STUDY OF ANTHROPOMETRIC PROFILE, GROWTH AND PUBERTY IN CHILDREN WITH DIABETES MELLITUS

THESIS SUBMITTED TO

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

In partial fulfilment of the requirement for the degree of

DOCTOR OF MEDICINE (M.D.)

(PEDIATRICS)

DR. U K KANDHA KUMAR

JULY, 2020

AIIMS, JODHPUR

(DECLARATION BY THE CANDIDATE)

DECLARATION

I hereby declare that the thesis titled **"STUDY OF ANTHROPOMETRIC PROFILE, GROWTH AND PUBERTY IN CHILDREN WITH DIABETES MELLITUS"** embodies the original work carried out by the undersigned at All India Institute of Medical Sciences, Jodhpur.

Dr. U K Kandha Kumar
Junior Resident
Department of Pediatrics
All India Institute of Medical Sciences,
Jodhpur, (Rajasthan)

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

CERTIFICATE

This is to certify that the thesis titled **"Study of anthropometric profile, growth and puberty in children with diabetes mellitus"** is the bonafide work of **Dr. U K Kandha Kumar** carried out under our guidance and supervision in the Department of Pediatrics, All India Institute of Medical Sciences, Jodhpur.

Dr. Kuldeep Singh
Professor and Head
Department of Pediatrics
All India Institute of Medical Sciences, Jodhpur

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

CERTIFICATE

This is to certificate that the thesis titled "**Study of anthropometric profile, growth and puberty in children with diabetes mellitus**" is the bonafide work of **Dr. U K Kandha Kumar** a postgraduate student in the Department of Pediatrics, AIIMS Jodhpur, in partial fulfillment of the requirement for the degree of M.D. PEDIATRICS is a bonafide work done by him under our direct supervision and guidance.

GUIDE

Dr. Varuna Vyas
Associate Professor,
Department of Pediatrics
All India Institute of Medical Sciences, Jodhpur

CO-GUIDES

Dr. Kuldeep Singh
Professor & Head
Department of Pediatrics
AIIMS, Jodhpur

Dr. Siyaram Didel
Associate Professor
Department of Pediatrics
AIIMS, Jodhpur

Dr. Pratibha Singh
Professor and Head
Department of Obstetrics and Gynecology
AIIMS Jodhpur

ACKNOWLEDGEMENT

These are not acknowledgements, these are dedications...

First and foremost, I am very grateful to the Almighty, for allowing me to be a part of this prestigious institution and blessing me in accomplishing this work.

I dedicate this dissertation to Dr. Varuna Vyas ma'am, Associate Professor Department of Pediatrics, AIIMS, Jodhpur, for being the perfect guide and for the support at every step. Her words of encouragement and reassurance at each step have given me the motivation to try my best to complete this dissertation. She has been a source of inspiration for me to improve myself on a daily basis. This dissertation is but a small reflection of her strong personality and love for this subject. I have gained many life lessons from her, on topics ranging from credibility to enthusiasm, punctuality to objective criticism - lessons which I am still trying to satisfactorily imbibe.

I also thank my co-guides Professor Dr. Kuldeep Singh, Dr Siyaram Didel, and Professor Dr. Pratibha Singh, for their valuable inputs and constant support.

My sincere thanks to Dr. Akhil Dhanesh Goyal sir, Associate Professor, Department of Social Preventive Medicine, for helping me in statistical analysis and replenishing this dissertation.

A lot of appreciation is due to my wonderful teachers- Professor Arun Singh, Professor Dr Jagdish Prasad Goyal, Dr. Neeraj Gupta, Dr. Prawin Kumar, Dr. Aliza Mittal, Dr Bharat Choudhary, Dr Lokesh Saini, Dr. Jitendra Kumar Meena, Dr Thanigainathan, Dr Sushil Kumar Choudhary, Each one of my professors I have learnt something from, and without their teachings, my training as a researcher or as a student would be incomplete.

I dedicate this dissertation to all of my patients, who in the course of this study- the planning, counselling, discussion and preparation, taught me more about trust, patience and humanity than any other part of my training has

I dedicate this dissertation to Mr. K K Udhaya Kumar and Mrs.U K Uma, my parents for sharing my every dream, every hope, and every aspiration and providing every

means- emotional, psychological, and material to fulfil them. No number of words can contain the magnitude of my gratitude or affection towards them. A special dedication to Ms U K Preethika, my sister for always standing beside me and for all the support.

I could never thank them enough for doing everything they do for me and for constantly putting up with me even on days when I would probably not want to put up with myself.

I dedicate this dissertation to my post-graduate friends, Dr.Anil, Dr.Vishnu, Dr.Doreswamy, Dr.Komal, Dr.Sanjana. Without their assistance, this dissertation would not be complete.

I dedicate this dissertation to my friends Dr. Akhil, Dr Nisha and Dr Likith for their love and support.

A special dedication to my seniors- Dr. Ramzan, Dr. Rohit Sasidharan, Dr. Bharti Yadav, Dr Simranjeet Singh, Dr Sakshi, Dr Pallavi, Dr Vivek. Dr Abishek, Dr Chetan, Dr Golla Ramakrishnan, Dr Ravali, Dr Anil, Dr Vimesh for their constant guidance and support and turning this arduous taskinto a memorable journey.

A very special gratitude goes out to my postgraduate seniors Dr. Chirag Thakur, Dr Gaurav Gautam, Dr. Priyanka, Dr Roma Debbaram, Dr Deepthi, Dr Harshini, Dr Saranya, Dr Jashan, Dr Harshitha, Dr Aakash, Dr Sujatha, Dr Rahul, Dr Prakshi, Dr Bagyashree, Dr Debhasish, Dr Sarita, Dr. Pujita, Dr Ashwini, Dr Lekshmi, Dr Siddan, Dr Dyvik, and my beloved juniors, Dr Deeksha , Dr Saketh, Dr Pradeep, Dr Janki, Dr Shaurab, Dr Aasha, Dr Sai Saranya, Dr Robin, Dr Sagar, Dr Samad, Dr Ananya, Dr Sathya, Dr Monika, Dr Revati, Dr Megha, Dr Anurag, Dr Vaishnavi, Dr Kushi, for all the support.

A sincere thanks to Dr.Vaman V Khadilkar sir for providing excel macros for Height, weight, BMI and height velocity Z score calculation.

I am also grateful to the nursing officers of PACA, the Pediatric ward and Pediatric OPD for their unfailing support and assistance throughout my thesis preparation.

This dissertation owes its final form to Mr. Taufiq and team. They compiled the pages full of misaligned words and strings of scattered data I gave them and turned it into this beautiful volume. I owe them profuse thanks.

There are several other exceptional individuals who have played a role, to a noticeable extent, in my thought process and my work. By way of gratitude, I shall avail myself of their continued contact and inspiration, and be for them an ever-yielding well of friendship and trust.

-

- ***Dr U K Kandha Kumar***

LIST OF ABBREVIATIONS

T1DM	Type Diabetes Mellitus
AIIMS	All India Institute of Medical Sciences
GAD	Glutamic acid decarboxylase
Anti-TPO Ab	Anti-Thyroid peroxidase antibody
Anti-TTg IgA	Anti-Tissue transglutaminase antibodies immunoglobulin A
US	United States
EU	European Union
DKA	Diabetic keto acidosis
HbA1c	Glycated hemoglobulin
MDI	Multi-dose insulin
CSII	Continuous subcutaneous insulin infusion
GLP-1	Glucagon-like peptide 1
BMI	Body mass index
HVZ	Height velocity Z score
HAZ	Height for age Z score
WAZ	Weight for age Z score
BMIAZ	BMI for age Z score
WHO	World Health Organization
IAP	Indian Academy of Pediatrics
SPSS	Statistical Package for Social Sciences
OPD	Outpatient department
IPD	Inpatient department
SPSS	Statistical Package for Social Sciences
DelHbA1C	Change in HbA1C
ISPAD	International Society for Pediatrics and Adolescent Diabetes
HLA	Human Leukocyte antigen
TBBA	Total body bone area
IGF	Insulin-like growth factor
IGFBP	Insulin-like growth factor binding protein

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INTRODUCTION

Human growth is a complex physiological process, that is unique to fetal life and childhood. It is regulated by genetic, hormonal and environmental factors. Normal human growth is pulsatile in nature[1]. Following the rapid growth of fetal life, there is a deceleration of growth during the first 3 years of life (infantile phase). This infantile phase is followed by a slowly decelerating childhood component. During adolescence, there will be a pubertal spurt showing a sigmoid-shaped pattern[2]. GH, the principal hormone involved in somatic growth and body composition, expresses its action directly or through its effects on IGF-1, IGF-binding proteins (IGF-BP) and acid labile subunit (ALS). Other hormones that influence the growth include thyroxine, adrenal androgens, sex steroids, glucocorticoids, ghrelin, leptin and insulin along with various neurotransmitters, metabolic modulators and other external factors[2]

Growth is an important indicator of health in childhood and adolescence including for those with type 1 diabetes (T1D). Optimal growth and the achievement the of final target height is one the quality indicators of childhood diabetes management, whereas suboptimal growth reflects endocrine and metabolic abnormalities[3]. There are several factors associated with growth in children and adolescents with type 1 diabetes mellitus, such as the age at onset, duration of diabetes, glycated hemoglobin levels, gender, and treatment modality. Optimal glycemic control likely influences child growth as insulin modulates the growth hormone/IGF-1 axis. Insulin regulates the expression of hepatic GH receptors, affects IGFs and IGFBPs synthesis by modulating GH post-receptor events, and significantly increases IGF 1 bioactivity that causes upregulation of growth. Low portal insulin as seen in T1DM leads to GH hypersecretion, low circulating IGF1 and IGFBP3 levels.[3] Insulin also plays an important role in regulating ovarian function. Granulosa, theca and stromal ovarian cells may be affected by insulin deficiency or excess, which may be present in women with type 1 diabetes mellitus. In vitro studies of theca cells obtained from healthy women have shown that insulin stimulates steroidogenesis [4]. This response, however, is greatly enhanced when the cells are simultaneously exposed to LH and insulin, leading to the concept that insulin may act as a co-gonadotropin[3.] Studies evaluating T1D women with amenorrhea have found low basal and stimulated gonadotropin levels that positively co-relates with poor glycemic control[5]

Type 1 Diabetes mellitus is one of childhood's most common chronic metabolic disorders that results from the destruction of insulin-producing pancreatic beta cells. There are several auto-antigens found within the beta cells that trigger the disease process and those include GAD (Glutamic acid decarboxylase), zinc transporter 8, Insulinoma associated antigen 2, Islet cell cytoplasm (ICA), Insulin autoantibody (IAA)[6]. Other factors including genetic susceptibility, viral infection, and dietary habits influence the pathogenesis of Type 1 diabetes mellitus. It is associated with other autoimmune disorders. Up to 25% of Type 1 Diabetes mellitus patients have positive Anti-TPO antibodies[7], around 10% of patients have autoimmune hypothyroidism[3] and 0.2% to 1% of patients have autoimmune hyperthyroidism[8]. The prevalence of the biopsy-proven celiac disease is around 13.5% and positive celiac serology is around 34.1%[9].

The incidence of type 1 diabetes increases with an average peak of around 10–14 years, but it can occur at any age. [10] The incidence is found to be higher in males than in females in high–incidence countries, and the opposite pattern is seen in low–incidence countries. [11] After puberty, males have an increasingly higher incidence of developing type 1 diabetes than females, even in low–incidence countries such as China. [10] Most standardized long-term incidence data focus on children younger than 15 years, with incidence ranging from 1 to 3 per 100 000 per year in China and other Asian and South American countries[10,11], around 10–20 per 100 000 in South European countries[12] in the USA [13], and 30–60 per 100 000 in Scandinavia [12]. Globally, the incidence of type 1 diabetes started to increase in the 1950s with an average annual increase of 3–4% over the past three decades. It is estimated that India has around 97,700 children diagnosed with Type 1 diabetes mellitus [14] with a prevalence of about 0.26/1000 population with a peak age of onset at 12 years[14]. In Karnataka, the incidence of Type 1 DM is 3.7/100,000 in boys and 4.0/100,000 in girls over 13 years of data collection. At Karnal, in Haryana, the prevalence of T1DM is 26.6/100,000 in urban and 4.27/100,000 in rural areas of the district[14]

Type 1 Diabetes mellitus can have the following clinical presentations. a) Classical osmotic symptoms including polyuria, polydipsia, polyphagia with weight loss despite adequate appetite[15] b) Diabetic Ketoacidosis[15] c) Clinically silent disease with incidental diagnosis[15] d) sometimes with rare presentations including perineal candidiasis[17], acute visual disturbances[18] due to alterations in the osmotic milieu of the

lens, cataract due to long-standing hyperglycemia[19]. It has special populations including infants with neonatal diabetes which are mostly due to monogenic etiologies that causes dysfunction pancreatic in beta cells resulting in poor insulin secretion. Another group of the special population includes children less than 5 years, since they are more prone to dehydration and have a higher incidence of diabetic ketoacidosis.

It has the following stages[16]

Stage 1 – Beta cell autoimmunity (≥2 islet autoantibodies), normal blood glucose, and pre-symptomatic

Stage 2 – Beta cell autoimmunity (≥2 islet autoantibodies), raised blood glucose (dysglycemia), and pre-symptomatic

Stage 3 – Beta cell autoimmunity, raised blood glucose (dysglycemia), and symptomatic

Stage 4 – Longstanding T1DM

Diabetes mellitus is diagnosed based on any one of the following signs impaired glucose tolerance[13]. 1) Fasting plasma glucose ≥126 mg/dL (7 mmol/L) on more than one occasion. Fasting is defined as no caloric intake for at least eight hours 2) Random venous plasma glucose ≥200 mg/dL (11.1 mmol/L) in a patient with classic symptoms of hyperglycemia. 3) Plasma glucose ≥200 mg/dL (11.1 mmol/L) measured two hours after a glucose load of 1.75 g/kg (maximum dose of 75 g) in an oral glucose tolerance test. Most children and adolescents are symptomatic and have plasma glucose concentrations well above ≥200 mg/dL (11.1 mmol/L); thus, an oral glucose tolerance test is seldom necessary to diagnose T1DM. 4) Glycated hemoglobin (A1C) ≥6.5 percent[13] (using an assay that is certified by the National Glycohemoglobin Standardization Program). This criterion should be confirmed by another measure of hyperglycemia.

The goals for successful management of diabetes include, a) strict glycemic control to prevent the long-term sequelae of hyperglycemia[20,21], b) to train the patient, parents and caregivers in self-management of diabetes to maintain the glucose levels within the target range, to prevent and manage hypoglycemia[20,21] c) Maintain normal growth, development, and emotional maturation and support increasing independence and self-care of diabetes as the child grows older[20,21].

Advances in the treatment of T1DM have decreased the risk of complications and comprehensive monitoring has delayed their occurrence, resulting in an overall increase in the quality of life of patients. Nutritional education, with frequent assessment of the dietary carbohydrates and proper use of the insulin-to-carbohydrate ratio, has allowed for optimizing insulin dosage. [22]

The basal-bolus regimen with multiple dose insulin (MDI) injections or continuous subcutaneous insulin infusion (CSII) and multiple capillary blood glucose measurements allow for better metabolic control. For this to be achieved, adequate and continued diabetes education of patients and families is required.[23,24] The goals of treatment of T1DM are to maintain adequate pre- and post-prandial blood glucose levels, avoiding hyperglycemia as well as hypoglycemia, and long-term complications.[25,26,27]

The discovery of insulin in 1921–22 was clearly the most significant therapeutic event in the history of type 1 diabetes. Diabetes management in modern countries often includes the use of insulin analogues and mechanical technologies (eg, insulin pumps and continuous glucose monitors) for improved treatment of type 1 disease. [28] In the future, therapies that closely emulate the physiological role of the endocrine pancreas will, hopefully, improve lifestyles in addition to preventing complications.

