1. Symptoms plus one abnormal blood glucose level

Or 2. Two abnormal blood glucose levels if symptoms are absent

Or 3. In doubtful cases, a diagnostic glucose tolerance test[6].

2.2 PREVALENCE AND INCIDENCE OF IDDM

Several studies suggest that IDDM is the most prevalent type of diabetes among children and adolescents in developed countries[13]. In Europe, the highest incidence rates have been recorded in Finland and Scandinavia where the rate is as high as 30 to 40 cases per

100,000 children. In England studies done show that approximately 1 to 2 percent of the population has diabetes and the incidence of new cases for those aged 0 to 19 years is 10 to 15 cases per 100,000 population each year[13]. In other studies, the incidence of IDDM has been reported to be 1.6 per 1,000 among American school children while in North American school children aged below 18 years it has been reported to be 1 in every 400 to 600 school children[2]. In countries like Japan and Australia the prevalence rate for IDDM has been estimated to be 0.1 and 3.7 percent respectively[2,6]. A report from Cuba found a low incidence rate of IDDM of between 0.15 and 0.2 per 1,000 in children aged 0 to 15 years[2, 6].

Findings from previous African studies done in the 1960s suggest a prevalence rate of 0.1 to 1.0 percent among the indigenous populations[11]. On the other hand, more recent studies show a varying prevalence rate of between 0 to 6 percent[14]. Diabetes accounts for 2 to 5 percent of all medical admissions and approximately 0.5 percent of all hospital admissions, seen in large hospitals in Sub-Saharan Africa[5, 11].

Elamin and co-workers reviewed data on IDDM generated from several African countries and found that the incidence of IDDM among 7 to 14 years old children in Khartoum was 0.95 per 1,000. A relatively high prevalence rate was also found in Nigerian school children aged 5 to 17 years though the disorder was rare under the age of 10 years. Very low incidence rates of children 0 to 19 years were reported in Tanzania, with IDDM rarely presenting under the age of nine years. Similar trends of IDDM in black Africans were found in Johannesburg, South Africa where only 7 percent of patients were

diagnosed under the age of 12 years. However, the Kinshasa diabetes centre reported approximately 30 new cases of IDDM in children and adolescents per year over the 5 years preceding this report.[11].

2.3 INSULIN DEPENDANT DIABETES MELLITUS IN CHILDHOOD

Insulin dependent diabetes mellitus is one of the chronic diseases of childhood. The disease is characterised by severe insulinopenia and dependence on exogenous insulin for survival [15]. Diagnosis of diabetes in children can be made at any age but is most often made during puberty[2,15,16].

Childhood diabetes is clearly distinct from the adult type by virtue of its association with major histocompatibility antigens (HLA-DR4 and HLA-DR3), the presence of circulating antibodies to insulin and lymphocytic infiltration of islets early in the disease[16]. In adults, NIDDM is the commonest type of diabetes seen. In these patients ketosis rarely develops. Furthermore, serum concentration of insulin in these patients may be normal or moderately depressed. In many of these adult diabetic there is a strong family history of the disease[15,16].

Approximately 90 percent of children with IDDM present with classical symptoms of polydipsia, polyuria and nocturia and 75 percent will have experienced weight loss or fatigue. Most of these will have glycosuria, ketonuria and plasma glucose value well above 11 mmol/L. About 25 to 40 percent will present in ketoacidosis and 5 to 10 percent in coma[12, 15]

As children with diabetes survive, they are faced with a variety of complications. Hypoglycaemia and ketoacidosis are the most common acute metabolic complications seen in these patients. Apart from chronic malnutrition, growth stunting and puberty delay, long term complications such as early cataracts, retinopathy, renal disease and neuropathy emerge usually during late adolescence.

IDDM retinopathy presents in at least 34 percent of patients after an average duration of 13 years [2, 11]. Progressive impairment of renal function accompanied by urinary protein loss culminating in end-stage renal failure threatens the health and life of up to half of those patients who develop IDDM in adolescence[2].

Diabetic neuropathy affects both the peripheral and the autonomic nervous system. Approximately 70 percent of IDDM patients are reported to have some degree of neuropathy leading to disability and 10 percent of these patients die from cardiovascular diseases [2,11,17].

2.4 MANAGEMENT OF IDDM

The chief aim of therapy is to obtain normal blood glucose levels and to maintain good control over the years in the hope that a state of euglycaemia or one approaching it will reduce the risk of the acute metabolic abnormalities and chronic complications of diabetes.

The success of diabetes control in children depends on a management regimen, which is complicated and difficult to adhere to even in the best circumstances in the developed world [2,11,16]. This management regimen of IDDM includes the following:

2.4.1 INSULIN REGIMEN

Insulin is a polypeptide hormone of complex structure. It is mainly extracted from pork pancreas and purified by crystallisation. It is also made biosynthetically by recombinant DNA technology using Escherichia coli or semi synthetically by enzymatic modification of porcine material[6, 11,16,18].

There are three main types of insulins currently available varying by how quickly they start to work and by how long they last in the body. These insulins are broadly classified as having short, medium, or long duration of action[2, 11,15,17].

