ejpmr, 2016,3(9),492-501

SJIF Impact Factor 3.628

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

EVALUATION OF PARENTS' SOCIO-ECONOMIC AND EDUCATIONAL FACTORS IN THE MANAGEMENT OF ADOLESCENT PATIENTS WITH TYPE-1 DIABETES IN CALABAR NIGERIA

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Article Received on 20/07/2016 **Article Revised on 10/08/2016** **Article Accepted on 29/08/2016**

ABSTRACT

Background/Aim: Type 1 diabetes is a chronic illness characterized by the body's inability to produce insulin due to the autoimmune destruction of the beta cells in the pancreas. Onset most often occurs in childhood, but the disease can also develop in adults in their late 30s and early 40s. This study was carried out to evaluate the management outcome in Type-1 diabetes adolescents in Calabar, as it relates to patients' parents socio-economic and educational factors. **Method:** A total of nineteen (19) diabetic adolescent attending selected clinics in Calabar and another 19 age-and-sex matched healthy adolescents were used for this study. **Results:** Body weight of the diabetic group correlated positively (r= 0.049*) with educational status of fathers. The systolic blood pressure (SBP) of diabetic subjects correlated positively (r= 0.546*, P<0.05) with the educational status of mothers. Positive correlation (r=0.7975; P<0.05) was observed in the relationship between parent's economics status and height in diabetic females. Majority of the parents were of the middle and high social class. Academic performance rating of the adolescent diabetics was significantly (P<0.05) lower compared with controls. In most of the patients, late presentation, frequent hospitalization and prolonged hospital stay was observed. HbA_{IC}% in diabetic adolescent females showed significant relationship (r = 0.923; p<0.001) with parent economic status. Two deaths occurred in the course of this study. Glycaemic control was suboptimal however combination therapy of diet and insulin was observed to improve the wellbeing of diabetic adolescents in this study. **Conclusion:** Education and enhanced economic status of parents correlate positively with glycaemic control, anthropometric parameters and general wellbeing of the diabetic subjects, especially those that received diet and insulin therapy. Hence, glycated haemoglobin appeared to be a very dependable marker for diagnosis of diabetes mellitus in adolescents.

KEYWORDS: *Diabetes mellitus, Adolescent, Socio-economic factor, Educational factor.*

INTRODUCTION

There is no permanent cure yet for diabetes mellitus but long term goals of management according to[1][2] are to prolong life, reduce symptoms and prevent diabetes related complications.[3]

Hyperglycaemia is considered the aetiological source of most if not all diabetic complications as well as anthropometric derangements,[4] Good glycaemic control has clearly been shown in several studies to reduce risk of development of acute and chronic complication and to slow the progression of already established complications.[4] Hence the need to evaluate the level of glycaemic control in adolescent diabetics being managed at the selected clinics using FBG and HbA_{IC}%. The risk of developing diabetes mellitus increases with age, lack of physical activities and development of DM also double with every 20% of excess body weight and with every decade of life.[5] [6] This study examined anthropometric parameters namely height, weight and body mass indices in diabetic and control subjects. Self-care which includes self-blood glucose monitory and daily insulin use were evaluated. Hospitalization frequency and indications as well as duration and outcome were also evaluated.

Age of onset and duration of ill health in affected adolescents were also assessed with regards to degree of complications expected. The well documented association of DM and raised blood pressure led to the assessment of blood pressure value in our adolescent diabetic and control subjects.[7] Outcome of the different treatment modalities on the wellbeing of the diabetic subjects were evaluated.