Tamborlane and colleagues reported that a real-time continuous glucose monitoring system decreased the amount of time spent in hypoglycemia (<4 mmol/L [70 mg/dL]) and lowered HbA_{1C} when used by patients an average of 6 days a week. In this study, the degree of HbA_{1C} reduction directly correlated with higher HbA_{1C} concentrations before beginning continuous glucose monitoring. In a second study, continuous glucose monitoring lowered nocturnal hypoglycemia in children (<18 years) with type 1 diabetes, compared with self-monitored blood glucose. [29] Therefore, continuous glucose monitoring is most appropriate for highly motivated patients with type 1 diabetes who are willing to wear the monitoring device and those with continuous poor control during intensive insulin therapy. [30]

New insulin analogues, incretins, and other hormones are being investigated for their ability to improve the management of type 1 diabetes. Examples include insulin degludec , an analogue that might improve basal insulin administration in patients with type 1 diabetes, since it provides effective glycemic control and reducesthe risk

of nocturnal hypoglycemia.[31] GLP-1 might also prove beneficial, with studies noting that this incretin decreased peak postprandial glucose by 45% regardless of residual β-cell function. [32] The hormone pramlintide has been shown to reduce postprandial hyperglycemia, body weight, insulin dosage, and HbA_{1C} concentrations.[33] Leptin might also benefit type 1 diabetes therapy via its ability to reverse a catabolic state through suppression of hyperglucagonemia. [34]

REVIEW OF LIRERATURE

There are multiple studies, being conducted to assess the anthropometric profile and pubertal development in children with type 1 diabetes mellitus. Most of the studies showed a significant impairment of growth[35,36,38-41,48], delay in pubertal onset and other menstrual irregularities associated with type 1 diabetes mellitus[44-47]. There are few studies that showed Type 1 diabetes mellitus per se will not cause any growth faltering, and the subjects were able to attain the final target heights [37]. Some of the studies have co-related the factors like glycemic control, age at onset, duration of the disease with the anthropometric profile and final adult heights[36,43].

INDIAN STUDIES:

Parthasarathy L et al.[35] conducted an observational cohort study to assess the longitudinal growth in children with type 1 diabetes mellitus. They studied 160 children (75 boys). They found that the mean Height velocity was 5.5 ± 2 cm at end of the study. The mean HVZ score was -0.3 ± 1.5. They found that, the children on basal-bolus regimen (n=72) had a better mean HVZ score 0.5 ±1.6 vs those children on split mix regimen -0.3 ± 1.4. Only fifty percent of the children attained the final target height and the remaining had suppressed height. Children diagnosed before 5 years of age were the most affected. Around 18% of children had short stature with HA Z scores less than 2 SD. The study concluded that, when compared to healthy children, children with diabetes had low height Z scores and had poor height velocity. Longer disease duration and poor metabolic control were associated with low height velocity Z scores. Children diagnosed at younger age had poor height velocity.

Parthasarathy L et al.[36] conducted a cross-sectional study to determine bone mineral density in Indian children and adolescents with Type 1 diabetes mellitus. Height Z score, IGF1 level and bone mineral density of spine using DEXA scan with normative Z scores were recorded. The mean age at diagnosis was 11.1±3.8years, disease duration was 2.2±2.5years and mean HbA1C was 10.1±1.8%. Height was lower in the diabetes group when compared to the reference population; Serum IGF1 Z scores were lower amongst the group with longer disease duration when compared with newly diagnosed patients (-1.58±1.3 vs -2.63±0.7; P=0.037). They found that the duration of diabetes (β=-0.180, P=0.000) and glycemic control (HbA1C; β=-0.096,

P=0.042) were the negative predictors of height and TBBA (Total body bone area) in younger children. The study concluded that a longer duration of the disease is associated with short bones and thin bone, however, the bone mineral density is preserved. There is an increased risk of bone fragility and fractures in children with diabetes mellitus.

Khadilkar V V et al.[48] in their retrospective, cross-sectional case-control study, assessed the anthropometric profile of diabetic children and compared them with age-gender-matched healthy controls. It was found that the mean age at diagnosis was 9.7 ± 4.4 years. Children with diabetes had low height (128.3 ± 24.3 cm vs. 133.6 ± 24.7 cm) and low BMI (29.2 kg ± 15.3 vs. 31.3 ± 15.4 kg). HAZ (-1.1 ± 1.2 vs. -0.2 ± 0.8) and Weight for age Z Score (WAZ) (-1.2 ± 1.3 vs. -0.7 ± 1.3) were significantly lower in children with diabetes when compared with the controls ($p < 0.05$). There was no significant difference in the anthropometric profile between children on different insulin regimens. HAZ of children was most affected in children diagnosed at less than 3 years of age. Children diagnosed with diabetes after puberty (>14 years) were comparable to healthy controls. The study concluded that there is a significant growth faltering in the children with type 1 DM when compared to the controls.

Ruchi Udawat et al. [37] conducted a cross-sectional study in children between 7 and 12 years of age diagnosed with type 1 DM in Ajmer city. Study population was100 patients. Their anthropometric profile was studied and was correlated with their clinical and health status. The study population was divided into 2 groups based on the age at diagnosis. Group A had patients in the age group of 7-9 years and group B had patients in the age group of 10-12 years. Height, weight, BMI, and Waist circumference were recorded and compared to the WHO and IAP standards. The study concluded that there was no significant growth faltering in children with diabetes mellitus. However continuous growth monitoring is an integral part of diabetes management.

Raha O et al.[46] in an observational cohort study concluded that there was a significant delay in the onset of menarche and high prevalence of menstrual irregularities in adolescent females with type 1 DM when compared to the other general population in West Bengal.

INTERNATIONAL STUDIES:

Jannet Svensson et al.[38] conducted a multicentric study across fifty-five centers and enrolled 22,941 subjects. The median (and IQR) age of the patients was 14.8 years (11.2, 17.6) and the median diabetes duration was 5.6 years (3.1, 8.9), and height z-score 0.34 (-0.37, 1.03). It was found that the height z scores were more in subjects in the younger age group, those with short disease duration and insulin pump users. Height was more affected in subjects with high HbA1C. The study concluded that in the patients receiving treatment from the centres proving modern medical management, there was a low incidence of growth faltering.

Elamin A et al.[39] conducted a prospective cohort study among 72 patients with type 1 DM. Their age was between 7 and 13 years. They were enrolled from the onset of diabetes and were followed up longitudinally until the final height was attained. They found that the mean height for age z score at diagnosis was.04 in boys and -0.15 in girls. The growth velocity was slow, and the pubertal growth spurt was significantly reduced. The mean final height was low. The mean age at menarche in girls (15.1 years) and the mean age of full sexual maturation in boys (17.2 years) were significantly delayed. This faltering in growth and delay in sexual maturation were positively correlated with the duration of the disease and HbA1c levels. BMI was low at the time of diagnosis and has significantly improved after the start of treatment and during puberty. The study concluded that diabetes mellitus possesses a significant impairment on growth and pubertal development.

Shaikh W et al.[40] enrolled children with type 1 DM between 8 to 18 years of age and followed them 6 monthly. The final height was compared with the targeted height of the respective subjects. The mean age at diagnosis was 11.17 ± 4.77 years and the mean age at menarche was 13.56 ± 1.41 years. The study concluded that a significant proportion of subjects was unable to attain the final targeted height and it is mandatory to keep a regular check on growth and pubertal status in type 1 diabetic patients.

Palmper M et al.[41] conducted a multi-centric study in 1294 patients with type 1 diabetes mellitus in the age group between 7 to 16 years and followed them longitudinally. It was found that there was a significant impairment in growth velocity. The highest HbA1c surge in boys coincided with the peak of growth spurt. In girls, HbA1c surge increase was observed during late phases of puberty. Despite there

being a significant impairment in the growth velocity, the subjects almost reached their final target heights.

Bizzarri C et all[42] conducted an observational cohort study to analyze the pubertal growth, final adult height, and glycemic profile in children with T1DM, who are on treatment with basal-bolus regimen or continuous subcutaneous insulin infusion via infusion pump. The study showed that the ag at onset of puberty was 11.7 ± 1.1 years in males and 10.9 ± 1.3 in females. Age at adult height attainment was 16.4 ± 1.6 years in males and 14.1 ± 1.8 years in females. HbA1 an lipid profile levels were high during puberty. Height for age Z scores at diagnosis was higher than target height SDS but however, there was no significant difference between the final height and target height. BMI Z scores showed an increasing trend from diagnosis to puberty.

Timoteo C et all[43] conducted a retrospective cohort study and found that there was an inverse association between HbA1c and growth velocity, although it was not statistically significant. The height z scores were normal at the time of diagnosis, and there is a dip in height velocity at the time of puberty. However, the subjects were able to attain the final target heights. The study concluded that, although HbA1c negatively influenced the height velocity and pubertal growth spurt, but however the subjects were able to attain the final target heights.

Codnet E et al.[44] conducted a case-control study to assess the anthropometric profile and pubertal development, in adolescent girls with type-1 diabetes mellitus compared to healthy controls. It was observed that there was a 6 months delay in thelarche in the Type 1 diabetes group ($p < 0.05$). There was a delay in menarche by 6 months in girls with T1DM ($p = 0.03$). Waist Hip Ratio was decreased during puberty in control group ($p < 0.001$), but not in the diabetes group. The final target height was the same in both groups. They concluded that there was a significant delay in puberty in adolescent girls with Type 1 diabetes mellitus.

Schweiger BM et al.[45] in their study compared age at menarche in females with T1DM and control group from National data, determined the factors associated with delay in menarche and menstrual irregularities in adolescent girls with T1DM. They found that menarche was delayed in adolescent females who were diagnosed with type 1 DM prior to menarche (12.81 +/- 0.09 years) when compared with the adolescent females diagnosed with type 1 diabetes mellitus after the onset of menarche (12.17

0.19 years, p = 0.0015). The mean age of menarche was 12.27 +/- 0.038 years in the T1DM group. The age at menarche was significantly earlier in the control group than adolescent females with T1DM prior to menarche (p < 0.0001) and similar to adolescent females diagnosed after menarche (p = 0.77). There was a negative correlation between BMI Z scores and age at menarche and there was no correlation with HbA1C levels. The prevalence of menstrual irregularities in type 1 DM patients was 35%. The study concluded that despite, the advancements in the treatment of Type 1 DM in recent decades, there prevails a significant menstrual delay and a high prevalence of menstrual irregularity.

Bonfig W et al.[47] conducted a multicentric study to determine the effect of type 1 diabetes on the growth and target adult height on the German and Austrian populations. The mean age at diagnosis was 8.8 ± 4.2 years, with a mean height SDS of 0.22 ± 1.0. The mean duration of diabetes was 9.1 ± 2.6 years, and the mean HbA1c concentration was 7.9% ± 1.2%. On regression analysis, it was found that there was a positive corelation of the final target with the height at onset of diabetes (P < .0001) and a negative corelation of the final adult height with mean HbA1c (P < .0001) and duration of diabetes (P = .0015).

Table 1: SUMMARY – REVIEW OF LITERATURE:

Author	Name of the study	Result
INDIAN STUDIES:		
Parthasarathy L et al.[35] Indian.Pediatr 2016 Nov	Longitudinal Growth in Children and Adolescents with Type 1 Diabetes. Sample size - 160	Children with diabetes were shorter and had lower height velocity. Longer disease duration and poor metabolic control were associated with low height velocity Z scores. The height velocity of children diagnosed at younger years was the most to be affected.
Parthasarathy L et al.[36] Bone. 2016 Jan	Bone status of Indian children and adolescents with type 1 diabetes mellitus Sample size - 170	The longer duration of the disease is associated with short and slender bones; however, bone mineral density is preserved. There is an increased risk of bone fragility and fractures in children with diabetes mellitus.
Khadilkar V V et al.[48] Indian J Endocrinol Metab. 2013 Nov	Growth status of children and adolescents with type 1 diabetes mellitus	HAZ of children who were diagnosed at <3 years of age was the least among all diabetic children. There is a significant growth faltering in children with type 1 diabetes mellitus when compared to the healthy controls
Ruchi Udawat et al. [37] Acta Scientific Nutritional Health 2022	Anthropometric Profile of Type1 Diabetic Children (Aged 7-12years) of Ajmer City of Rajasthan (India) Sample size - 100	There was no significant growth faltering in children with diabetes mellitus
Raha O et al.[46] Gynecol Endocrinol.	Menarcheal age of type 1 diabetic Bengali Indian females	There is a significant delay in menarche and a high prevalence of

2013 Nov	Sample size - 103	menstrual irregularities in adolescent females with type 1 diabetes mellitus when compared to the other general population in West Bengal.
INTERNATIONAL STUDIES:		
Svensson J et al.[38] Pediatr Diabetes. 2018 Dec	The influence of treatment, age at onset, and metabolic control on height in children and adolescents with type 1 diabetes-A SWEET collaborative study Sample size - 22,941	Height was more affected in subjects with high HbA1C. For patients receiving treatment from the centers proving modern medical management, there was a low incidence of growth faltering.
Elamin A et al.[39] J Diabetes Complications. 2006 Jul-Aug	Growth, puberty, and final height in children with Type 1 diabetes Sample size - 72	The growth velocity was slow, and the pubertal growth spurt was significantly reduced. The mean final height was low. This faltering in growth and delay in sexual maturation were positively correlated with the duration of the disease and HbA1c levels.
Shaikh W et al. [40] Cureus. 2022 Feb	Linear Growth and Final Height in People With Type 1 Diabetes Sample size – 66	A significant proportion of subjects were unable to attain the final targeted height
Palmper M et al.[41] J Diabetes Res. 2017	Interaction of Pubertal Development and Metabolic Control in Adolescents with Type 1 Diabetes Mellitus Sample size - 1294	There was a significant impairment in growth velocity. However, the subjects were able to reach their final target heights

Bizzarri C et al.[42] Horm Res Paediatr. 2018	The Impact of Insulin Treatment and Metabolic Control Sample size - 104	There was no significant difference between the final height and the target height. BMI Z scores showed a positive trend from diagnosis to puberty
Timoteo C et al.[43] Acta Med Port. 2012 Jul-Aug	Growth and puberty in type 1 diabetes mellitus - experience from a Pediatric endocrinology unit Sample size - 39	Although HbA1c negatively influences the height velocity and pubertal growth spurt, there was no compromise in the attainment of the final height
Codnet E et al.[44] Pediatr Diabetes. 2004 Dec	Ponderal gain, waist-to-hip ratio, and pubertal development in girls with type-1 diabetes mellitus Sample size Cases – 100 Controls - 576	The final height was similar to the target height. There was a significant delay in puberty in adolescent girls with Type 1 diabetes mellitus.
Schweiger BM et al.[45] Reprod Biol Endocrinol. 2011 May	Menarche delay and menstrual irregularities persist in adolescents with type 1 diabetes Sample size - 228	There was a negative correlation between BMI Z scores and age at menarche and there was no correlation with HbA1C levels. The prevalence of menstrual irregularities in type 1 DM patients was 35%.
Bonfig W et al.[47] J Pediatr. 2012 Jun	Growth in children and adolescents with type 1 diabetes Sample size – 22,651	There was a positive correlation of the final target with height at the onset of diabetes and a negative correlation of final adult height with mean Hb A1c and duration of diabetes.

RESEARCH QUESTION

Does Type 1 Diabetes mellitus impact longitudinal growth and pubertal development?