2.4.1.1 SHORT ACTING INSULINS.

Soluble insulins and insulin lispro are a common example of preparations with a rapid onset and short duration of action. When injected subcutaneously, soluble insulin has a rapid onset of action with peak action between 2 and 4 hours, and a duration of action of up to 8 hours. Thus, soluble insulin should be administered at least 8 hourly when given alone. It should however be noted that human preparations tend to have a more rapid onset and a shorter overall duration of action. These play an important part not only in daily maintenance of insulin dependent diabetics but also in managing diabetic emergencies.

2.4.1.2 MEDIUM AND LONG ACTING INSULINS.

When given subcutaneous, medium and long acting insulins have an onset of action of approximately 1 to 2 hours with maximal effect at 4 to 12 hours and a duration of action of 16 to 35 hours. Isophane insulin and insulin zinc suspension are modified preparations with a delayed onset and an intermediate duration of action [2,15,16,18]. Human ultratard is an example of insulins with a slower onset and lasts for long periods.

Human insulin is now standard in most developed countries though animal insulins are still widely used. Insulin preparations are available in concentrations of 20,40,80 and 100 U per ml. Many countries have now adopted 100 U per ml as the single standardised concentration[17].

The standard regimen used to treat IDDM vary from a single daily injection of intermediate-acting insulin lente to a highly intensive regimens requiring three or more daily injections[8,16,19,20] . The twice daily dosage is the standard treatment for many patients with IDDM today. Some young patients between the ages of 5 and 10 years, may for sometime be well controlled on a single daily injection although very young patients may require only intermediate or long acting insulin. The average insulin requirements vary from 0.5 U/kg/day to 1.5 U/kg/day. During adolescence, insulin requirement is increased and the dosage can go up to 2 U/kg/day[2,15,16,18,19] .

In UTH, the insulin commonly available is the biosynthetic human insulin in 100 U per ml concentration. However, there is no standard treatment protocol used in the treatment

of IDDM at UTH and most clinicians treat diabetes according to the experience they have been exposed to.

2.4.2 DIET MANAGEMENT

Dietary management of IDDM in children and adolescents is aimed at providing adequate nutrition for normal growth and development. The overall nutritional requirement of diabetic children and adolescents is similar to that of children without IDDM[16]. The main stay of this diet therapy for IDDM patients is to eat a well balanced diet which consists of unrefined, complex carbohydrates, proteins and unsaturated fats, manage carbohydrate intake carefully by avoiding refined sugars and keeping the day to day intake consistent by eating meals and snacks at the same time each day.

This diet management an important adjunct to the insulin treatment in IDDM is impractical in many developing countries like Zambia since eating habits are governed not only by local customs, but also by complex socio-economic factors. Where the basic diet centers on a carbohydrate staple, the patient may find it difficult to change to the so-called "diabetic diet".

2.4.3 EXERCISE

Exercises play an important role in maintaining good general health[20]. Regular exercise lowers blood glucose concentration acutely by increasing the glucose uptake of exercising muscle and enhancing insulin absorption from subcutaneous injection sites[2]. Exercise is best if done on a consistent schedule.

Two specific precautions regarding exercise need to be considered in children with IDDM. Firstly in the face of ketonuria and severe hyperglycaemia, exercise can result in worsening hyperglycaemia and ketosis or can precipitate ketoacidosis. In this situation, some insulin should be administered and allowed to start working before a bout of exercise is initiated. Secondly, the risk of hypolygcaemia may be increased for at least 12 hours after a period of prolonged exercise [2,16].

2.4.4 MONITORING OF GLYCAEMIC CONTROL

Careful and frequent gylycaemic monitoring is the key component of diabetes management. An ideal system of assessing overall blood glucose control in IDDM involves self-monitoring of blood glucose levels using reagent strips with or without reflectance meters[2,15,17]. This is the mainstay of day-to-day monitoring. Without self-monitoring all the other management efforts are probably wasted [16]. Patients measure blood glucose before each mealtime and at bedtime. However, children and adolescents often prefer not to measure blood glucose at lunchtime. In such cases urine glucose measurements are useful. Glycosylated haemoglobin (HbA_{1c}) levels are used as a measure of long-term glycaemic control. The blood levels reflect the average blood glucose concentration over the preceding 2-3 months[2,11,17,19] . Measuring HbA_{1c} is difficult and expensive and few clinics in developing countries have this facility[2,11]. Therefore, control of symptoms and avoidance of hypoglyceamia are the prime aims of treatment of diabetes in Africa today[20].

2.4.5 HEALTH EDUCATION

Day to day management of diabetes should be implemented by families or the patients themselves not by health care providers. Therefore families, children or teenagers need to be taught principles of IDDM control and management. This facility has been one of the most important advances in overall diabetes care in developed countries over the last 10 to 15 years[2]. It is delivered by highly trained specialists nurses or nurses educators. The obstacle in Africa is lack of trained nurse educators[2,11]. Diabetes education should be an ongoing lasting process.

2.4.6 MANAGEMENT OF DIABETES KETOACIDOSIS

Ketoacidosis in IDDM patients develops when the body lacks insulin. This commonly occurs when there is increased insulin demand during the course of infection, trauma or surgery[20].