Socio-economic factors that may have direct or indirect effects on the course of the disease and its management such as parent educational and economic status as well as

presence of diabetes in parents and siblings were assessed.[8] Seeing that there were previous reports that obese adolescent diabetics show significant cognitive slowing as well as learning and memory deficits[9] and[10], the academic performance of the adolescent diabetic subjects and compared with the control was investigated, blood group distributions amongst the control and diabetic subjects was also assessed alongside gender distribution and ethnicity of subjects[11] and.[12]

MATERIALS AND METHODS

Materials

Materials used in this study were: Glucometer, Accu-check Advantage II, Roche Diagnostic, Germany; Accu-check Advantage II, Test strips; Bathroom weighing scale (Hanson, England); Stethoscope – Lithman; sterile gloves; tourniquet; DIALAB Glycated haemoglobin kit, Germany; meter rule; mercurial sphygmomanometer, China; methylated spirits; cotton wool; 5mls syringes and needles; sample bottles (Fluoride Oxalate bottles, EDTA bottles); Antisera A, Anti-B and Anti-AB (Human Polyclonal Immucorinc, Norcross); white porcelain tile; 0.9% normal saline; Anti-Rh (anti-D) serum; centrifuge; water bath.

Subjects

This study was carried out in two groups of adolescents after ethical approval by Ethics Committee University of Calabar Teaching Hospital, Calabar (UCTH). The first group of subjects involved in the study is the test group comprised of 19 confirmed male and female adolescent diabetics drawn from the Endocrinology Unit of the Paediatric Department of the University of Calabar Teaching Hospital, Faith Foundation Clinic and Union Medical and Children Centre. The second group of subjects which is the control group comprised 19 adolescent males and females with no clinical symptoms of diabetes or any other endocrine condition. Both groups are made of adolescents from various parts of the country who reside in Calabar.

Method of sampling

This was a prospective study involving confirmed adolescent diabetic children aged between 13 and 19 years, receiving treatment between February 2012 and January 2013 in the above mentioned clinics with no other chronic illness and who also gave consent following detailed explanation of extent and purpose of the study to subjects, their parents/guardians. The subjects were randomly selected within the limit of the desired age bracket. Both test and control groups were age and sex matched.

The selection criteria for diabetics were based on blood glucose level above 7.0Mmol/L.[13] A structured questionnaire was used to obtain information on parents' occupation, education status, diabetes in parents and siblings. Biodata information were obtained during history taking and from subjects hospital case files. Parameters measured include height, weight, BMI, blood pressure, blood groups, fasting blood glucose and glycated haemoglobin levels. The subjects were monitored quarterly for one year.

Sample collection

Blood samples for investigation were collected during subject clinic visits. After an overnight fast, fasting venous blood samples were collected aseptically from the subjects via venepuncture for fasting plasma glucose determination. 4mls of the blood was emptied into EDTA bottles and about 2mls fixed into fluoride oxalate bottles. Blood sample in EDTA bottle was used for blood grouping and glycosylated haemoglobin while that in fluoride oxalate bottles was used for fasting blood sugar estimation. Blood grouping was done according to method described by Dacie and Lewis.[14]

Estimation of glucose

The blood samples in fluoride-oxalate bottles were centrifuged at 2000/rpm for 5 minutes and plasma was collected. Three test tubes were used and 0.01ml of subjects' blood was put into one test tube, 0.01ml of glucose standard into another and 0.01ml of distilled water into the third tube. Into each of the tubes 1ml of glucose reagent was added and incubated at 37°C for 10 minutes. The absorbance of standard and subjects was read against the blank at a wave length of 660 nm. The intensity of the colour change is proportional to the concentration of the glucose in the sample blood. Blood glucose estimation was also carried out with glucometer (Accucheck advantage II Roche diagnostic GmbH Germany) and Accucheck advantage II test strips) where sugar strip was inserted into a one stop glucometer and a drop of blood was placed on the sample spot. The meter automatically issued result in mmol/L after 45 seconds. The glucometer is a glucose oxidase based instrument used for blood glucose measurement.[15]

Glycated haemoglobin analysis

This was analysed using ion exchange chromatography as described in the DIALAB Glycated haemoglobin Kit obtained from Gieselshaft, Germany. No special preparation was necessary for this assay.

Socioeconomic status

Socioeconomic status and education attainment may be factors influencing the glycaemic control of patients with type 1 DM and this may be because both factors are involved in the motivation of such parents to address their children health needs. Education acts as a proxy for the socioeconomic status of the family and geographic area of resident.