LACUNAE IN LITERATURE

At present the literature on Growth and Puberty in Indian children is very limited. We could find only 3 similar studies from India. These studies have evaluated the baseline anthropometric profile of children with type 1 DM and compared them to the healthy population. None of them have included children with co-morbidities associated withT1DM, including celiac disease, thyroid disorders and Mauriac syndrome that possess a significant impact on growth parameters. None of them have acknowledged pubertal issues. No similar studies were done in North western India. Only few studies have assessed the co-relation between the metabolic profile i.e., change in HbA1C with Height velocity z scores.

Our patients are mostly from poor families and many of them have not received dedicated pediatric diabetes care prior presenting to us.

AIMS AND OBJECTIVES

Aim:

- To study the anthropometric profile, growth and puberty in children and adolescents with diabetes

Primary Objective:

- To study the anthropometric profile and pubertal stage of children with Diabetes and to co-relate them with clinical profile of the patient.

Secondary Objectives:

- To study the prevalence of short stature in children with Diabetes Mellitus.
- To study the prevalence of pubertal precocity/pubertal delay in children with Diabetes Mellitus.
- To study the prevalence of menstrual irregularities in adolescent girls with Diabetes Mellitus
- To follow up the children with Diabetes Mellitus and see for changes in anthropometry in the follow up.

MATERIALS AND METHODS

ETHICS APPROVAL:

Institute's Ethics committee approval was obtained. Certificate reference number – AIIMS/IEC/2021/3371

STUDY DESIGN:

Observational Cohort Study

STUDY SITE:

Department of Pediatrics, AIIMS Jodhpur

STUDY POPULATION:

All children with Diabetes Mellitus coming to the Department of Pediatrics

INCLUSION CRITERIA:

All children 1 to 18 years of age with the diagnosis of Diabetes Mellitus.

EXCLUSION CRITERIA:

Those who refused to give consent

ENROLMENT:

- All children 1 year to 18 years with the diagnosis of Diabetes Mellitus coming to the department of Pediatrics were approached for the participation in the study.
- An Information Sheet giving the details of the study was provided and the nature of the study was verbally explained.
- Age-appropriate assent and consent was obtained. Enrolment, recording of baseline information was done after obtaining consent/assent.

DATA COLLECTION:

- Patients with the diagnosis of Type 1 Diabetes mellitus were enrolled in this study at the time of presentation to the Department of Pediatrics.

- Age-appropriate assent and consent were obtained.
- Demographic and clinical information were collected in a pre-prepared proforma.
- Anthropometric details of the patients including Height, Weight, BMI, Mid-parental height, along with their respective Z scores (WHO Z scores for children less than 5 years and IAP Z score for children more than 5 years) were documented.
- The height was measured to the nearest millimetre.
- Weight was measured to the nearest 0.1 kg.
- All anthropometric measurements were taken three times, and the average of the three readings was taken as the final value.
- The sexual maturity rating (SMR) using Tanners Staging was documented.
- Appropriate history was taken and detailed clinical examination was done.
- Baseline HbA1C at the time of presentation was measured and documented.
- All clinically relevant investigations including Thyroid function test, Anti-TPO antibody levels and Anti-TTg IgA levels were done and documented in the proforma. No extra investigations were done for the purpose of the study.
- The menstrual history was documented in all adolescent girls. If any abnormality was identified, appropriate investigation and treatment was done.
- Once enrolled, the children were followed up till the completion of the study.
- In the follow up, detailed anthropometric evaluation including Height, Weight, BMI, along with their respective Z scores (WHO Z scores for children less than 5 years and IAP Z score for children more than 5 years) were documented.
- HbA1C was measured in the follow up visit and was documented in the proforma.
- Height velocity was measured using the height at enrollment and at the last available follow up height.

- Height velocity Z score was documented. Height velocity z score by Khadilkar, V et all (Khadilkar, V., Khadilkar, A., Arya, A. et al. Height Velocity Percentiles in Indian Children Aged 5–17 Years. Indian Pediatr 56, 23–28 (2019)) was used as the reference for calculation height velocity Z score for children more than 5 years of age. There is no standard reference for height velocity Z scores for children less than 5 years of age.
- The co-relation between change in HbA1C with the change in anthropometric profiles including height velocity Z score in the follow up was studied.

SAMPLE SIZE CALCULATION:

Since it was a time bound single center study no formal sample size calculation was done.

All participants satisfying the inclusion criteria were enrolled.

STATISTICAL ANALYSIS:

- All anthropometric data were converted into Z scores based on WHO growth charts (for children with less than 5 years of age), revised IAP growth charts and Indian height velocity growth charts (for children more than 5 years of age).
- Data was analysed using SPSS version 23.
- Nominal data was described using frequency, percentages and compared using Chi Square test or Fisher's Exact test as applicable.
- Ordinal data was described using median and interquartile range and compared using Mann Whitney U test or Kruskal Wallis test as applicable.
- Continuous data was described using mean and standard deviation and compared using independent sample t test.
- Co-relation between continuous variables was assessed using Pearson’s co-relation co=efficient and scatter plot.
- A p value of less than 0.05 was considered as significant.

OUTCOME:

- Assessment of the clinical profile, anthropometric profile (Weight, Height, BMI with their respective Z scores) and pubertal stage of children with Diabetes Mellitus.
- Prevalence of short stature in children with Diabetes mellitus.
- Prevalence of pubertal precocity/pubertal delay in children with Diabetes mellitus.
- Prevalence of menstrual irregularities in adolescent girls with Diabetes Mellitus.
- Prevalence of co-morbidities associated with Diabetes mellitus including Celiac disease, Autoimmune hypothyroidism, Mauriac syndrome and their impact on growth parameters.
- Changes in anthropometry (including height velocity with respective Z scores) in the follow up.
- Change in HbA1C in the follow up.
- Co-relation of change in HbA1C with duration of diabetes mellitus and with height velocity Z score in the follow up

OBSERVATIONS AND RESULTS

- In our observational cohort study, we have enrolled 100 patients with Diabetes mellitus in the age group between 1 and 18 years, visiting the Pediatric Endocrinology OPD, Pediatric Emergency, and the patients admitted in inpatient ward of the Department of Pediatrics, AIIMS Jodhpur.
- All were diagnosed to have type 1 Diabetes mellitus.
- All the patients remained insulin dependent throughout the course of the study
- Eighty patients were followed with a minimum duration of six months.

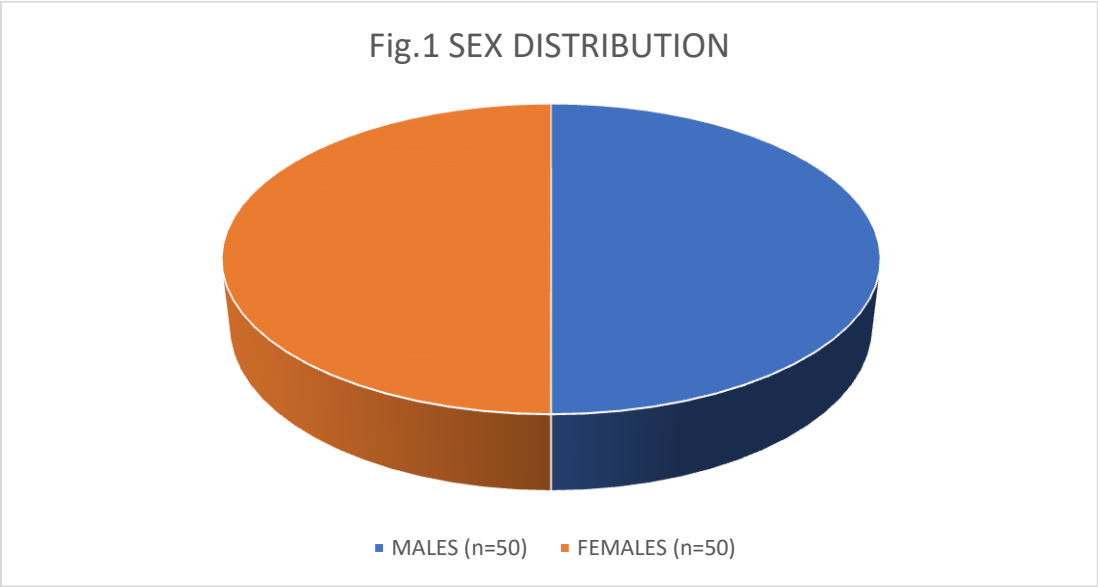
A total of 100 patients were enrolled and their demographic profile is described in the table 2.

TABLE 2: DEMOGRAPHIC DATA:

Parameter	Frequency	Percentage
Total study population	100	100%
Male patients	50	50%
Female patients	50	50%
Newly diagnosed patients	40	40%
Old patients (Duration of diabetes>6months)	60	60%

Sex distribution of our study population is shown in the figure 1. It is found that there is an equal sex distribution in our study.

FIG 1: SEX DISTRIBUTION:

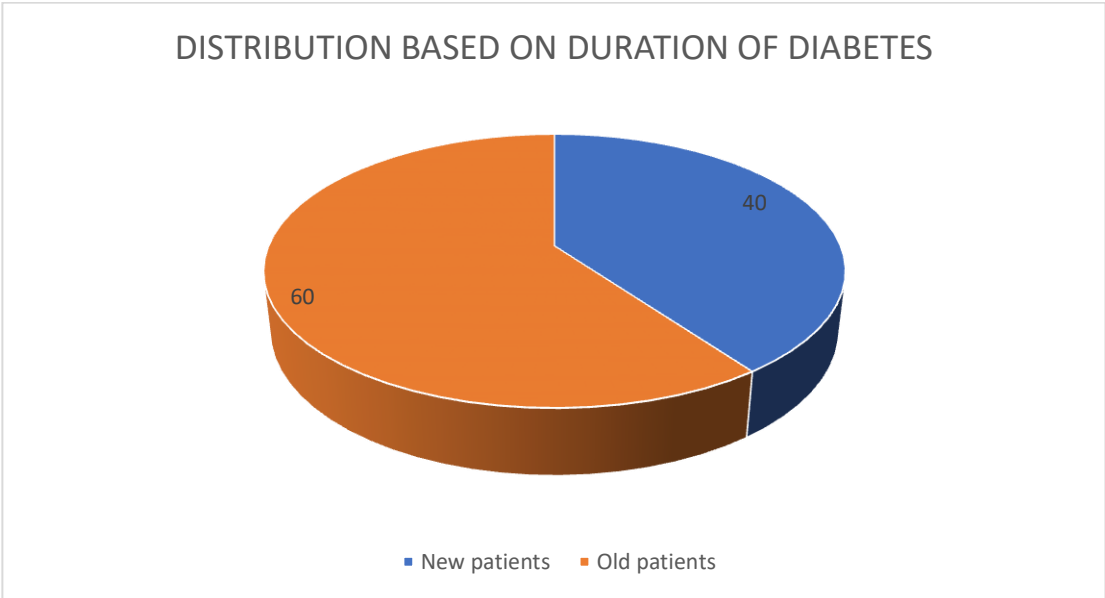


We have sub-categorized the total study population into two groups based on the duration of type 1 diabetes mellitus as shown in the figure 2.

New patients – Patients diagnosed with diabetes within the last 6 months at the time of enrollment.

Old patients – Patients with duration of diabetes more than 6 months

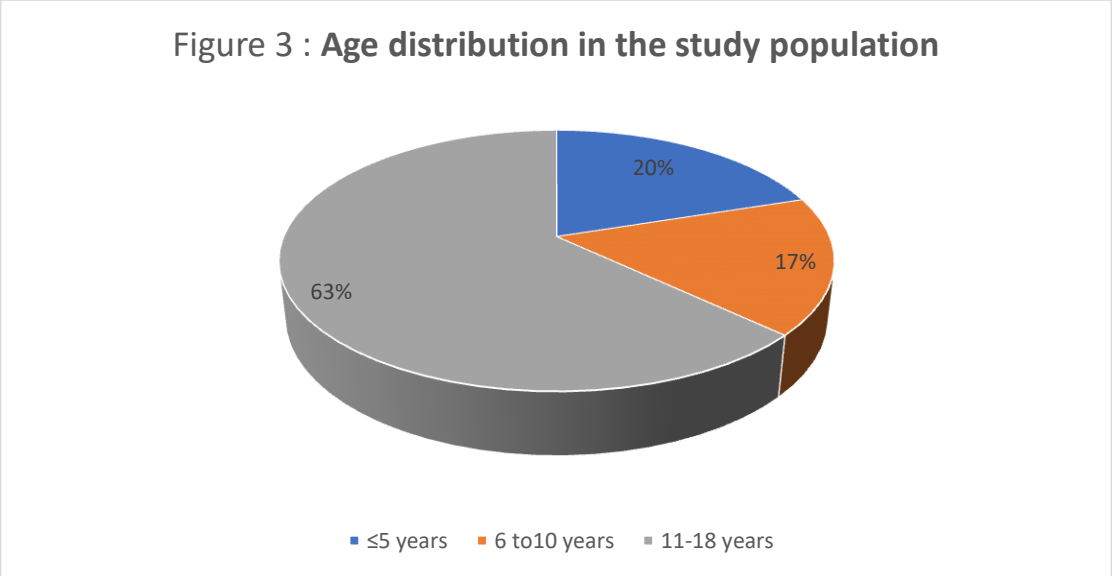
FIG 2: DISTRIBUTION BASED ON DURATION OF DIABETES:



The total study population was sub-categorized based on the age at enrollment as shown in the figure 3 and table 3.

TABLE 3: AGE DISTRIBUTION IN THE STUDY POPULATION:

Age	Frequency	Percentage
≤5 years	20	20%
6 to10 years	17	17%
11-18 years	63	63%
Total	100	100%



Descriptive analysis of age at diagnosis is shown in the table 4. The mean age at diagnosis was 9.13±4.19 years.

TABLE 4: AGE AT DIAGNOSIS IN THE STUDY POPULATION:

Parameter	Mean ± SD	Median	Min	Max
Age at diagnosis	9.13 ± 4.19	9	1	16

Distribution of the study population based on the age at diagnosis is shown in the table 5. The date of start of insulin therapy is considered as the date of diagnosis of type 1 diabetes mellitus

TABLE 5: DISTRIBUTION OF STUDY POPULATION BASED ON THE AGE AT DIAGNOSIS:

Age at diagnosis	Frequency	Percentage
≤5	24	24%
6-10	35	35%
11-18	41	41%
Total	100	100%

ANTHROPOMETRIC PROFILE AND AGE AT DIAGNOSIS:

The study population was divided into three groups based on the age at diagnosis. The anthropometric profile between the different groups were compared. Since the study population in all three groups were not normally distributed, the median values with IQR were taken for comparison of data between the groups,

The mean WAZ score of our study population was -1.10 ± 1.31. The mean WAZ score in population diagnosed at ≤5 years, 6-10 years and 11-18 years were -1.14 ±1.19, -1.16 ± 1.36 and -1.00 ± 1.32 respectively.

The median WAZ score was below -1 in all the age groups (Table 6). The Interquartile range of WAZ score was also in the negative range for all the age groups. Numerically median WAZ score was lower in children diagnosed between the age of 6 to 10 years as shown in the table 6. However, it was not statistically significant.

Table 6 : WAZ score and age at diagnosis (n=100)

Age at onset of Type 1 DM	WAZ score (Median (IQR))	Kruskal Wallis Test P value
≤5 (n=20)	-1.16 (-1.86, -0.41)	0.976
6-10 (n=17)	-1.33 (-2.04, -0.01)	
11-18 (n=63)	-1.32 (-2.13, -0.09)	

The mean HAZ score of our study population was -0.67 ± 1.44. The mean HAZ score in population diagnosed at ≤5 years, 6-10 years and 11-18 years are -0.89 ± 1.3, -0.87 ± 1.41, -0.35 ± 1.4 respectively.