Management include:-

- Replacement of fluid losses.
- Replacement of electrolyte losses.
- Restoration of the acid-base balance. This corrects itself with restoration of the collapsed circulatory volume.
- Replacement of the deficient insulin.
- Monitoring of blood glucose closely.
- Replacement of energy losses.
- Seek underlying cause.

2.5 MORTALITY DUE TO IDDM

The major problem for many diabetics in the tropics is survival rather than complications risk[3]. IDDM is rarely mentioned on death certificates as a cause of death, as a result, the number of deaths directly attributed to the disease is not easy to quantify. However, data from Africa suggest a high early mortality from the disease. Studies done in Zimbabwe demonstrate that over 40 percent of patients were dead when followed six years after diagnosis[11] . Hence the diagnosis of childhood diabetes is often equivalent to the death sentence. In Tanzania for example, the mortality of patients with IDDM was found to be 40 percent [21,22]. Many reasons exist for the high mortality in developing countries with the main one being the inconsistent and erratic supply of insulin[23].

CHAPTER THREE

3.0 JUSTIFICATION

It is obvious from the discussion that diabetes mellitus is an important health issue in Africa and the number of diabetic patients is increasing. The long-term complications are beginning to appear in surviving patients[11].

In Zambia data on diabetes is limited as very little research has been done on the subject and no published study has critically looked at the situation in Lusaka.

This study therefore, seeks to demonstrate the importance of diabetes among children and adolescents in Zambia and also suggest programmes to improve care and control of this condition in the main referral centre in Lusaka, Zambia.

CHAPTER FOUR

4.0 OBJECTIVES

4.1 GENERAL OBJECTIVE

To determine the prevalence of insulin dependent diabetes mellitus and evaluate it's management in children and adolescents attending the University Teaching Hospital, Lusaka, Zambia.

4.2 SPECIFIC OBJECTIVES

1. To determine the prevalence of IDDM in children and adolescents in UTH.
2. To describe the socio-demographic characteristics of the IDDM patients.
3. To describe the clinical characteristics of IDDM patients at first presentation.
4. To evaluate the management of IDDM during follow up.

CHAPTER FIVE

5.0 MATERIAL AND METHODS

5.1 STUDY DESIGN

This study is a descriptive cross-sectional study of children and adolescents with IDDM who attended the University Teaching Hospital between mid December 1997 and mid June 1998.

5.2 STUDY SETTING

The study was based at the University Teaching Hospital (UTH), Lusaka. This study was conducted from the Department of Paediatrics and Child Health and the Department of Internal Medicine.

The University Teaching Hospital is the country's largest hospital and a national referral centre. The hospital covers most specialties and it serves as a teaching hospital for the University of Zambia School of Medicine. Most of the patients seen at UTH are referred from health centres in Lusaka and from other health institutions in the country. However, there are a few patients, who go directly to the institution.

The Department of Paediatric and Child Health has two wings, the outpatient wing and in-patient wing. The in-patient wing has general medical and specialised wards. These specialised wards include the intensive care unit for patients aged up to 15years. Other

specialised wards include the nutrition ward, infectious disease control ward, diarrhoea disease control ward and haemato-oncology ward.

Patients are screened in the outpatient department and admitted to the general wards via the admission ward. The department of Paediatrics and Child Health does not have a follow up specialist clinic for IDDM patients. Upon discharge IDDM patients are seen in the general follow up clinic for on going care.

The adult diabetic clinic is held weekly in the Department of Internal Medicine. In this clinic, diabetic patients are medically assessed and counselled. At every clinic visit, urine and blood sugar are checked before the patient is attended to by the doctor.

5.3 STUDY POPULATION

Both new and old cases of children and adolescents with IDDM aged between 0 to 19 years were recruited to the study. Patients participating in this study were either admitted in the Departments of Paediatrics and Internal Medicine or were attending the Paediatrics or adult diabetic outpatient clinics. IDDM was defined according to the WHO criteria (refer to page 14 of this dissertation), and every child or adolescent who met the criteria was admitted to the study.

5.4 STUDY PROCEDURE

After verbal consent, a questionnaire was administered to patients in the case of adolescents or parents/caretakers in the case of the children.

5.5 DATA COLLECTION

A questionnaire with open and closed-ended questions was used to collect data from patients, or parents/caretakers. The questionnaire focused on variables listed below.

Medical records for all old IDDM patients were retrieved and data contained in them reviewed as part of the study. Urine glucose results were also recorded from the case notes.

5.5.1 VARIABLES

DEPENDENT			**INDICATOR**
Prevalence of IDDM	:	-	Proportion of old and newly diagnosed patients of IDDM seen in UTH
Social	:	-	Residential area
		-	Employment status of caretaker
		-	Level of education
		-	Family history of diabetes
Demographic	:	-	Proportion of male/female
		-	Current age of IDDM patient
		-	Age of onset of IDDM
Clinical characteristics	:	-	Common symptoms of IDDM in

children and adolescents at first presentation.

Management : - Type of insulin and frequency of administration.

- Availability of insulin.
- Number of hospital admissions.
- Reasons for admission
- How often investigations are done at review.
- Frequency of reviews.