This was analysed via combing the highest educational attainment, occupation and income of the parents (based on the mean income of each educational qualification and occupation. This method stratifies socioeconomic status (SES) into five classes I – V. Class I are in the high class, classes II and III are in the middle class while classes IV and V are low socioeconomic class. The

father's occupation has a cumulative score of 3 while the mother's educational attainment has a cumulative score of 2. The total score places subjects in the respective classes. For example class 1 = total score of 1, class 2 = total score of 2 and so on.[8]

Father occupation

A – Professionals, top civil servants, politicians, businessmen, score 1.

B- Middle level bureaucrats, skilled artisans and well to do traders score 2.

C-Unskilled workers and those whose income is at or below the national minimum wage, score 3.

Mother's education attainment

A - Tertiary education – University, Polytechnic (HND), score 0.

B - Secondary education – secondary school, College of education, ordinary diploma, score 1

C - Primary education or no schooling, score 2.

This classification is very relevant in developing countries like Nigeria where most mothers are uneducated. Mother's education has been shown by studies to be positively associated with health care knowledge and health care practice within the family irrespective of income.[16][17]

Statistical analysis

Data were presented as mean ± SEM. Analysis of data for statistical significant was done using the unpaired students t-test, Pearson's correlation and regression analysis. The analysis was done with the aid of computer software, SPSS 17.0 for windows. P value of less than 0.05 was accepted as statistical significant.

RESULTS

Parental education/socioeconomic status of control and diabetic male and female subjects

Educational status

In the control group 12(3.1%) fathers had tertiary education, 2(10.5%) stopped at secondary level, 3(15.8%) had primary education and 2(10.5%) had no formal education. In the diabetic group 12 (63.1%) fathers had tertiary education, 5 (26.3%) completed secondary education while 2 (10.5%) stooped at primary level. This result is shown in Table 2a.

Table 2b illustrates maternal educational status where 10 (52.68%) mothers were educated up to tertiary level, 5 (26.3%) had secondary education and 2 (10.5%) each had primary and non-formal education in the control subjects. In the diabetic subjects, 4 (21.1%) had no formal education, 2 (10.5%) had primary education, 5 (26.3%) stooped at secondary level and 8 (42.1%) completed tertiary education.

Economic status

In Table 2c, subjects were categorised into (high), (middle) and low socioeconomic classes using parents' level of education and type of occupation[8] and.[18] Results showed that in the control group 5(26.4%) parents each belonged to low and high socioeconomic class respectively, while 9(47.4%) parents were in middle socioeconomic class.

In the diabetic group 7(36.9%) parents belong to middle class and high class respectively while the remaining 5(26.3%) were in low socio economic class.

Correlation between father's educational status, anthropometric parameters, blood pressure values and blood glucose levels (FBG, HbA_{IC}) in control and diabetic male and female subjects.

No significant correlation was observed between father's educational status, height and blood pressure parameters in both control and diabetic subjects. However an inverse; moderate and significant correlation was observed between fathers educational status and glucose levels in the diabetics ($P<0.05$), the correlation coefficients (r) were – 0.546 and – 0.464* respectively for FBG levels and HbAiC% in diabetics. Also the body weight of diabetics correlated positively, moderately and significantly with the educational status of the father ($r = 0.490$, $P<0.05$) as shown in table 3.

TABLE 1: Blood group distribution in diabetic and control subjects

	O^{+ve}	A^{+ve}	B^{+ve}
Control	19(100%)	0(0.0)	0(0.0)
Diabetics	16(84.21%)	2(10.53%)	1(5.3%)

TABLE 2a: Father educational status

Subject	Sex	None	Primary	Secondary	Tertiary	Total
Control	Male	2(10.5%)	2(10.5%)	2(10.5%)	8(42.1%)	14(73.7%)
	Female	0(0.0%)	1(5.3%)	0(0.0%)	4(21.1%)	5(26.3%)
Diabetic	Male	0(0.0%)	1(5.3%)	2(10.5%)	8(42.1%)	11(57.9%)
	Female	0(0.0%)	1(5.3%)	3(15.8%)	4(21.1%)	8(42.1%)