The median HAZ score was below 0 in all age groups. (Table 7). On analysis, numerically median HAZ score was lower in children diagnosed between the age of 6 to 10 years as shown in table 7. However, it was not statistically significant.

Table 7: HAZ score and age at diagnosis (n=100)

Age at onset of Type 1 DM	HAZ score (Median (IQR))	Kruskal Wallis Test p value
≤5 (n=20)	-0.71 (-1.73, 0.15)	0.981
6-10 (n=17)	-0.86 (-1.91, 0.11)	
11-18 (n=63)	-0.83 (-1.93, 0.49)	

The mean BMIA Z score of our study population was -0.99±1.19. The mean BMIA Z scores in population diagnosed at ≤5 years, 6-10 years and 11-18 years were -0.87 ± 1.23, -1.00 ± 1.21, -1.06 ± 1.15 respectively.

The median BMIA Z score and the IQR were below zero in all the age groups. (Table 8). The median BMIA Z score was lower in children diagnosed less than 5 years of age as shown in table 8. However, it was not statistically significant.

Table 8 : BMIA Z score and age at diagnosis (n=100)

Age at onset of Type 1 DM	BMI/A Z score (Median (IQR))	Kruskal Wallis Test P value
≤5 (n=20)	-1.17 (-1.84, -0.73)	0.844
6-10 (n=17)	-0.75 (-1.84, -0.39)	
11-18 (n=63)	-1.10 (-1.78, -0.02)	

ANTHROPOMETRIC PROFILE AND GENDER:

The study population was divided into two groups based on gender. The anthropometric profile between the two groups was compared. Since the study population in both the groups were not normally distributed, the median values with IQR were taken for comparison.

The mean WAZ score between males and females were -1.04 ± 1.36 and -1.15 ± 1.28 respectively.

The median WAZ score and IQR was below zero in both males and females. The median WAZ score was lower in females than in males as shown in table 9. However, it was not statistically significant.

Table 9: WAZ score and gender:

Parameter	Male (n=50)	Female (n=50)	Mann-Whitney U test – p value
WAZ (Median (IQR))	-0.98 (-2.04, -0.09)	-1.32 (-2.14, -0.26)	0.654

The mean HAZ score between males and females were -0.59 ± 1.55 and -0.74 ± 1.34 respectively.

The median HAZ score was below zero in both males and females. It was lower in females when compared to males as shown in table 10. However, it was not statistically significant.

Table 10 : HAZ score and gender:

Parameter	Male (n=50)	Female (n=50)	Mann-Whitney U test – p value
HAZ score (Median (IQR))	-0.47 (-1.93, 0.61)	-0.85 (-1.41, 0.07)	0.515

The mean BMIA Z score between males and females were -0.95 ± 1.28 and -1.05 ± 1.12 respectively. The median BMIA Z score was above zero in males but below zero in females. The median BMIA Z score was lower in females when compared to males as shown in table 11. However, it was not statistically significant.

Table 11: BMIA Z score and gender:

Parameter	Male(n=50)	Female(n=50)	Mann-Whitney U test – p value
BMI/A Z score (Median (IQR))	0.99 (-1.77, 0.33)	-1.29 (-1.91, -0.21)	0.428

ANTHROPOMETRIC PROFILE AND DISEASE CHRONICITY:

The study population was divided into two groups based on duration of diabetes. The anthropometric profile between the old and new patients were compared. Since the study population in both the groups were not normally distributed, the median values with IQR were taken for comparison.

New patients = Patients with disease duration less than 6 months.

Old patients = Patients with disease duration more than or equal to 6 months.

The mean WAZ score in new and old patients were -1.01 ± 1.33 and -1.16 ± 1.31 respectively. The median WAZ score was below zero in both old and new patients as shown in table 12. There was no statistical difference in WAZ score between the old and the new patients.

Table 12: WAZ score and disease chronicity:

Parameter	New patients(n=40)	Old patients (n=60)	Mann-Whitney U test – p value
WAZ score (Median (IQR))	-1.30 (-2.26, -0.05)	-1.29 (-2.02, -0.29)	0.650

The mean HAZ score in new and old patients were -0.31 ± 1.36 and -0.90 ± 1.46 respectively. The median HAZ score was below zero in both old and new patients. It was significantly lower in old patients when compared to new patients as shown in table 13.

Table 13: HAZ score and disease chronicity:

Parameter	New patients (n=40)	Old patients(n=60)	Mann-Whitney U test – p value
HAZ score (Median (IQR))	-0.45 (-0.96, 0.61)	-1.11 (-2.05, 0.14)	0.022

The mean BMIA Z score in new and old patients were -1.12 ± 1.35 and -0.91 ± 1.09 respectively. The median BMIA Z score was below zero in both old and new patients as shown in table 14. There was no statistical difference in BMIA Z score between the old and the new patients.

Table 14: BMIA Z score and disease chronicity:

Parameter	New patients (n=40)	Old patients (n=60)	Mann-Whitney U test – p value
BMIA Z score (Median (IQR))	-1.37 (-1.93, -0.63)	-0.92 (-1.56, -0.19)	0.101

PREVALENCE OF STUNTING AND THINNESS:

Stunting – HAZ score less than -2 SD from the mean in children less than 5 years of age according to WHO growth standards.

Short stature - HAZ score less than -2 SD from the mean in children more than 5 years of age according to revised IAP growth standards.

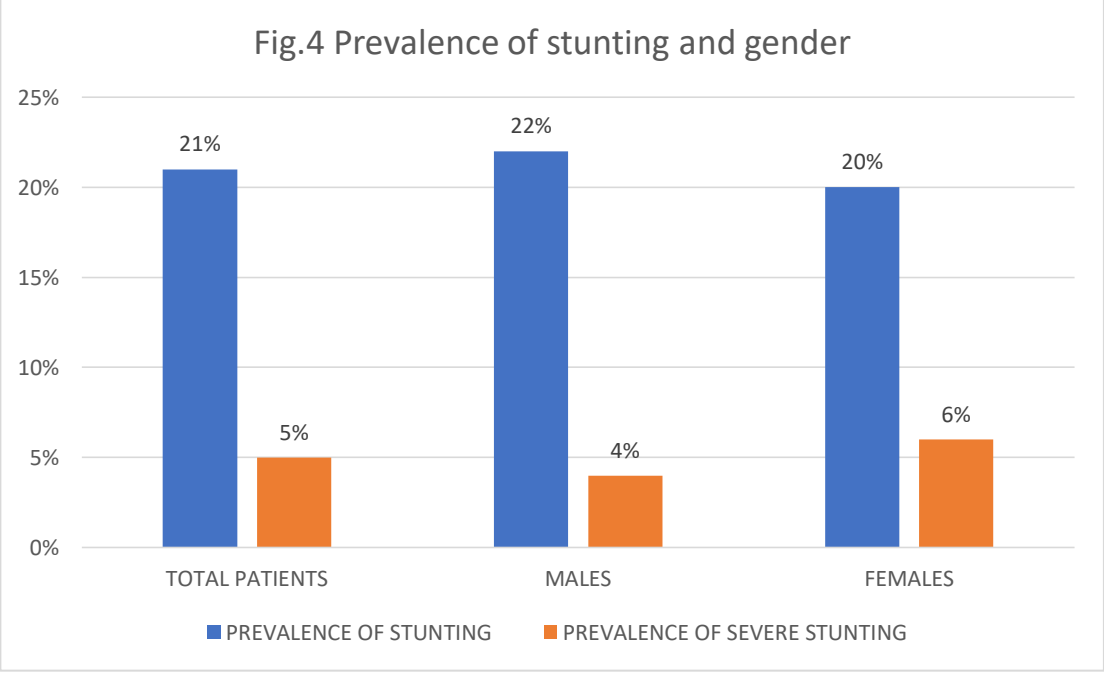
Wasting – BMIA Z score less than -2 SD from the mean in children less than 5 years of age according to WHO growth standards.

Thinness: BMIA Z score less than -2 SD from the mean in children more than 5 years of age according to revised IAP growth standards.

The overall prevalence of stunting in children with type 1 diabetes mellitus was 21%, among which 25% of children were severely stunted. It was found that there was no significant difference in the prevalence of stunting between males and females as shown in the table 15.

Table 15: Prevalence of stunting and gender:

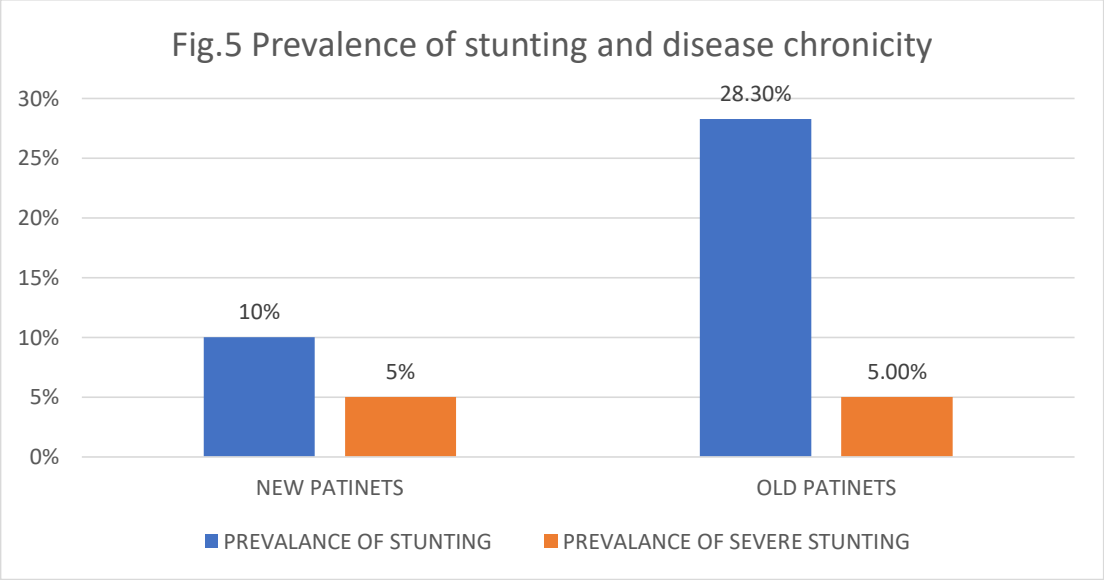
Groups	Frequency of stunting	Prevalence of stunting	P value by chi-square test	Frequency of severe stunting	Prevalence of severe stunting
Total patients (n=100)	21	21%		8	5%
Males (n=50)	11	22%	0.619	2	4%
Females (n=50)	10	20%		3	6%



The prevalence of stunting in new and old patients was 10% and 28.3% as shown in the table 16. Stunting was 2.83 times more common in patients with disease duration more than 6 months when compared to newly diagnosed patients. This difference is statistically significant as revealed by p value of 0.028 by Chi-square test.

Table 16: Prevalence of stunting and disease chronicity:

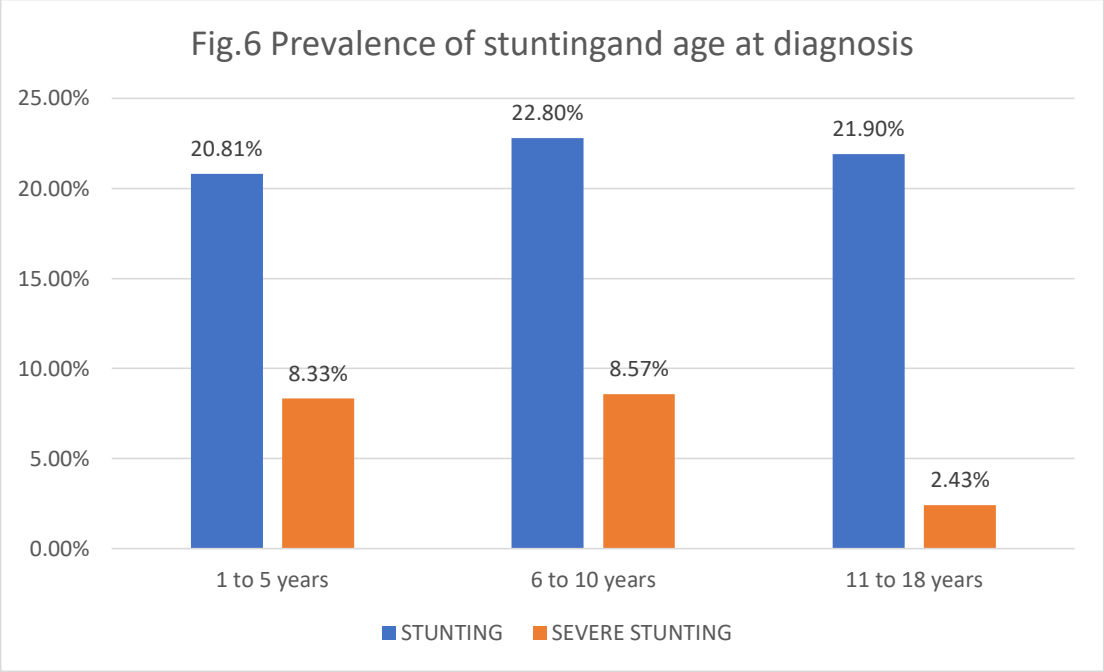
Groups	Frequency of Stunting	Prevalence Of Stunting	P Value by Chi-Square Test	Frequency Of Severe Stunting	Prevalence Of Severe Stunting
New patients (n=40)	4	10%	0.028	2	5%
Old patients (n=60)	17	28.30%		3	5.00%



The comparison of prevalence of short stature in different groups based on the age at diagnosis is shown in the table 17 and figure 6. It was found that there is no significant difference in the prevalence of stunting in different age groups, as revealed by p value of 0.863 by chi-square test.

Table 17: Prevalence of stunting and age at diagnosis:

Groups	Frequency of stunting	Prevalence of stunting	p value by chi-square test	Frequency of severe stunting	Prevalence of severe stunting
1 to 5 years(n=24)	5	20.81%	0.863	2	8.33%
6 to 10 years(n=35)	8	22.80%		2	8.57%
11 to 18 years(n=41)	8	21.90%		1	2.43%



ANALYSIS OF PATIENTS WITH SHORT STATURE:

Figure 7 shows the analysis of patients with short stature. On analysis of stunted patients, it was found that some proportion of patients have additional co-morbidities including celiac disease, autoimmune hypothyroidism, Mauriac syndrome and hypogonadic hypogonadism that are associated with growth faltering. 71.42% had short stature despite ruling out the above-mentioned co-morbidities.