5.6 QUESTIONNAIRE PRE-TEST

The questionnaire was pre-tested among selected patients with insulin dependent diabetes mellitus and among parents/caretakers in cases of children. Patients were interviewed from follow up clinics and based on the results, the questionnaire was adjusted accordingly.

5.7 DATA PROCESSING AND ANALYSIS

To ensure that all information needed was collected; all questionnaires were numbered and checked for completeness. Information obtained from questionnaires was processed and analysed with EPI-INFO software. Incidence and prevalence calculations were derived from:

(a) the total number of patients who attended the Department of Paediatrics and Child Health during the period of study.

(b) the number of paediatric patients identified with IDDM.

5.8 ETHICAL CONSIDERATION

Permission to conduct the study was obtained from the UTH Research and Ethics Committee and from Heads of Department of Paediatrics and Child Health and Department of Internal Medicine. Participation was voluntary. The general and specific objectives of the study were explained to patients and a verbal consent was obtained.

CHAPTER SIX

6.0 RESULTS

6.1. PREVELANCE OF IDDM AMONG PAEDIATIC PATIENTS.

During the study period a total of 19,922 patients were seen in the Department of Paediatrics and Child Health. Out of these 11,813 (59%) were admitted. Fifteen (15) *patients out of the total number seen were diagnosed as IDDM. This figure represented a* calculated prevalence rate of 0.08 percent of IDDM among paediatric patients seen.

6.2 INCIDENCE OF IDDM AMONG PAEDIATRIC PATIENTS.

A total of four (4), out of the 15 IDDM paediatric patients were presenting to hospital for the first time. Thus, the calculated incidence rate of IDDM among paediatric patients was 20 new cases per 100,000 sick children.

6.3 OVERALL PREVALENCE RATE.

When the age limit of this study was extended to include all IDDM patients less than 19 years, a total of 32 IDDM patients were identified. The number of new cases of IDDM seen increased to five (5). Unfortunately due to poor record keeping, the overall prevalence rate could not be calculated because of lack of data on how many patients aged 15 to 19 attended the hospital.

6.4 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PATIENTS WITH IDDM

TABLE 1. SEX DISTRIBUTION

SEX	NUMBER OF PATIENTS	PERCENTAGE (%)
FEMALE	17	53.1
MALE	15	46.9
TOTAL	32	100

In considering the sex distribution, all IDDM patients aged less than 19 years were included in the analysis. Overall, there were 15 males (46.9%) and 17 females (53.1%) giving a male to female ratio of about 1:1.

6.4.1 AGE DISTRIBUTION OF PATIENTS WITH IDDM.

Six IDDM patients were aged between 5 and 9 years, 9 were between 10 and 14 years and 17 were between 15 and 19 years. In this study there were no patients aged less than 5 years that had IDDM (Refer to Figure 1).

Figure 1: Age and Sex Distribution

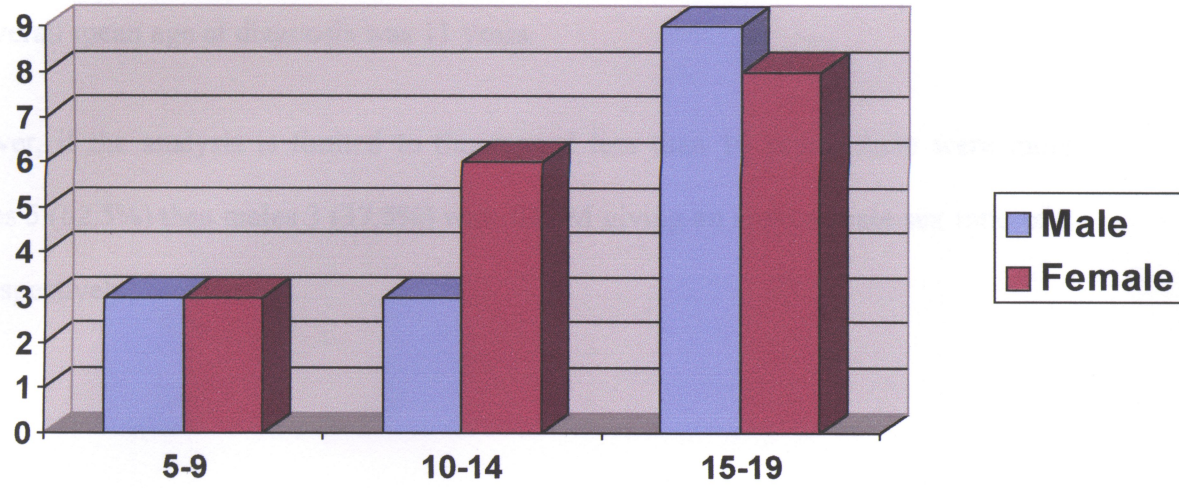

TABLE 2: REPORTED AGE AT ONSET OF IDDM

AGE AT ONSET IN YEARS	MALE	FEMALES	TOTAL	PERCENTAGES (%)
0-4	1	0	1	(3.1%)
5-9	2	5	7	(21.9%)
10-14	8	10	18	(56.3%)
15-19	4	2	6	(18.8%)
TOTAL	15	17	32	(100%)

The majority of patients seen in this study 18 (56.3%), first presented with IDDM between the ages of 10 and 14 years. In this age category, 8 (44.4%) were males and 10 (55.5%) were females suggesting that there was no significant difference between sexes in relation to onset of disease. (Refer to Table 2 and Figure 2). Furthermore, this suggests

that if an environmental factor contributes to onset of IDDM in Zambia, it affects both sexes equally.