TABLE 2b: Mother educational status

Subject	Sex	None	Primary	Secondary	Tertiary	Total
Control	Male	1(5.3%)	2(10.5%)	3(15.8%)	8(42.1%)	14(73.7%)
	Female	1(5.3%)	0(0.0%)	2(10.5%)	2(10.5%)	5(26.3%)

Diabetic	Male	0(0.0%)	2(10.5%)	3(15.8%)	5(26.3%)	11(57.9%)
	Female	4(21.1%)	0(0.0%)	2(10.5%)	3(15.8%)	8(42.1%)

TABLE 2c: Parents' economic status

Subject	Sex	Low	Middle	High	Total
Control	Male	4(21.1%)	6(31.6%)	4(21.1%)	14(73.7%)
	Female	1(5.3%)	3(15.8%)	1(5.3%)	5(26.3%)
Diabetic	Male	2(10.5%)	5(26.3%)	4(21.1%)	11(57.9%)
	Female	3(15.8%)	2(10.5%)	3(15.8%)	8(42.1%)

TABLE 3: Correlation between father's educational status anthropometric parameters, blood pressure values and blood glucose levels (FBG, HbAiC) in control and diabetic subjects

Variable	Control	Diabetic
Height (r)	-0.091^{NS}	0.298^{NS}
Weight (r)	0.141^{NS}	0.490*
SBP (r)	0.114^{NS}	0.357^{NS}
DBP (r)	0.147^{NS}	0.030^{NS}
FBG (r)	-0.003^{NS}	-0.546*
HbA_{IC}% (r)	0.198^{NS}	-0.464*

NS = Not statistically significant
*P<0.05

Correlation between mother's educational status, anthropometric parameters, blood pressure and blood glucose levels (FBG, HbA_{IC}) in control and diabetic male and female subjects.

Fasting blood glucose levels and HbA_{IC}% of diabetic subjects correlated inversely, strongly and significantly with mother's educational status (r = -0.649 and -0.631, P<0.01 respectively). In the control subjects no significant correlation was observed between educational status of mother and glucose levels. The SBP of diabetic subjects correlated positively, moderately and significantly (r = 0.546*, P<0.05) with the educational status of the mother. No significant correlation was recorded between educational status of the mother and all other parameters in both control and diabetics. This is represented in Table 4.

Relationship between parent economic status and body weight in control and diabetic male and female subject

In the diabetic males, there was a weak, positive non-significant relationship between parent economic status and body weight (r = 0.269; P>0.005). No significant relationship existed between parent economic status and body weight in control males (r = 0.050; P>0.05). The relationship between parent economic status and body weight in diabetic females was strong, positive and significant (r = 0.813*; P<0.05). While in control females, the relationship was inverse and weak (r = 0.145^{NS}; P>0.05).

TABLE 4: Correlation between mother's educational status anthropometric parameters, blood pressure values and blood glucose levels (FBG, HbA_{IC}) in control and diabetic subjects

Variable	Control	Diabetic
Height (r)	-0.007^{NS}	0.273^{NS}
Weight (r)	0.111^{NS}	0.394
SBP (r)	-0.406^{NS}	0.546*
DBP (r)	-0.113^{NS}	-0.031^{NS}
FBG levels (r)	0.28^{NS}	-0.649**
HbA_{IC} %	0.387^{NS}	-0.631**

NS = Not statistically significant; *P< 0.05 and **P<0.01

Relationship between parent economic status and height in control and diabetic male and female subjects

In diabetic and control males, parent economic status did not have any significant correlation with height. Correlation coefficients were -0.052 and -0.018 respectively for diabetic and control males.

However, parent economic status correlated positively and significantly with height in diabetic females (r = 0.7975; P< 0.05) and in control females a weak, positive and non-significant correlation was observed between parent economic status and height (r = 0.102; P> 0.05).

Relationship between parent economic status and fasting blood glucose levels

In control males and females, no correlation existed between parent economic status and fasting blood glucose levels r = 0.051 and r = -0.080 as shown in Figures 12 and 13. In diabetic males, there was a negative, moderate and non-significant relationship between parent income and FBG level (r = -0.433; P>0.05) but in the diabetic females, the relationship was strong, negative and significant (r = -0.889; P<0.001).