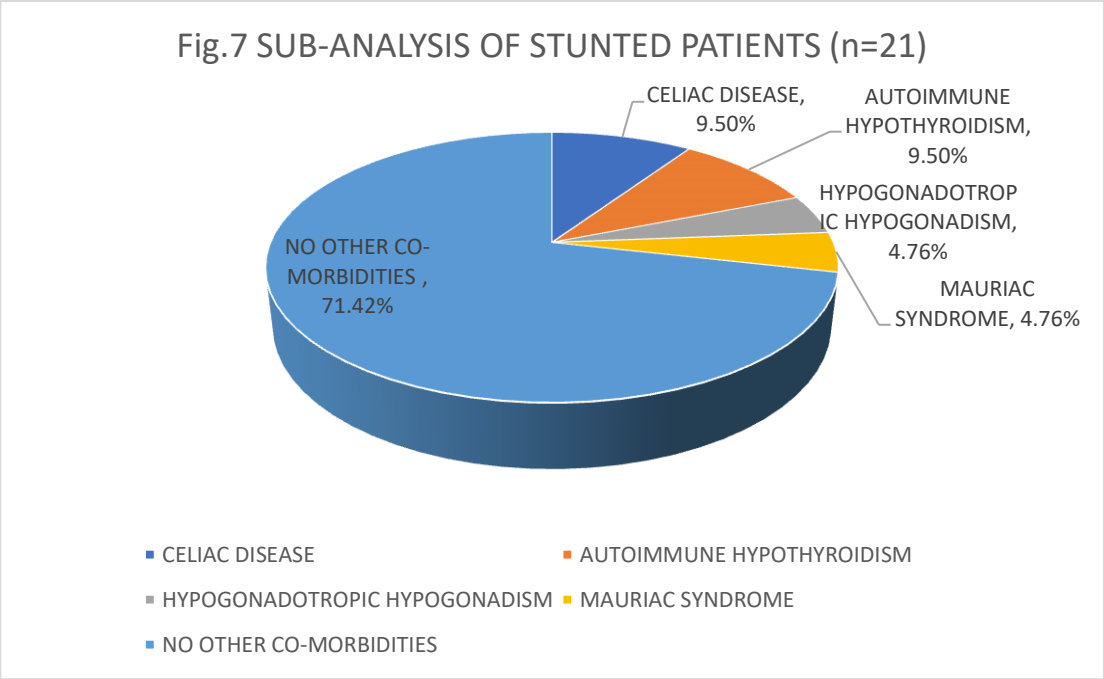


Table 18 shows the comparison of prevalence of thinness between the gender. The prevalence of wasting/thinness in the total study population is 16%, of which 18.75% of patients had severe thinning/wasting. Thinness is 2.2 times more common in females when compared to males. However, this was not statistically significant as revealed by p-value of 0.102 by Chi-square test.

Table 18: Thinness and gender:

Groups	Frequency of thinness	Prevalence of thinness	p value by chi-square test	Frequency of severe thinness	Prevalence of severe thinness
Total patients (n=100)	16	16%		3	3%
Males (n=50)	5	10%	0.102	2	4%
Females (n=50)	11	22%		1	2%

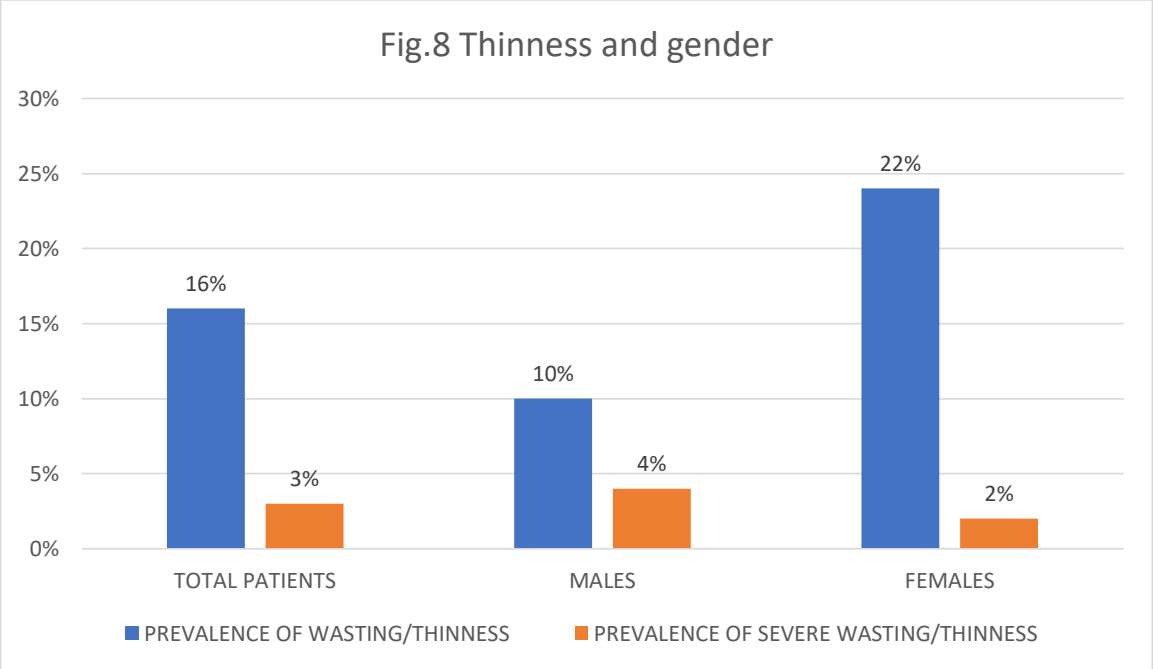


Table 19 shows the comparison of prevalence of thinness with disease chronicity. On comparing the prevalence of thinness between old and new patients, it was found than thinness was 1.5 times more common in new patients. However, this is not statistically significant as revealed by p value of 0.374 by Chi-square test. Out of 10 newly diagnosed patients with thinness, 8 patients presented with diabetic keto-acidosis.

Table 19: Thinness and disease chronicity:

Groups	Frequency of thinness	Prevalence of thinness	p value by chi-square test	Frequency of severe thinness	Prevalence of severe thinness
New patients (n=40)	8	20%	0.374	2	5%
Old patients (n=60)	8	13.30%		2	3.3%

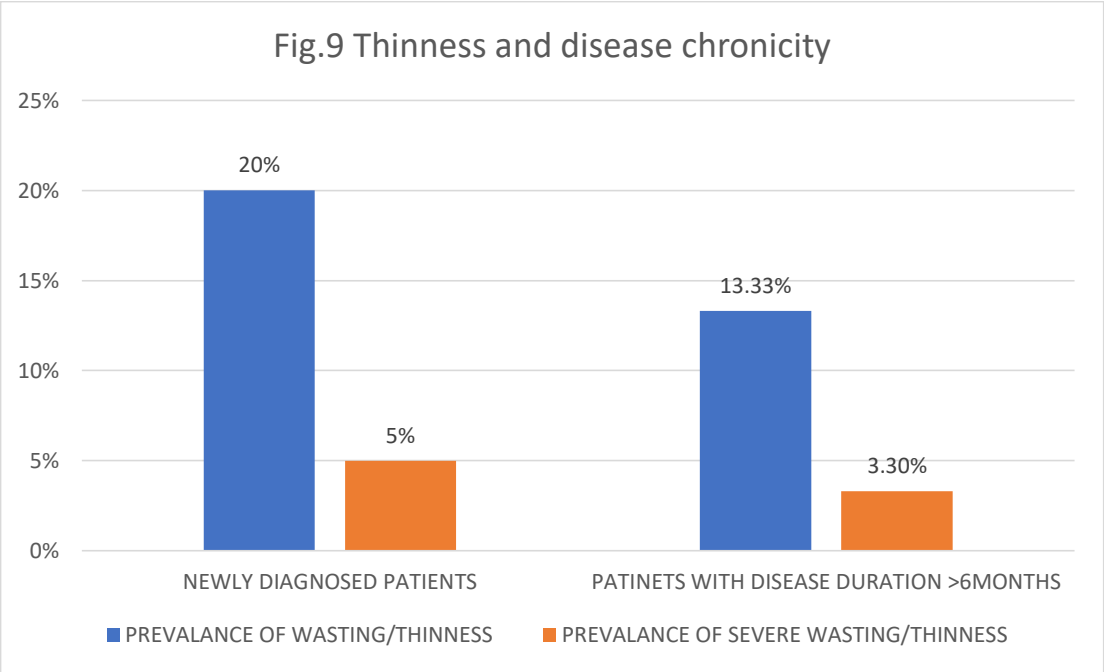
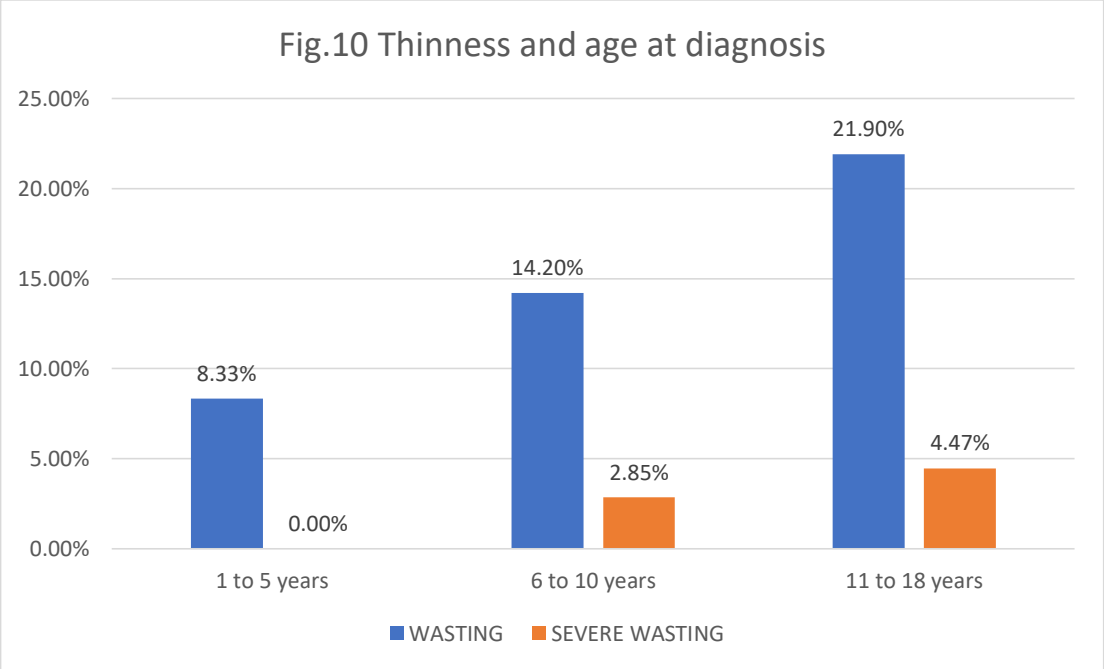


Table 20 shows the comparison of prevalence of thinness between the different age groups based on the age at diagnosis. The prevalence of thinness was higher in the age group between 11 and 18 years. However, this was not statistically significant as revealed by p value of 0.689 by Fisher's exact test.

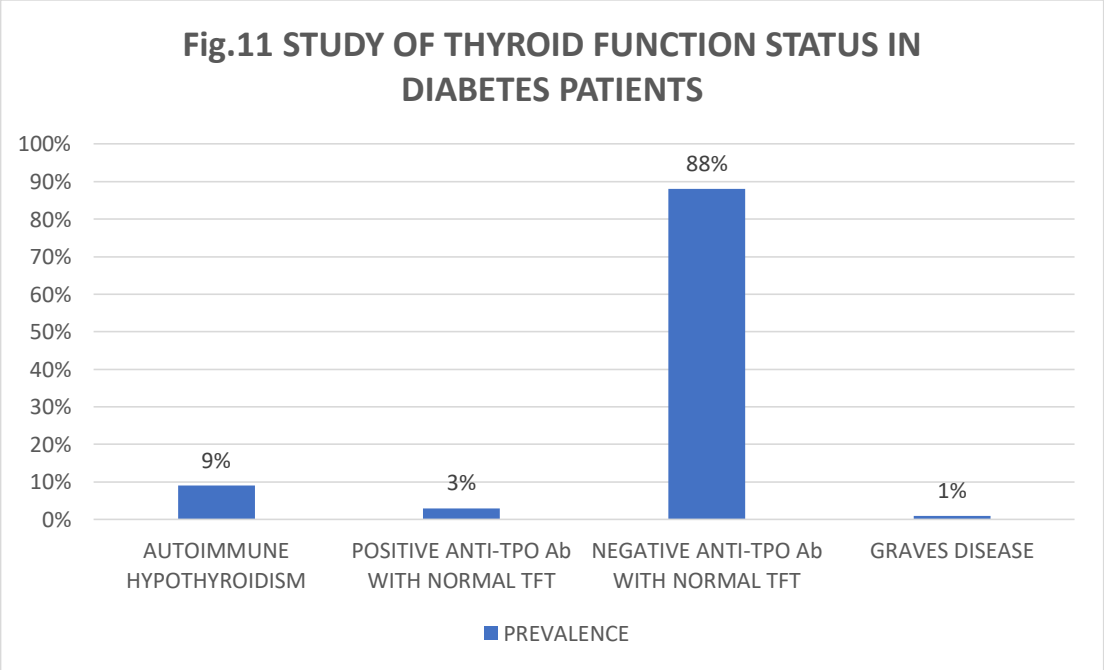
Table 20: Thinness and age at diagnosis:

Groups	Frequency of thinness	Prevalence of thinness	P value by fisher's exact test	Frequency of severe thinness	Prevalence of severe thinness
1 to 5 years(n=24)	2	8.33%	0.689	0	0%
6 to 10 years(n=35)	5	14.20%		1	2.85%
11 to 18 years(n=41)	9	21.90%		2	4.47%



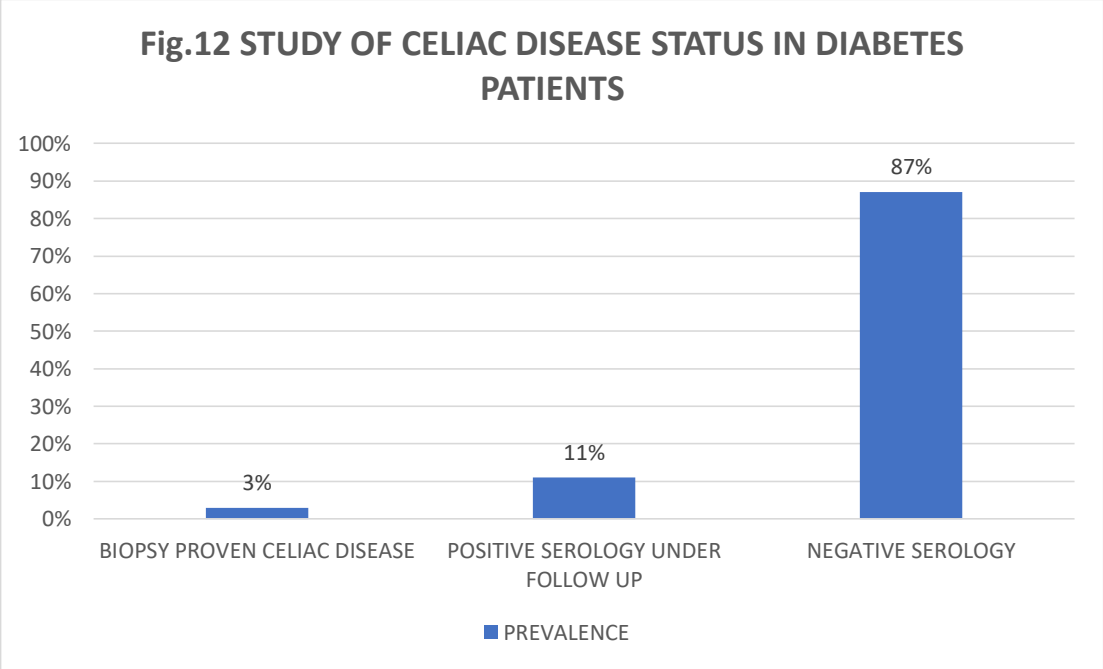
STUDY OF THYROID FUNCTION STATUS IN DIABETES PATIENTS:

Figure 11 shows the study of thyroid function status in the study population. Screening for thyroid disorders was done by measuring Anti-TPO antibody levels and thyroid function test in all patients with type 1 diabetes mellitus. It was found that prevalence of auto immune hypothyroidism was 9% in the study population. Among the total patients with autoimmune hypothyroidism, 37% of patients had short stature.



STUDY OF CELIAC DISEASE STATUS IN DIABETES PATIENTS:

Figure 12 shows the study of celiac disease status in the study population. Screening for celiac disease was done by measuring Anti-TTgIgA antibody levels in all patients with type 1 diabetes mellitus. If antibody titers are positive, then upper GI endoscopy with biopsy was done. The prevalence of biopsy proven celiac disease was 3% in the study population, and 11% of population had positive serology and are currently in our follow up. Among the total patients with proven celiac disease, 66% of patients had short stature.