The overall mean age at diagnosis was 11 years.

However, if the analysis is limited to those aged less than 10 years, there were more females 5 (62.5%) than males 3 (37.5%) with IDDM giving an approximate sex ratio of 2 to 1 respectively.

Figure 2: Age at Onset and Sex Distribution of Patients with IDDM

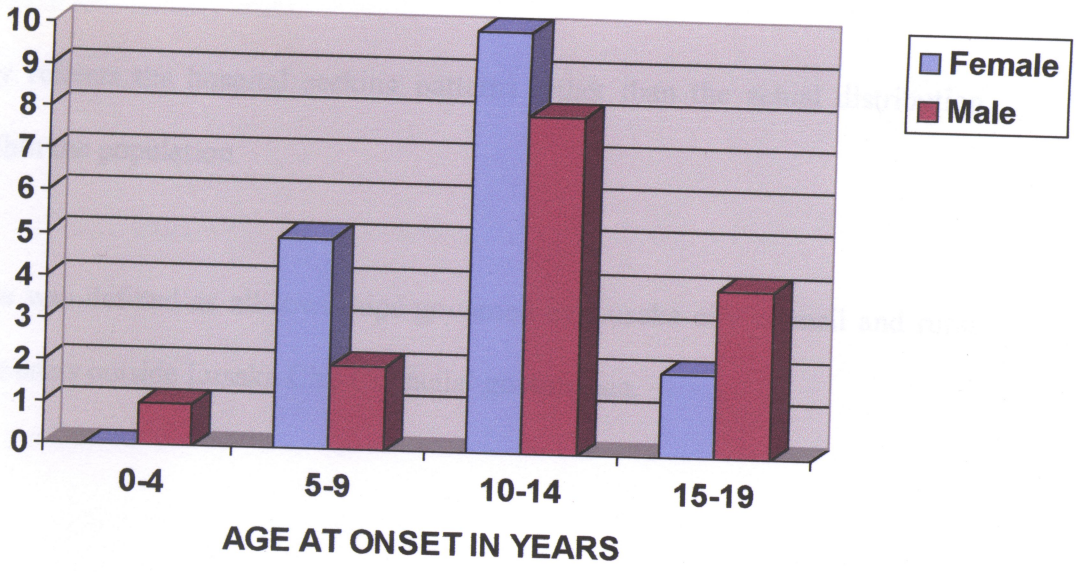

TABLE 3: RESIDENTIAL AREA OF PATIENTS WITH IDDM

RESIDENTIAL AREA		NUMBER OF PATIENTS	PERCENTAGE (%)
RURAL		4	12.5
URBAN	LOW DENSITY	9	28.1
	HIGH DENSITY	19	59.4
TOTAL		32	100

Twenty eight (87.5%) of the patients admitted to this study came from urban areas whilst 4 (12.5%) came from rural areas. Out of these, 19 (67.9%) lived in high-density areas and 9 (32.1%) lived in low-density areas.

This probably reflects the hospital seeking patterns rather than the actual distribution of disease within the population.

- Urban area was defined as all townships governed by Lusaka city council and rural were those areas outside Lusaka City Councils' governance.

TABLE 4 LEVEL OF EDUCATION OF PATIENTS WITH IDDM

EDUCATION	NUMBER OF PATIENTS	PERCENTAGES (%)
NOT-YET IN SCHOOL	2	6.3
PRIMARY	16	50.0
SECONDARY	14	43.8
TOTAL	32	100

Thirty (93.8%) of IDDM patients admitted to this study were actively enrolled in school suggesting that IDDM complications had not adversely affected their educational prospects (Refer to Table 4).

6.4.2 EMPLOYMENT STATUS OF PARENTS AND CARETAKERS OF IDDM PATIENTS

Out of the 32 IDDM patients or parents/caretakers interviewed, 21 (65.6%) were in formal employment, 3 (9.4%) were peasant farmers, 5 (15.6%) were self-employed and 3 (9.4%) were unemployed. Out of the 21 in formal employment, 13 (61.9%) were civil servants, 4 (19%) were employed in parastatal companies and the remaining 4 (19%) were working in various small companies.

Nine (69.2%) of the 13 civil servants were general workers and 4 (30.8%) were primary school teachers.

6.4.3 FAMILY HISTORY OF DIABETES

Twelve of IDDM patients had a positive family history of diabetes (Refer to Table 5). Fifty eight percent of these patients had relatives with diabetes mellitus on the maternal side. However, the sample size in the study was too small to make a conclusion on this finding.

TABLE 5 FAMILY HISTORY OF IDDM PATIENTS.

RELATIONSHIP	NUMBER	PERCENTAGE
Grandparents	6	50
*Siblings (first degree relatives)	1	8.3
Others such as uncles, cousins, nephews, aunties	5	41.7
TOTAL	12	100

*The affected siblings had IDDM.