Relationship between parent economic status and HbA_{IC} in control and diabetic male and female subjects

In control males, the relationship between parent economic status and HbA_{IC} (r = 0.049) was weak and non-significant but parent income related negatively and weakly with HbA_{IC} in diabetic males (r = 0.191; P>0.05). In control females moderate and positive relationship (r = 0.599; P>0.05) was observed and in diabetic females there was strong, inverse and significant relationship (r = 0.923; P<0.001).

Hospital admission per month

Frequency of hospitalization in the adolescent diabetics per month ranged from 3 – 4 times in 84% of patients, 5 – 6 times in 10.53% while 5.3% of patient was admitted more than 6 times as presented in Table 5.

Indications for hospitalization and outcome

Table 6 showed that malaria was the greatest indication or hospitalization in 47.3% of patients, while upper respiratory tract infection (URTI) followed 15.8% and diabetic ketoacidosis (DKA) 10.53%. In 15.8% of the patients hospital admission was due to gastroenteritis and in 5.3% of cases it was urinary tract infection and uncontrolled hyperglycaemia respectively.

TABLE 5: Hospital admissions per month

Monthly admissions	No of subjects N = 19	Percentage
1 – 2 times	0	0%
3 – 4 times	16	84.2%
5 – 6 times	2	10.53%
> 6 times	1	5.3%

TABLE 6: Indications for hospitalization and outcome

Indications	Adolescent Diabetics (N = 19)	%	Outcome
Malaria	9	47.3%	Discharged
URTI	3	15.8%	Discharged
UTI	1	5.3%	Discharged
Gastroenteritis	3	15.8%	Discharged
DKA	2	10.52%	Died
Uncontrolled hyperglycaemia	1	5.3%	Discharged

Duration of hospital stay

In more than half of the patients, 14 (73.6%), the duration of hospital was between 1 - 2 weeks. 3 (15.8%) patients stayed 3- 4 weeks, while hospital stay lasted 5-6 weeks in 1 (5.3%) and greater than 6 weeks in another 1(5.3%) patient, as represented in table 7.

Frequency distribution of daily insulin dosing in adolescents type 1 diabetics

Significant number of patients 15(79.0%) had twice daily injections, 3(15.8%) were injecting thrice daily while a patient (5.2%) reported taking once daily insulin as shown in Fig. 1.

Effect of treatment modalities on fasting blood glucose levels in male and female diabetic subjects

The mean value of blood glucose from various treatment modalities was 6.50±0.55 mmol/L for combined therapy; insulin alone was 9.06±0.51mmol/L; diet + insulin therapy was 6.42±0.22mmol/L. Thus fasting blood glucose concentration was significantly lower in diabetic patients treated with diet and insulin compared with combined (p<0.01) and insulin alone (p<0.001).

Effect of treatment modalities on BMI of diabetic male and female subjects

The mean BMI of diabetic patients on combined therapy (22.35±0.68kg/m²) was significantly higher compared with those on diet + insulin 21.80±0.72kg/m²; P<0.001) and insulin alone 18.47 ±1.26kg/m^2; P<0.001).

TABLE 7: Duration of hospital stay

Weeks	Adolescent Inpatients	%
1 – 2 weeks	14	73.68%
3 – 4 weeks	3	15.8%
5 – 6 weeks	1	5.3%
> 6 weeks	1	5.3%

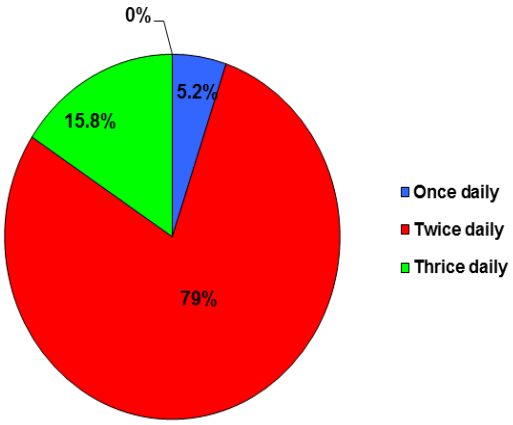

FIG. 1: Daily insulin dosing

FIG. 1: Daily insulin dosing

Effect of treatment modalities on glycated haemoglobin concentration in diabetic male and female subjects

The mean values of glycated haemoglobin in diabetic patients who received combine, insulin alone and diet + insulin therapy were 7.88±0.54; 10.14±0.41 and 6.78±0.29 respectively. It was significantly lower in diet + insulin recipient compared with combine ($P<0.01$) and insulin alone ($P<0.05$).