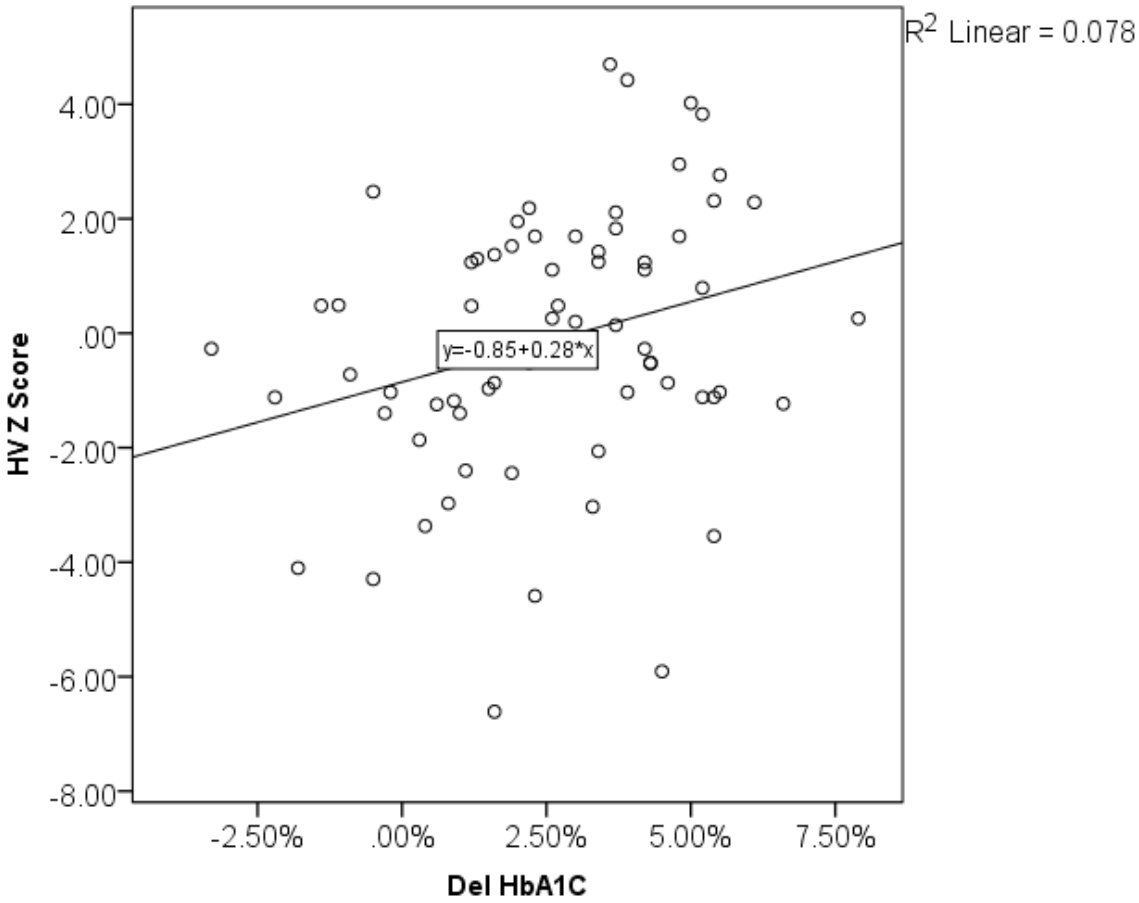


OBSERVATIONS ON FOLLOW UP:

Eighty patients were followed up for a minimum period of 6 months from the time of enrollment. The mean duration of follow up was 6.11±0.93 months. The maximum and minimum duration of follow ups were 12 and 6 months respectively. We assessed the anthropometric profile including height, weight, BMI, height velocity and the change in HbA1C on follow up. Delta HbA1c refers to the difference between the initial and follow up HbA1C(Last available HbA1C) values.

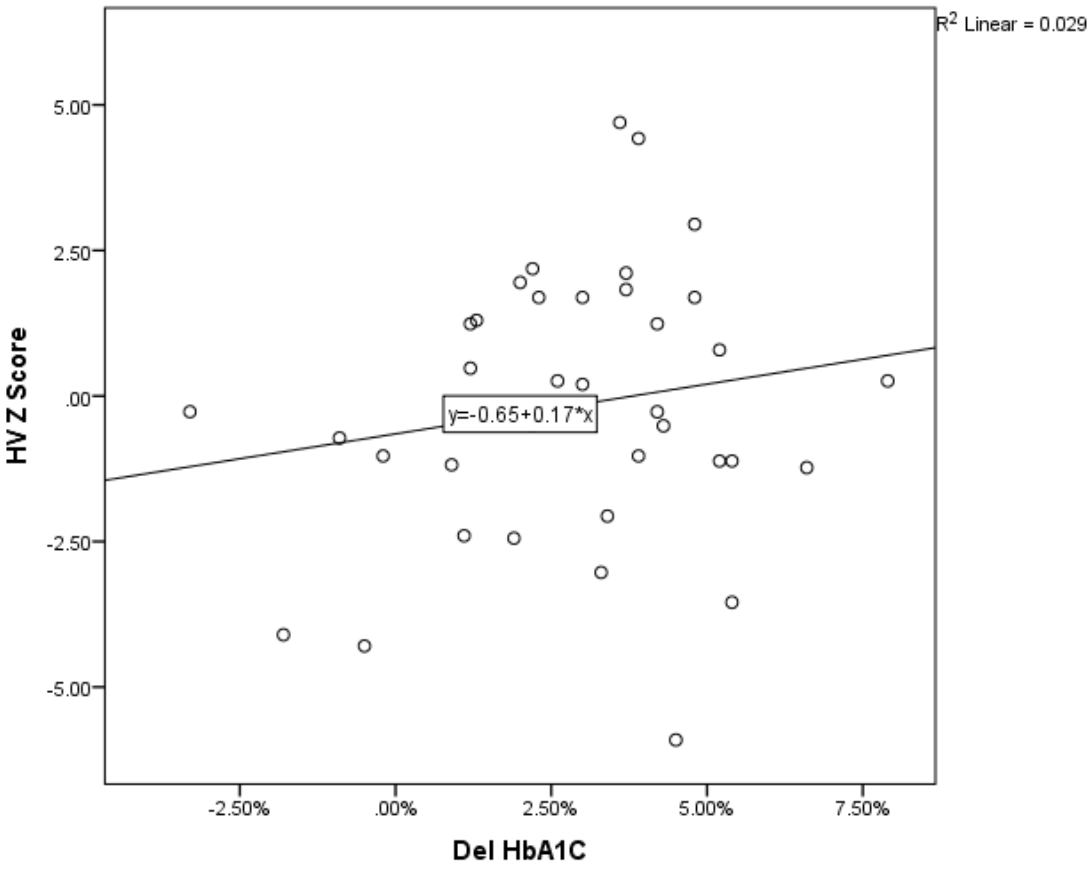
The co-relation between change in HBA1C and HVZ score in total study population is shown in the figure 13. There was a significant positive correlation between Del HbA1C and HV Z Score (r=0.307, p=0.01), as revealed by Pearson's co-relation and scatter plot.

Fig 13: Change in HBA1C and HVZ score in total study population:



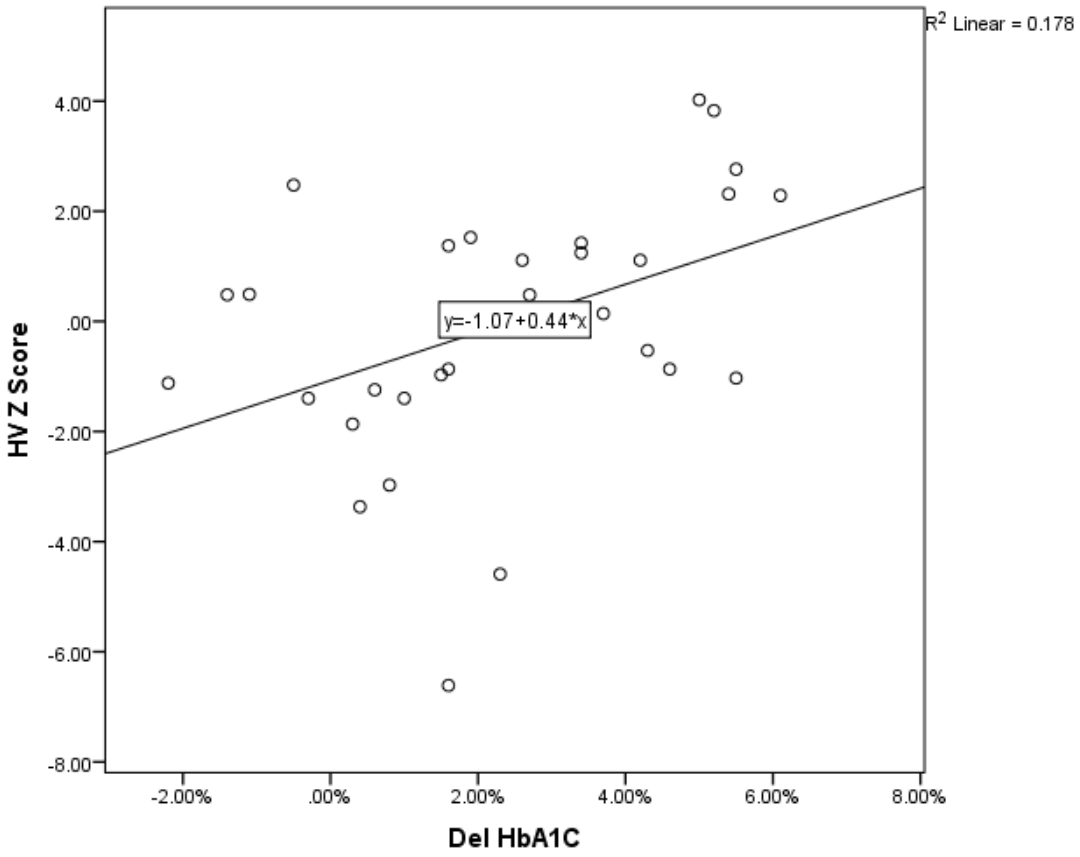
The co-relation between change in HBA1C and HVZ score_in boys is shown in the figure 14. There was no significant correlation between Del HbA1C and HVZ score in boys (r=0.171, p=0.299) as revealed by Pearson's co-relation and scatter plot.

Fig 14: Change in HBA1C and HVZ score score in boys:



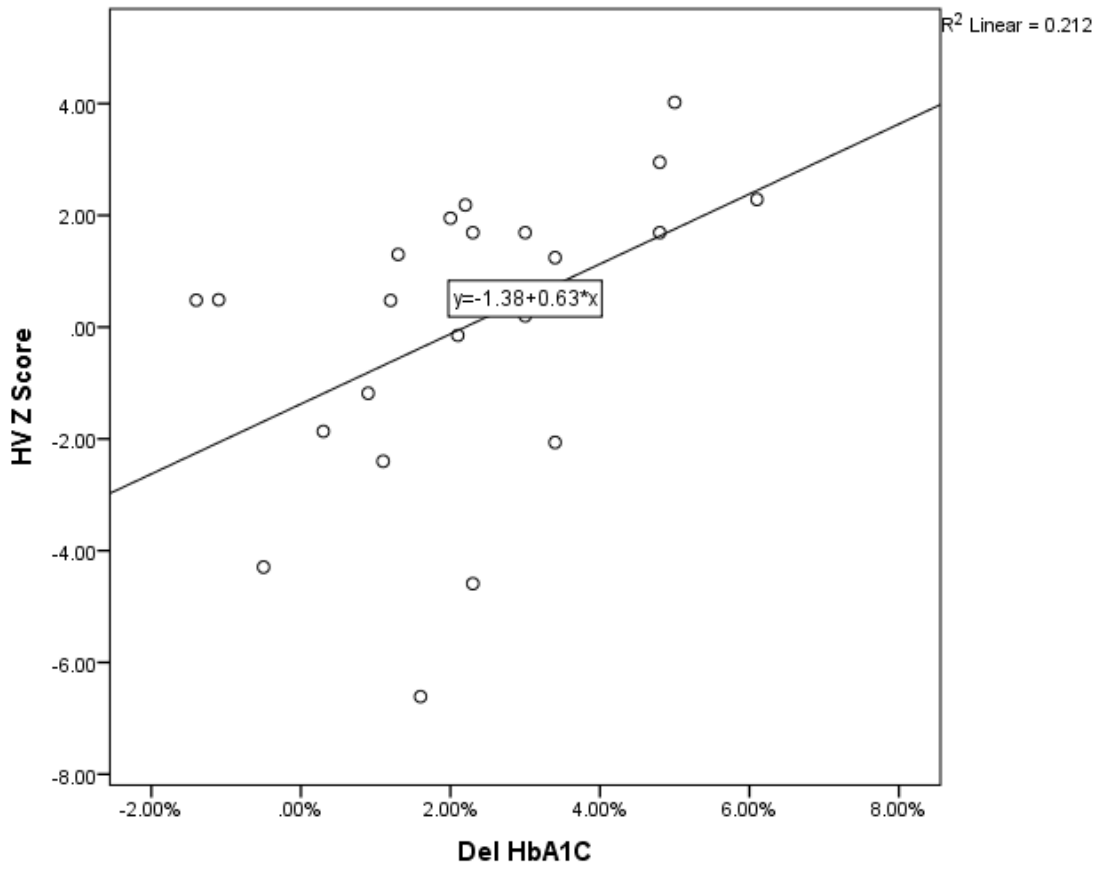
The co-relation between change in HBA1C and HVZ score in girls is shown in the figure 15. There was a significant positive correlation between Del HbA1C and HVZ score in girls (r=0.422, p=0.018) as revealed by Pearson's co-relation and scatter plot.

Fig 15: Change in HBA1C and HVZ score in girls:



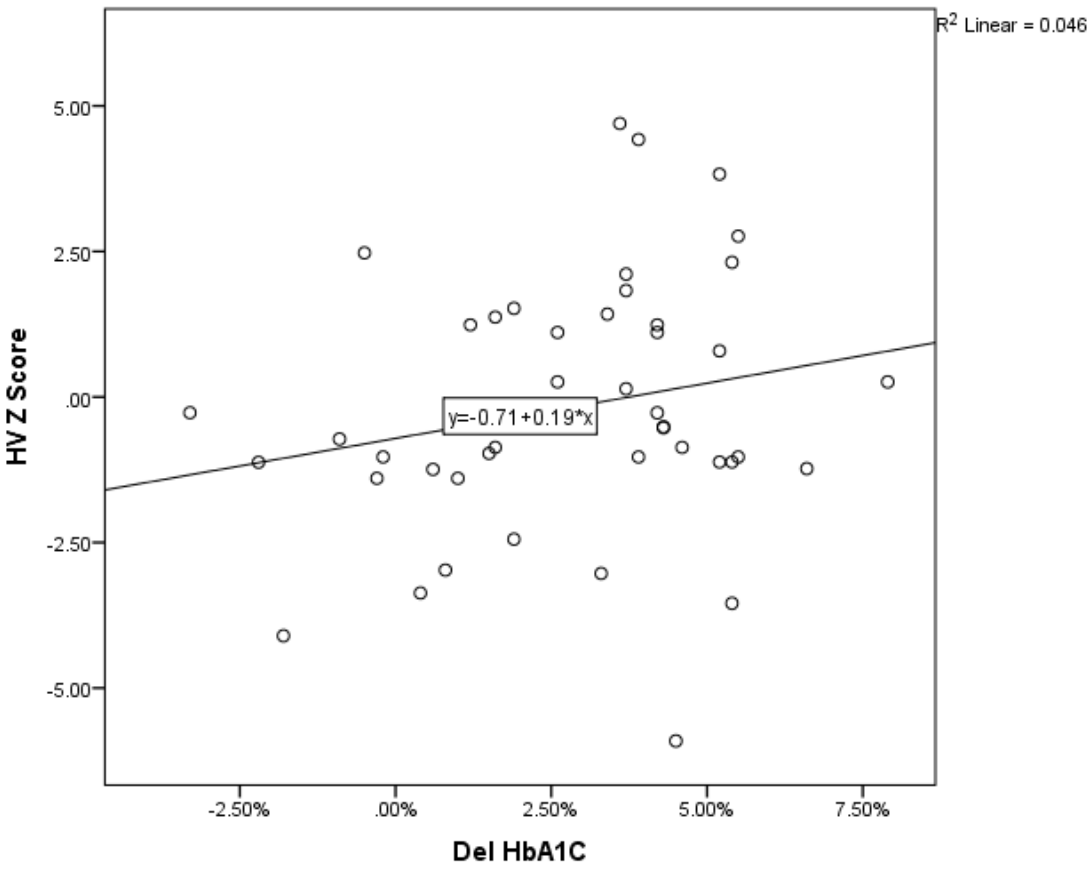
The co-relation between change in HBA1C and HVZ score in population less than 10 years of age is shown in the figure 16. There was a significant positive correlation between Del HbA1C and HVZ score in children upto 10 years (r=0.460, p=0.027) as revealed by Pearson's co-relation and scatter plot.