6.5 CLINICAL SYMPTOMS ASSOCIATED WITH FIRST PRESENTATION OF IDDM.

Five new IDDM patients were identified in this study. Out of these 4 presented with classical symptoms of polyuria and polydipsia. Interestingly, 1 presented for the first time with symptoms of loss of vision due to cataracts.

6.6 MANAGEMENT

TABLE 6 NUMBER OF HOSPITAL ADMISSIONS IN THE PAST YEAR

HOSPITAL ADMISSIONS	NUMBER OF PATIENTS	PERCENTAGE (%)
0	14	51.9
1	10	37.0
2	2	7.4
3	1	3.7
TOTAL	27	100

Out of 27 old IDDM patients identified in this study 13 (48.1%) had been admitted to hospital over the year prior to commencement of this study. Ten had been admitted once, two had been admitted twice and one had three admissions.

The reasons for admission to hospital are summarised in table 7 below.

The majority of these patients 8 (61.5%) were admitted for glycaemic control. This was due to the fact that patients ran out of insulin before their next hospital appointment. In

order to control the glucose level in such patients, the attending clinician had to make a decision to admit them.

TABLE 7 REASONS FOR ADMISSION TO HOSPITAL

REASON	NUMBER OF PATIENTS	PERCENTAGE (%)
GLYCAEMIC CONTROL	8	61.5
INFECTION	2	15.4
KETOACIDOSIS	3	23.1
TOTAL	13	100

6.6.1 FREQUENCY OF HOSPITAL REVIEWS.

The number of follow up visits ranged from 0 to 12 per year while the average number of these visits in one year among the old 27 IDDM patients was 3.9.

TABLE 8 PERCEPTION OF IDDM PATIENTS OVER AVAILABILITY OF INSULIN IN THE HOSPITAL.

INSULIN	NUMBER OF PATIENTS	PERCENTAGE (%)
ALWAYS	6	22.2
SOMETIMES	19	70.4
DON'T KNOW	2	7.4
TOTAL	27	100

Out of the 27 patients/caretakers interviewed 19 (70.4%) reported that insulin was available 'sometimes' in the hospital pharmacy. Six (22.2%) reported that insulin was always available.

- 'Sometimes' was defined as insulin being available in the pharmacy once in two months.

Overall, this suggested that insulin supply in the UTH hospital was not stable or was inadequate.

TABLE 9 MONTHLY STOCKS AND TYPE OF INSULIN AVAILABLE IN THE UTH PHARMACY

MONTH	LENTE INSULIN (VIALS)	SOLUBLE INSULIN (VIALS)
DECEMBER 1997	400	250
JANUARY 1998	300	200
FEBRUARY 1998	-	500
MARCH 1998	-	450
APRIL 1998	-	450
MAY 1998	-	420
JUNE 1998	-	300

During the period of this study, long acting insulin was out of stock for much of the time. However, the short acting insulin was available although one could not ascertain whether the amounts were adequate for IDDM patients attending the hospital (Refer to Table 9).

6.6.2 TYPE OF INSULIN ADMINISTERED AND FREQUENCY OF ADMINISTRATION

Twenty six (96.3%) of the patients were on the twice-daily regimen that combined one dose of long acting (lente) insulin and one dose of short acting (soluble) insulin. One patient was on soluble insulin only which was being given three times daily. Though the majority of patients were on at least one dose of long acting (lente) insulin, this was not

available most of the time in the hospital pharmacy (Refer to Table 9). Patients on lente insulin were asked to purchase the drug.

6.6.3 RETROSPECTIVE INFORMATION ON PATIENTS URINALYSIS

The 27 old patients of IDDM were asked on how frequent glucosuria was determined during the follow-up visits, over the past year prior to the study. Twenty (74%) reported that glucosuria was determined at every hospital follow up visit 15 (26%) said the test was done ' sometimes' while 2 (7.4%) respondents did not know anything because the patients were not brought in by the regular care taker.

TABLE 10 RESULTS OF URINE GLUCOSE DIPSTICK

URINE GLUCOSE DIPSTICK PER AVERAGE OF 3VISITS	NUMBER OF PATIENTS	PERCENTAGE (%)
1+	2	7.4
2+	4	14.8
>2+	9	33.4
NEGATIVE	10	37
NOT KNOWN	2	7.4
TOTAL	27	100

Urine glucose dipstick results were analysed for all the 27 old IDDM patients for the year prior to the commencement of this study. Thirteen (48.1%) had urine glucose of 2+ or more while 2 (7.4%) had urine glucose of 1+ and 10 (37%) had no glucose in urine. Two (7.4%) old patients had no information on dipstick result (Refer to Table 10).

CHAPTER SEVEN

7.0 DISCUSSION

The main findings in this study were that the incidence and prevalence of IDDM among children and adolescents has increased since the last study done over two decades ago[24]. A number of IDDM children and adolescents had a maternal relative with diabetes suggesting that this condition could be inherited through the maternal line. However, the sample size in this study was too small to arrive at a definite conclusion.