DISCUSSION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

DISCUSSION

Diabetes mellitus is a medical condition characterized by high blood glucose level and poor insulin performance. In Nigeria, diabetes mellitus is the most common chronic physical health condition in children. Diabetes mellitus is a disease entity that is still an enigma most especially in the developing countries where adolescent/childhood, diabetes is poorly understood and managed[19], although scientists are working to know why the disease is gradually emerging as a public health problem in children and adolescent world-wide,[20] [21], it is important to note that in Nigeria the cumulative prevalence rate (CPR) of type I diabetes mellitus has been reported to range from 0.038% to 0.025% for boys and girls respectively between the ages of 5 – 17 years.[19]

There is no permanent cure yet for diabetes mellitus but long term goals of management according to[1] [2] are to prolong life, reduce symptoms and prevent diabetes related complications.[3]

Hyperglycaemia is considered the aetiological source of most if not all diabetic complications as well as anthropometric derangements. Good glycaemic control has clearly been shown in several studies to reduce risk of development of acute and chronic complication and to slow the progression of already established complications.[4] Hence the need to evaluate the level of glycaemic control in adolescent diabetics being managed at the selected clinics using FBG and HbA_{IC}%. Risk of developing diabetes mellitus increases with age, lack of physical activities and development of DM, also doubles with every 20% of excess body weight and with every decade of life. This study examined anthropometric parameters namely height, weight and body mass indices in diabetic and control subjects. Self-care which includes self-blood glucose monitory and daily insulin use were evaluated. Hospitalization frequency and indications as well as duration and outcome were also evaluated.

Age of onset and duration of ill health in affected adolescents were also assessed with regards to degree of complications expected. The well documented association of DM and raised blood pressure led to the assessment of blood pressure value in our adolescent diabetic and control subjects[22], [23] Outcome of the different treatment modalities on the wellbeing of the diabetic subjects were evaluated.

Socio-economic factors that may have direct or indirect effects on the course of the disease and its management such as parent educational and economic status as well as presence of diabetes in parents and siblings were assessed.[24] Taking into consideration the report that obese adolescent diabetics show significant cognitive slowing as well as learning and memory deficits[9] and [10], the academic performance of the adolescent diabetic subjects was assessed and compared with the control. Blood group distributions amongst the control and diabetic subjects were also assessed.

Socio-economic factors and fasting blood glucose/HbA_{IC}% level

Parents' educational status

Being educated is often an indicator of better socioeconomic status in this environment.[25] According to Williams and Collins, 1995 people of different social statues lead lives that differ in almost all aspects – childhood circumstances, educational experiences, work careers, marriage and family experiences, leisure, neighbourhood conditions and health care. Thus, there are strong indications of influence of socioeconomic factors such as parent educational status and parents' economic status on children/adolescent blood glucose control.[26] Results from this study showed that poor glycaemic control was observed more in patients with parents with poor educational status. Because children and adolescents are growing and developing, their ability to participate in self-management of diabetes varies with their changing motor development, cognitive abilities and emotional maturation, parental involvement is necessary to assure appropriate self-management and good metabolic control, this can only be achieved with a parent empowered educationally to know about the disease and its management.[27] Result of body weight, blood glucose levels and HbAic% showed significant correlation with father's educational status. The more educated the father the more likely he will seek support/provide and follow up management of his child for better glycaemic control.