Fig 16: Change in HBA1C and HVZ score in population less than 10 years of age:



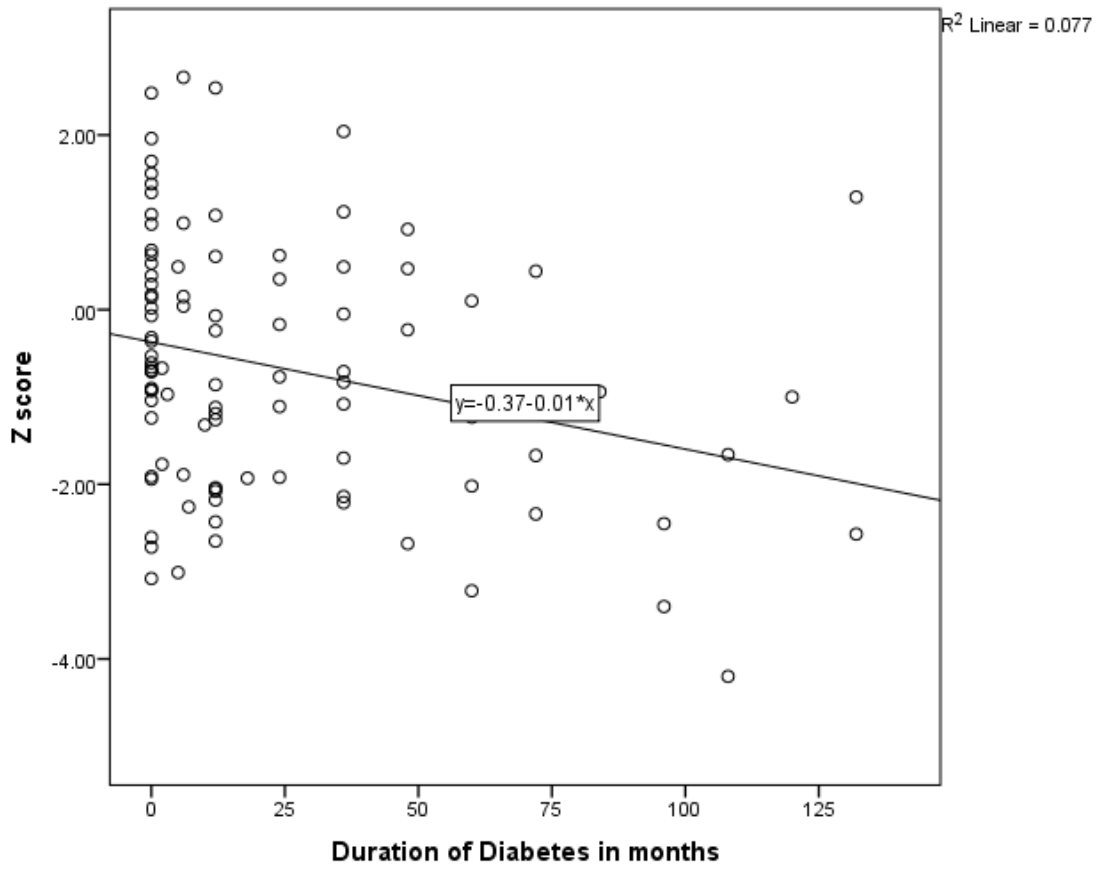
The co-relation between change in HBA1C and HVZ score in population more than 10 years of age is shown in the figure 17. There was no significant correlation between Del HbA1C and HVZ score in >10 years (r=0.214, p=0.149) as revealed by Pearson's co-relation and scatter plot.

Fig 17: Change in HBA1C and HVZ score in population more than 10 years of age:



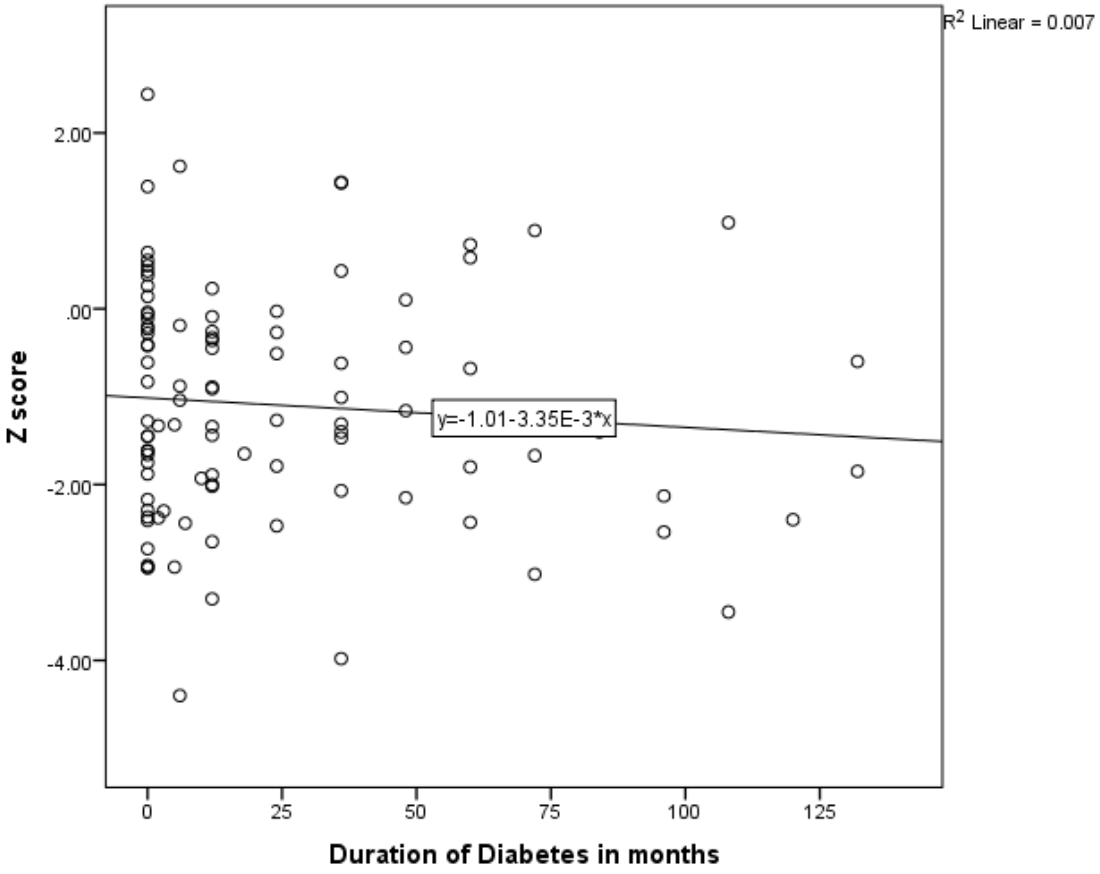
The co-relation between co-relation between duration of diabetes with HVZ score is shown in the figure 18. There was a significant Negative correlation between Duration of Diabetes and HVZ Score (r=-0.277, p=0.005) as revealed by Pearson's co-relation and scatter plot.

Fig 18: Duration of diabetes with HVZ score:



The co-relation between the duration of diabetes with WAZ score on follow up is shown in the figure 19. There was no significant correlation between Duration of Diabetes and Weight Z Score (r=-0.083, p=0.409) as revealed by Pearson's co-relation and scatter plot.

Fig 19: Duration of diabetes with WAZ score on follow up:



The co-relation between the duration of diabetes with BMIA Z score on follow up is shown in the figure 20. There was no significant correlation between Duration of Diabetes and BMI Z Score (r=-0.092, p=0.361) as revealed by Pearson's co-relation and scatter plot.

Fig 20: Duration of diabetes with BMIA Z score on follow up:

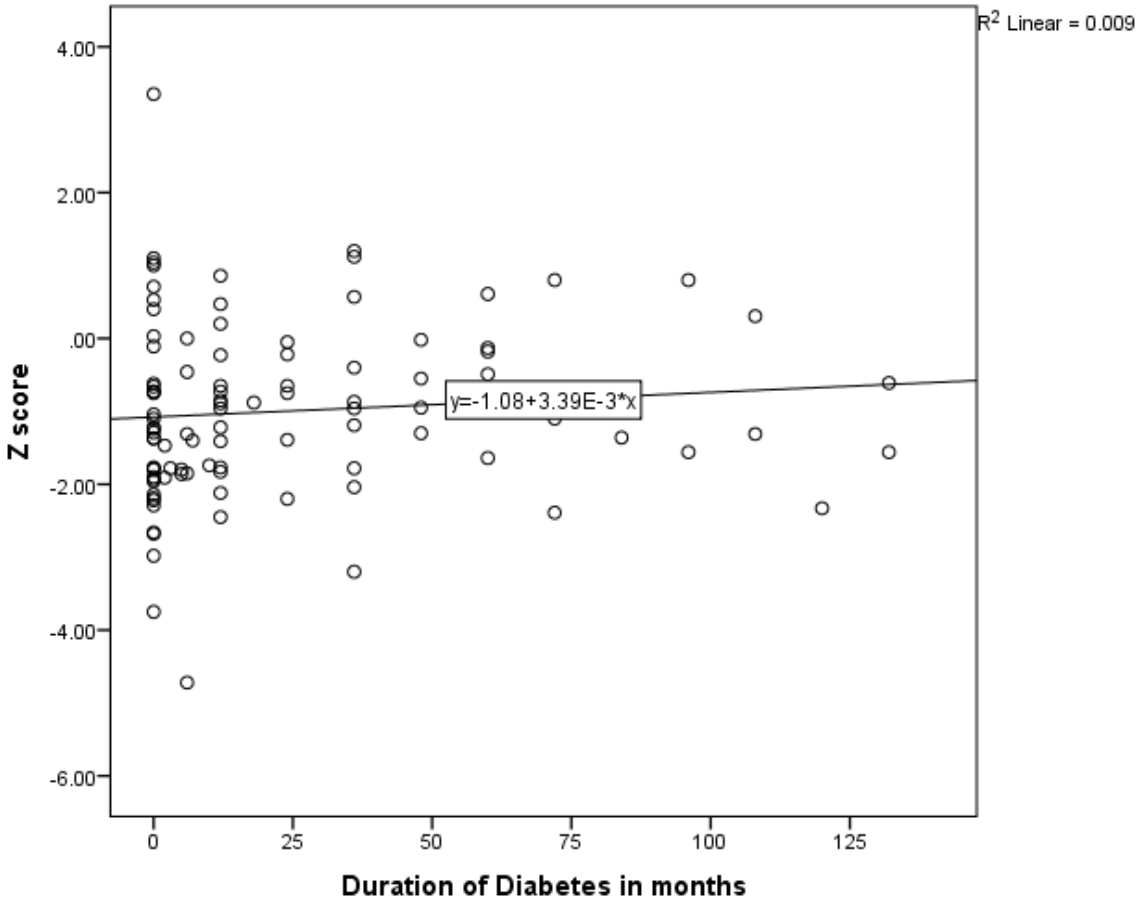
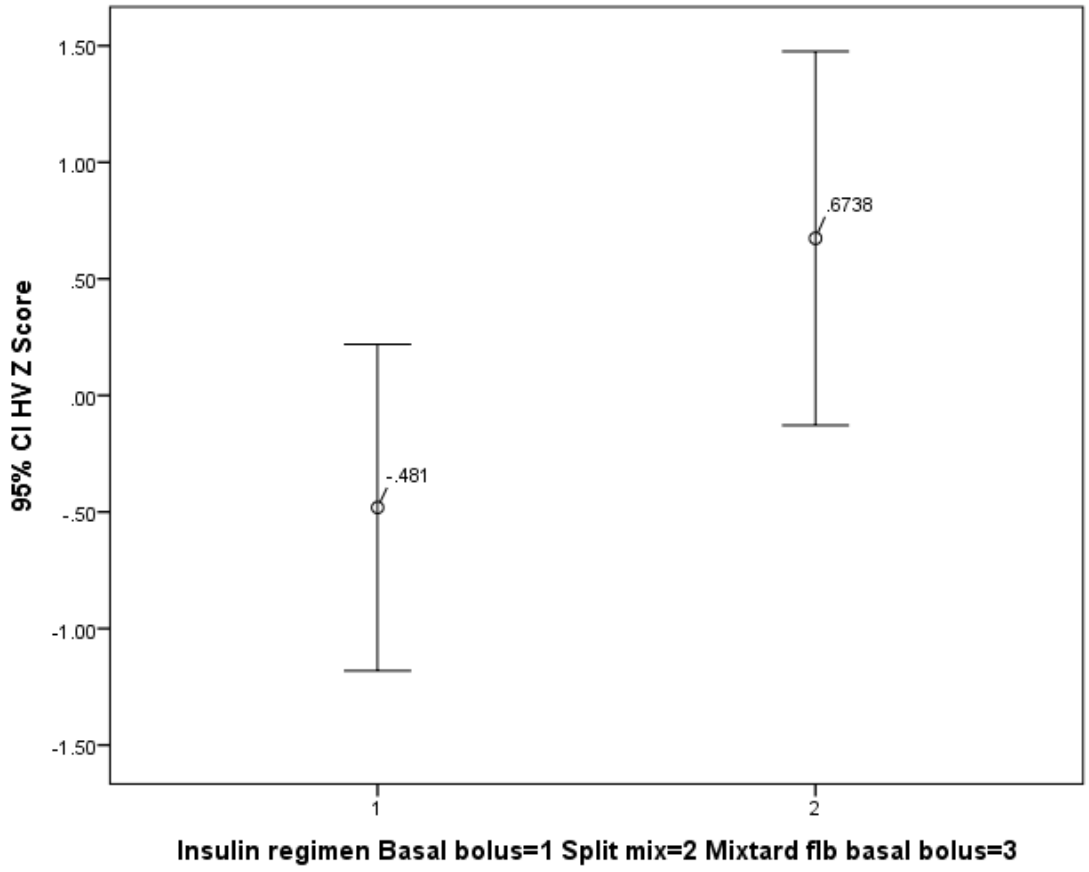


Table 21 and Figure 21 shows the comparison of HVZ score between basal bolus regimen group and split mix regimen group. It was found that height velocity Z score was significantly higher in split mix regimen groups as shown by p value of 0.049

Table 21	Insulin regimen Basal bolus=1 Split mix=2	N	Mean	Std. Deviation	P value
HV Z Score	1	48	-.4810	2.41080	0.049
	2	22	.6738	1.80864	