The prevalence of insulin dependent diabetes mellitus in children and adolescents in Zambia, like in all sub Saharan countries is considered to be rare[11]. In this study 4 new patients with IDDM were identified among 19,922 patients attended to in the Department of Paediatrics and Child Health at UTH. This represents an incidence rate of 20 cases per 100,000. In a previous study, done in UTH by Seghal et al (1981), 3 new cases of IDDM were identified out of a total admission of 1800 over a two-year period[24]. In a four-year study, done by Egere et al from 1968 to 1971 at Kitwe Central Hospital, out of a total of 170 diabetics seen, only 5 cases of IDDM were seen in children between 10 and 15 years of age. There were no cases identified in children below the age of 10[25].

In the current study 15 patients with IDDM were identified among 19,922 paediatric patients attended to resulting in a prevalence rate of 0.08 percent. This is relatively higher than that observed in a study by Seghal et al (1981) in the same hospital. This suggests that prevalence of IDDM has increased in Lusaka. The reason for this is not clear although environmental factors, increased awareness of the disease, changing health-

seeking behaviour and increase in the population of Lusaka may be the contributing factors.

An increase in the incidence and prevalence of IDDM has also been observed in other African countries. In the Democratic Republic of Congo for example, the Kinshasa Diabetes Centre has been enrolling approximately 30 new cases of children and adolescents with IDDM annually[11].

The overall the sex ratio among IDDM patients recruited to this study was approximately 1:1. This finding is similar to that reported worldwide[2,15,16]. When one restricts analysis to less than 10 years, several literature has suggested that there are more male than female with diabetes. However beyond puberty girls tend to have an increased likelihood towards developing diabetes[16]. In this study however, the interesting finding was that more females were observed in those who first presented with the disease below the age of 10 years with a sex ratio of 2:1. This is interesting because an excess of males among IDDM patients with an age of onset of 5 years or younger has been noted in several populations[8].

In this study, the average age at first presentation of IDDM was 11 years with a range of 4 to 17 years and median age was 13 years. This is comparable to findings of Seghel et al (1981) in which the mean age was reported to be 8.8 years[24]. It should be noted that IDDM in our environment presented at a younger age compared to their African counterparts. Several studies done in Africa have reported an age range at first

presentation of IDDM of 15 to 19 years[2,11]. This difference may be due to differing environmental factors.

Most IDDM patients in the study came from high-density urban areas. This probably reflects the health-seeking behaviour of IDDM patients, as diabetic care is only available in towns and cities. Urban health centres and small hospitals are often ill equipped to provide the needed care[11]. Residential area of IDDM patient may have an influence on the prevalence also. Overcrowding in high-density areas predisposes individuals to viral infections, which have been implicated in the development of diabetes mellitus too.
In this same study, results showed that, most of the IDDM patients had received at least primary school education level. This education level signifies that it would be easier for the health care providers to teach these patients about the disease. Individuals who are able to read and write will have a better understanding of their condition.

Most parents/caretakers of these patients were in formal employment with the majority being civil servants. This was not surprising as the civil service is the largest employer in this country. The average earnings of a civil servant in 1996 was ZMK 86,326 ($43)[10] and this has not changed much over the years because of the government's wage freeze policy as well as the constant devaluation of the local currency. The low income has had an impact on the management of IDDM as patients who were on lente insulin, which was not available in the hospital pharmacy most of the study period, were forced to purchase it from private pharmacies. In the absence of funds this was likely to be done infrequently resulting in the patient relying only on soluble insulin, hence poor control of the diabetes.

Problems with availability of insulin in developing world have been reported by others[2,11]. The situation in UTH is not any different from the African scenario. In the majority of cases insulin was only available "sometimes" in UTH pharmacy. This observation was supported by the hospital pharmacy report on insulin stocks. From the month of February 1998 to the time of writing up this report, there had been no lente insulin in UTH. The cost of insulin in private pharmacies ranges from ZMK 30,000 ($15) to ZMK 46,000 ($23) per vial and multistix between ZMK 50 – 70,000 ($25 - $35).

These costs are more than the average monthly earnings of most Zambian workers and obviously beyond the reach of most diabetic patients. McLarty et al from Tanzania in 1993 distributed a questionnaire through two Journals. He received replies from 50 practitioners working in 25 African countries. Half of the 50 practitioners reported that insulin was sometimes not available in large urban centres. And insulin was unavailable for at least some of the time in 22 percent of countries[23]. In 1994 the International Diabetes Federation sent a questionnaire to its 105 member associations in 85 countries. All the countries came to a conclusion that in many countries insulin supplies were erratic and often not available to people with IDDM[23]. Insulin dependence in diabetes implies life long dependence and the consequences of non-availability of insulin is death[23,26]. Furthermore, dietary management and exercise were hard to follow because both require substantial funds for individuals to implement.

The majority of newly diagnosed IDDM patients presented with classic symptoms of polyuria, polydipsia and weight loss while one patient aged 15 years presented with cataracts and blindness.

Monitoring of IDDM in this study was poor. The ideal way of assessing overall blood glucose control in diabetic children involves self-monitoring of blood glucose levels with reagent strips, and intermittent clinic measurement of glycosylated hemoglobin. Measurement of glycosylated hemoglobin is costly and difficult[2,11]. Urine testing therefore, remains the simplest, cheapest and non-invasive method available for long term monitoring of diabetes[2].