With regards to maternal educational status, blood glucose levels and HbA_{IC}% in diabetic subjects significantly improved as mothers educational status increases. Reasons for this may not be far-fetched as mothers apart from contributing financially, prepare the meals, feed the child and provide other care. Mother's education is often found to be positively correlated with child health and nutrition in developing countries. Moreover, in most homes the mother is the most important often only health care provider and her routine decisions influence child health.[16] [28] Since they are closer to the child most times they help to ensure that all the do's and don'ts of the management are observed for better glycaemic control. Adolescents whose parents maintain some guidance and supervision in the management of DM have better glycaemic control.[17] It is also important to note that most of the mothers in this study even with high educational levels admitted they did not know that diabetes mellitus could occur in children. In fact they believed DM was a disease exclusive to the adult population.

Parents' economic status

In this study a negative and moderate correlation was observed between parent economic status and blood glucose levels in the diabetics. No correlation was observed in the control subjects. This result may be because parents with higher income who are also educationally empowered can afford required management materials as and when due and can also accommodate hospital costs. Also for unexplained reasons studies from Nigeria found the prevalence of type 1 DM to be higher in children from poor homes.[29] Diabetic children of high economic status parents and diabetics with higher income live longer and manage their blood glucose level better than under class citizens.

Parents' economic status vs body weight

There was a non-significant relationship between parents' economic status and anthropometric parameters in diabetic males and control subjects. However, a strong positive significant relationship was observed in the diabetic females. Thus weight and height improved with improved parent economic status in the females, indicating that female diabetics may have responded better to therapy in this study group. Other contributing factors to this response in female adolescent diabetics may be due to the fact that body fat is more in the females in this age group and also peak height velocity occurring earlier in females can also contribute to the improved height in the diabetic females compared to the diabetic males.[30] Although weight loss just before a diagnosis of type 1 diabetes is the rule, rapid weight gain and normal linear growth should ensure rapidly upon initiation of appropriate treatment and may account for the observed result.[31] With proper management which includes meal planning the anthropometric parameters of patients with type 1 DM can be improved.[32] But it takes higher parental income and motivation to achieve this. There is no metabolic derangement in the control subjects. Hence, there is a physiological balance between intake and output. This accounts for the non-significant relationship between parent economic status and anthropometric parameters in control subjects. This physiological balance is deranged in diabetic subjects; hence the strong correlation with anthropometric parameters, especially in diabetic female subjects with parents of high income who can afford diabetic diets or services of the dietician in addition to other management requirements for optimum glycaemic control.[33]

Diabetes in parents and siblings

Family history of diabetes was obtained in 6(31.58%) subjects. 2(10.53%) out of these had diabetic fathers, 3(15.79%) had a diabetic mother each. Two out of these three mothers had gestational diabetes. Only 1(5.26%) affected diabetic adolescent had an elder male sibling who is diabetic. Positive parental history of Type II diabetes is associated with a later onset of type I diabetes, the metabolic syndrome, and a metabolic profile related to insulin resistance. However, data on the consequence of a family history of type II diabetes on the offspring with type I diabetes are still scarce. Although environmental factors are undoubtedly important[34], familial factors and lifestyle also seem to play a major role, in the pathogensis of DM.[35] Offspring of a parent with diabetes have a lifetime risk of type 2 diabetes of 40%, and when both parents have type II diabetes the risk is even higher.[36] It is also important to note that even in families with a patient with type I diabetes, there

is a higher proportion of relatives with type II diabetes.[37] It is believed that parental country of birth and early exposures to environmental factors play an important role in the aetiology of type 1 diabetes.[38] While it is concluded that transmission ratio of distortion is strongly related to age at onset of diabetes in the diabetic parents, however the recurrence risks is equal in the offspring of mothers and fathers with adult onset diabetes.[39] Though our result may indicate genetic factor involvement, we could not draw any association between the diabetes in some of the parents and offspring due to small sample size and the fact that there are so many parameters which cannot be covered by this study that need to be assessed both in the parents and offspring before drawing a conclusion. Thus family history is as likely to be negative as positive for type I diabetes mellitus.