In this study, urine testing for glucose was done as measure of glycaemic control. Glycaemic control was defined as glucose-free urine. Blood glucose levels were not recorded because the test was not available in the hospital during the study period.

It was observed from the study, that the majority of our diabetic patients seen in follow up clinics were poorly controlled with 48 percent having a urine glucose of 2+ or more on dipstick. Over half of IDDM patients were readmitted because of poor control. There was no age difference between well-controlled patients and those who were poorly controlled. Poor glycaemic control in IDDM patients studied was mainly due to non-availability of insulin. The mean number of follow up visits in one year was 4 and since urinalysis was only done during these follow up visits, it follows that the patients had an average of 4 urinalysis done in a year. These infrequent review visits, poor monitoring of IDDM by

the health care providers and lack of self-monitoring of the disease contribute to the poor glycaemic control.

This study has shown that there is an apparent increase in the incidence and prevalence of IDDM in children and adolescents attending Zambia's largest tertiary hospital. In addition, the management of IDDM is poor due to several factors such as poor access to care specific for diabetic patients, unsustained insulin supplies and inability to monitor their own glycaemic status due to financial inadequacies.

CHAPTER EIGHT

CONCLUSION

The incidence and prevalence of insulin dependent diabetes mellitus among children in UTH appeared to have increased since the last study done in 1981 in UTH Zambia. The overall mean age at diagnosis was 11 years with a male to female ratio of 1:1. This was lower compared to the findings of studies done in Tanzania and South Africa[5, 11]. Another observation was that, there were more females developing the disease before 10 years, an observation seen in low prevalence populations[2]. The majority of patients presented with classical symptoms at the time of diagnosis while only one patient aged 15 years presented with blindness due to cataracts.

Most of the patients were literate and came from urban areas with the majority living in high-density areas. Majority of caretakers of IDDM patients were in formal employment and most of these were civil servants. Glycaemic control was very poor with over half of the patients being readmitted for control. The average number of hospital reviews was 4 in a year. Like in all developing countries, insulin supply in the hospital pharmacy is erratic and sometimes not available.

Most deaths and many of the complications of IDDM patients can be delayed or even prevented by effective treatment. Therefore, a regular and consistent supply of insulin and medical supplies is important. However, a good understanding of the disease by both

the health care providers and the child and his or her caretaker is of equal importance. In the end it is the responsibility of the government to ensure that drugs such as insulin are available for those who need them. This has been hampered by poor health planning due to lack of hard data on prevalence rates.

CHAPTER NINE

RECOMMENDATIONS AND LIMITATIONS

1. Diabetic care should be organised :

   (i) children with Insulin Dependent Diabetes should preferably be cared for in a specialist clinic;

   (ii) by recruitment of dieticians who are an important part of the diabetic management team and;

   (iii) by lobbying with the Zambian Government for adequate supplies for diagnosis and treatment of diabetes.

2. Training in diabetes management should be encouraged among health practitioners.

3. Further studies are needed to investigate:

   (i) the observed increase in prevalence and incidence rates;

   (ii) the higher numbers of females before age of 10.

STUDY LIMITATION

As a result of poor hospital record keeping incidence and prevalence could only be calculated for paediatric patients.

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ANNEX

QUESTIONNAIRE

File No. ..... Study No. .....

Date of interview.

Name of interviewee .....

Residential Address .....

1. Current Age (Years) .....

2. Age of onset of diabetes .....

3. Sex 1. Male..... 2. Female .....

4. Province of Origin.....

5. Residential Area: 1. Urban ..... 2. Rural .....

6. Level of Education:
   1. Never been to school
   2. Not yet in school
   3. Primary (Grade 0-7)
   4. Secondary
   5. College or University

7. Employment Status

   Occupation of parent/caretaker:
   1. Office worker
   2. General worker
   3. Self employed (business)
   4. Peasant farming
   5. Unemployed
   6. Doesn't know

8. If answer to above is 1 or 2 what job do you do and who are your employers?

   .....

9. Family history of diabetes:
   1. None
   2. Father
   3. Mother
   4. Sister
   5. Brother

6. Others (uncles, aunties, grand parents or cousins)

10. Mode of presentation of new diabetic patients:

1. Polyuria, polydipsia, polyphagia (alone or combination)
2. Unexplained weight loss
3. Coma
4. Others
5. Not Applicable

11. Number of Control reviews attended in the last one year .....

12. Number of hospital admissions in the last one year:.....

13. Cause of last admission:

1. Control
2. Infection
3. Ketoacidosis
4. Coma
5. Don't know
6. Not applicable

14. Duration of stay during last admission (No. of days): .....

15. What type of insulin are you on? .....

16. How often is it given? .....

17. How often is insulin available in the hospital pharmacy?

    1. Always
    2. Sometimes (once in two months)
    3. Not Available
    4. Not Applicable

18. If answer is (3), what is the source? .....

19. How often is urinalysis done in the clinic in the last one year?

    1. At every visit
    2. Sometimes (one in two months)
    3. Rarely
    4. Not applicable

20. Investigations

Urine dipstick (glucose):

1. Negative (nil + trace)
2. 1+
3. 2+
4. More than 2+
5. Not Applicable