Academic performance

It has been noted that insulin influences body function such as vascular compliance and cognition. Once insulin enters the human brain it enhances learning and benefits verbal memory.[40] Bearing in mind that school problems such as school phobia, truancy and under achievement which will eventually lead to academic failure is common during adolescence period, when such children are saddled with a chronic ill health like DM with further psychological complications, absenteeism from school due to ill health and frequent hospitalizations then poor academic performance may become inevitable.[41]

In this study academic performance was better in control groups than in diabetic group. This result can be explained by the various reasons mentioned in addition to the effect of recurrent severe hypoglycaemia and hyperglycaemia which has been related to decreased memory and learning capacity.[42] Though it is difficult to draw a strong conclusion due to short duration of ill health, small sample size and the fact that the assessment of academic achievement was based on verbal information which could be deceptive, results showed that children with type 1 diabetes have mild cognitive impairment and subtly reduced overall intellectual functioning. Academic achievement was also slightly lower in early onset diabetes (EOD) compared to late onset diabetes (LOD) in children in their study. But McCarthy and her group in their study found that the subtle cognitive deficits often documented in children with type 1 diabetes may not significantly limit the functional academic abilities of these children over time, thus they concluded that for most children type 1 diabetes is not associated with lower academic performance compared with control and cautioned that careful monitoring is still needed to ensure that episodes of hypoglycaemia associated with seizures are not adversely affecting learning.[42]

Ethnicity/tribe (state of origin)

Different ethnic populations vary in their susceptibility to diabetes and mounting evidence indicates that racial/ethnic differences in morbidity and mortality are tied to socioeconomic resources.[43] Six diabetic subjects are from Cross Rivers, two subjects were from Delta, Rivers, Akwa Ibom and Hausa speaking states of (Kaduna and Niger). Igbo speaking states of Imo and Anambra and Yoruba speaking state of Oyo, each all had 1 diabetic subject. Earlier study in Nigeria adults showed diabetes was more prevalent in the Ibibio and Hausa Fulani subjects than other ethnic group.[44] But the ethnic distribution in this study is across the whole country indicating that adolescent diabetes may be present in more ethnic groups than the above mentioned in Nigeria. Hence, the need to look into best ways for early diagnosis with high index of suspicion to achieve good glycaemic control in affected subject.[45]

SUMMARY

Mean age of diabetic males and females were not statistically significant as compared to male and female control group. Result showed lower body weight, height and BMI in diabetic subjects compared to controls. More adolescent males were affected with DM than females. Average age of onset of illness in diabetic males and females were not significant, and the same result was observed in duration of illness.

No blood pressure abnormalities were observed in both groups. Majority of the parents were of the middle and high social classes. Patient's glycaemic control, anthropometric parameters and general wellbeing correlated positively with their parents' education and economic status. Academic performance was better in non-diabetic than diabetic adolescents. ABO/Rhesus blood group showed predominance of O^{+ve} in both groups.

The major presenting clinical features were polyuria, polydipsia, polyphagia and weight loss. Almost all the patients presented late to hospital. Hospitalization of diabetic patients was mainly due to malaria group. Majority of the diabetic patients had prolonged hospital stay with encouraging discharge rate. Acceptable FBG level, HbA_{IC}%, body weight and BMI were seen in those on diet + insulin followed by those on combination therapy while those on insulin alone had unacceptable values. Self-blood glucose monitoring was inadequate. Daily insulin dosing was also inadequate in these patients. Hence the suboptimal result. Two deaths occurred amongst the diabetic group in the course of this study due to ketoakidosis.

CONCLUSION

Education and enhanced economic status of parents correlate positively with glycaemic control, anthropometric parameters and general wellbeing of the diabetic subjects, especially those that received diet and insulin therapy. Hence, glycated haemoglobin appeared to be a very dependable marker for diagnosis of diabetes mellitus in adolescents.

Research Ethics: Ethical review and clearance of the research protocol, research instruments and consent procedures were obtained from the Ethical Review Committee of the Department of Human Physiology University of Calabar, Nigeria.

Declaration of interest: The authors declare that they have no competing interests.

Funding: No external funding was sought for preparation of this manuscript.

Authors' contributions: Each author contributed substantially to the work and to the preparation of the manuscript.

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