Fig 21 : Comparison of HVZ score between basal bolus regimen group and split mix regimen group:



STUDY OD PUBERTAL STATUS IN CHILDREN WITH TYPE1 DM:

Delayed puberty in males: [50]

- Lack of testicular enlargement i.e., volume of testis less than 2.5 cm by 14 years of age.
- Delay of more than 5 years between testicular enlargement and completion of puberty

Delayed puberty in females**:** [50]

- Lack of breast development by 13 years of age.
- Lack of menarche by 16 years of age.
- Delay of over 4 years between thelarche and completion of puberty

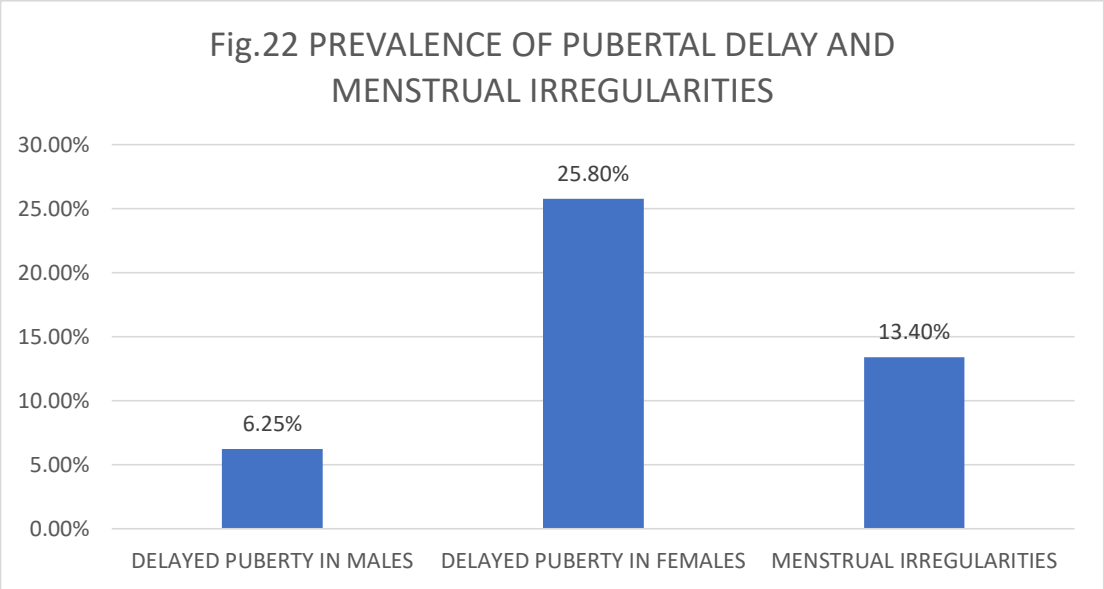
The prevalence of pubertal delay and menstrual irregularities is shown in the table 21.

We have considered ‘n’ as

- Age more than 14 years in boys
- Age more than 13 years in girls
- For analysis of menstrual irregularities, we have taken ‘n’ as the number of girls who have attained menarche.

Table 22: PREVALENCE OF PUBERTAL DELAY AND MENSTRUAL ABNORMALITIES:

	n	FREQUENCY	PREVALENCE
PRUBERTAL DELAY IN MALES	16	1	6.25%
PUBERTAL DELAY IN FEMALES	31	8	25.8%
MENSTRUAL IRREGULARITIES IN FEMALES	23	3	13.04%



- There was one male patient with delayed puberty and was diagnosed with hypogonadotropic hypogonadism.
- Among 25.8% (frequency – 8) of female patients with delayed puberty, 9.6% (frequency – 3) had delayed thelarche and the remaining 16.1% (frequency – 5) had delayed menarche.
- On evaluation for delayed menarche, 9.6% of the population had hypogonadotropic hypogonadism
- For adolescent females with menstrual irregularities, detailed evaluation was done by the pediatrics and the Gynecology team. The cause of menstrual irregularities kept was immature Hypothalamo – pituitary-gonadal axis and poorly controlled diabetes mellitus.

DISCUSSION

With an increasing understanding of the disease and advancements in modern therapeutic techniques in recent times, the care given to type 1 diabetic patients has significantly improved. However, the impairment in longitudinal growth and pubertal development still remains one of the chronic complications of type 1 diabetes mellitus. There are multiple studies that demonstrated the retarded growth and delay in pubertal development in children and adolescents with type I diabetes mellitus[35,39,40,43-47.] It was also found that poor metabolic control is associated with significant growth faltering in type 1 diabetes mellitus[47,43.] Previous studies done on this subject have been cross-sectional, longitudinal, cohort and case-control studies. Our study was conducted in the Department of Pediatrics, AIIMS Jodhpur a tertiary care hospital in the Northwestern Indian state of Rajasthan. In our study, we collected cross-sectional data at the time of enrolment in the study for 100 patients and did a longitudinal follow-up of minimum 6 months in 80 patients. We did not do a case-control study as height, weight and BMI are variable characteristics, and have many genetic and environmental determinants, hence recruitment of appropriate controls would be difficult.

We have enrolled 100 patients in age groups between 1 and 18 years with the diagnosis of Type 1 diabetes mellitus among which 50 were males and 50 were females. The presence of equal number of males and females in the study was unintentional. In the present study, it was found that the mean age at diagnosis of type 1 diabetes mellitus is 9.13±4.19 years. This data was similar to the study conducted by Parthasarathy L et all [35] and Khadilkar V V et all[48,] who in their study demonstrated that the mean age at diagnosis was 9.7±4.4 years and 9.4±3.3 years respectively.

In our study we have further subdivided the study population into sub-categories based on gender (Males, Females), age at onset of diabetes (< 5 years, 6 to 10 years and 11 to 18 years), and duration of diabetes (Newly diagnosed patients and patients). A detailed anthropometric evaluation was done at the time of presentation and baseline HbA1c was recorded. These parameters were compared between the sub-population in various groups.

Short stature and diabetes:

It is known that longitudinal bone growth is chiefly regulated by growth hormone, which is secreted in a pulsatile fashion. Many studies showed that poor glycaemic control can affect the Growth hormone – Insulin-like growth factor – Insulin axis[35]. Other factors like age at onset, duration of diabetes and metabolic control also influence the overall somatic growth in type 1 diabetes mellitus[39,47,48]. The mean HA Z score of our study population was -0.99±1.19. The median HAZ Score and IQR were -0.74 (-1.89, 0.40) in our study population. This was significantly lower in children with disease duration > 6 months than in those where the duration of diabetes mellitus was < 6 months. There was no statistically significant difference in the HAZ score between patients based on the age of diagnosis, age at evaluation or gender. The overall prevalence of stunting in children with type 1 diabetes mellitus was 21%, among which 25% of children were severely stunted. A similar observation (Prevalence of short stature is 18%) was found in the study conducted by Parthasarathy L et all [35]. Seventy-one per cent of the patients who had short stature had no identifiable co-morbidities apart from type 1 diabetes mellitus.

The prevalence of short stature was 2.83 times more in old patients when compared to new patients, and was statistically significant. The median duration of diabetes in the patients in this group (old patients) was 36 months and their mean HbA1C is 11.89±2.6. Based on these observations it was seen that the disease duration was one of the negative predictors of poor growth. A similar observation was found in the study done by Walter Bonfig et all[47] and Elamin et all[39] who in their studies demonstrated that the faltering in growth was positively correlated with the duration of the disease and HbA1c levels.

Ruchi Udawat et al. [37] in their study showed that Type 1 DM does not have any impact on growth. They conducted a cross-sectional study and compared the mean anthropometric values with IAP and WHO standards. Population with age groups between 7 and 12 years were only included in the study. Other co-morbidities associated with type 1 DM, glycemic control, and duration of diabetes were not considered. Z score was not used for comparison. As discussed earlier, growth is a complex process and it is regulated by genetic, environmental and hormonal factors. It would be ideal to use Z scores for comparison rather than the whole values.

It is a well-known fact that type 1 diabetes is associated with other comorbidities like Celiac disease[9], autoimmune hypothyroidism[7,8], Mauriac syndrome and rarely with autoimmune polyglandular syndrome type 2 that significantly causes growth retardation. On further analysis of the patients with short stature, it was found that other co-morbidities like Celiac disease (Prevalence-9%), autoimmune hypothyroidism (Prevalence-9%) and Mauriac syndrome (Prevalence-4.76%) were also prevalent. 71.42% had short stature despite ruling out the above-mentioned co-morbidities. Among the total patients with proven celiac disease, 66% of patients had short stature. Among the total patients with autoimmune hypothyroidism, 37% of patients had short stature. Hence it is also necessary to screen for these co-morbidities and institute timely management[13]. Hence having more than one morbidity increased the chances of having short stature. It is thus imperative to monitor growth as faltering growth may be an indicator of undiagnosed comorbidity. Also, short stature can be a consequence of isolated Type 1 diabetes mellitus without any other comorbidity.

Thinness and Diabetes:

Most of the children, when diagnosed with Type 1 diabetes mellitus are underweight and have low BMI. On the institution of insulin therapy with adequate dosing, BMI starts improving over time. Insulin being an anabolic hormone, plays a role in inhibiting protein catabolism, stimulating lipogenesis, and slowing basal metabolism[49]. In our study, it was found that the mean BMIA Z score was -0.99±1.19. This finding was similar to the observation done by Parthasarathy L et all [35]. The mean BMI for age in their study was -0.9± 1.2. Our observation was slightly lower than the observation done by Khadilkar et all[48.] The mean BMI for age in their studies was -0.4±1.8. On further analysis of median BMI Z scores between various subgroups, it was found that BMI for age was more affected in females, in children diagnosed at less than 5 years of age and in newly diagnosed patients. However, these differences were not statistically significant. These findings were similar to the study conducted by Khadilkar et all[48.] In the present study, it was found that the prevalence of thinness/wasting was 16%, among which 18.75% of patients had severe thinness. Thinness/wasting was 2.2 times more common in females when compared to males with type 1 diabetes mellitus. It was also found that thinness/wasting was 1.5 times more prevalent in new patients when compared to the old patients with disease duration of more than 6 months. Out of 10 newly diagnosed patients with thinness, 8

patients presented with Diabetic keto acidosis and their mean BMIA Z score is -2.75 SD. All of these patients have survived. This indicates the state of wasting and catabolism that occurs before the diagnosis and before the DKA episodes[49]. The mean BMI Z score in newly diagnosed patients with thinness after the institution of insulin therapy has improved from -2.6±0.5 to -1.6±0.6 in the follow-up.

Influence of Duration of diabetes and metabolic control on Growth:

In the present study, we have followed up the patients for 6 months. These patients were followed up for clinical management, assessment of change in anthropometric profile and change in HbA1C. We have studied if there is any improvement in the growth velocity as glycemic control improves over time. Most of the patients were newly diagnosed and were initiated on insulin therapy. It was found that there was a significant positive corelation between the improvement in glycemic control measured by change in HbA1C and linear growth measured by height velocity Z score during the same period. There was a statistically significant correlation between the change in HbA1C and Height velocity Z score. On subgroup analysis this was statistically significant in females and children with age group less than 10 years. We have also found that there was a significant inverse correlation between the duration of diabetes and growth velocity. Catarina el all[39] conducted a retrospective study with the objective to study if there is any correlation between metabolic control and duration of type 1 diabetes with the growth velocity. They found a similar result, that there is a positive correlation between growth velocity and glycemic control and there is a negative correlation between the duration of diabetes and growth velocity. Similar observation was also found in the studies conducted by Elamin et all[39] and Walter Bonfig et all[47]. Walter Bonfig et all[47] in their study found that the mean height for age Z score was 0.25±0.95SD at the time of diagnosis. The mean near adult height Z score was -0.16±1SD. The height velocity was 0.82 cm/year in the near-adult analysis. On the multivariate regression model, they found that the height velocity was negatively correlated with the duration of diabetes and with poor glycemic control. Elamin et all[39] in their study assessed the height at diagnosis, height at puberty and final target heights in children with type 1 diabetes. They found that the height velocity had negatively correlated with the duration of diabetes and with poor glycemic control.

Based on the observations from our study, it is evident that glycemic control plays an

important role in longitudinal growth. Especially in this COVID era, it was difficult for the patients to comply with routine follow-ups. This correlates with the high prevalence of short stature in old patients and improvement in growth velocity after a proper follow-up and sugar optimization. Hence optimal growth velocity can be considered as an indirect marker of glycemic control and future research and can be done to establish its significance. As per ISPAD recommendations 2022 it is mandatory to monitor the anthropometric parameters every 3rd monthly [51].

Puberty and diabetes:

Puberty in adolescents with type 1 diabetes mellitus is a crucial phase, since it is characterized by derangement in glycemic control, increased insulin requirement and acceleration of underlying chronic complications. And type 1 diabetes itself can cause delay in puberty and lead to menstrual irregularities in girls. It was found in the present study that the prevalence of pubertal delay in males is 6.25% (Only one male patient had a pubertal delay and was diagnosed with hypogonadotropic hypogonadism). In females the prevalence of delayed puberty was 25.8% after excluding thyroid disorders, celiac disease and other chronic systemic illnesses. Among 25.8% (frequency – 8) of female patients with delayed puberty, 9.6% (frequency – 3) had delayed thelarche and the remaining 16.1% (frequency – 5) had delayed menarche. On evaluation for delayed menarche, 9.6% of the population had hypogonadotropic hypogonadism. This was attributed to poor glycemic control and emphasis was laid on further improving the same. The patients are under follow-up. There are many studies, that have evaluated the pubertal development in adolescents with type 1 diabetes. Ethel Codnet et all[44 in] their study demonstrated that there was a delay in thelarche by 6 months and a delay in menarche by 6 months. Bahareh M Schweiger et all[45] in their cross-sectional study, found that there was a significant delay in the age at menarche and a high prevalence of menstrual irregularities in those children diagnosed with type 1 diabetes mellitus before the onset of diabetes mellitus when compared to those children diagnosed with type 1 diabetes after the onset of menarche. In an observational cohort study conducted by Oindrila Raha et all[46,] in Indian Bengali females with type 1 diabetes mellitus, it was found that was a significant delay in the onset of menarche and there was strong co-relation between HbA1c with menstrual characteristics.

In the present study, it was also observed that the prevalence of menstrual irregularities is 9.6%. For adolescent females with menstrual irregularities, detailed evaluation was done by the pediatrics and the Gynecology team. The cause for menstrual irregularities kept was immature Hypothalamo – pituitary gonadal axis and poorly controlled diabetes mellitus. Similar observation was found in the study conducted by Bahareh M Schweiger et all[4]

CONCLUSION

Based on the observations obtained from our study, we conclude that Type 1 diabetes mellitus possess a significant impact on longitudinal growth and pubertal development in children and adolescents with type 1 diabetes mellitus. Duration of the disease is a significant negative predictor of longitudinal growth and good glycemic control is a positive predictor of growth velocity. Institution of insulin therapy in appropriate doses will cause improvement in BMI. It is also necessary to screen for these co-morbidities including Celiac disease, and thyroid disorders and institute timely management, as these co-morbidities per se results in growth faltering. Hence, growth monitoring becomes an integral part of multi-centered care of type 1 diabetes mellitus. Since pubertal delay and menstrual irregularities are very prevalent in adolescents with type 1 DM, it is mandatory to keep a routine check on the pubertal status.

Strengths of the present study:

1. Detailed anthropometric evaluation was done both in cross-sectional and longitudinal aspects.
2. Co-morbidities associated with type 1 diabetes mellitus and their impact on growth were studied.
3. Impact of disease duration and glycemic control on growth velocity was studied.

Limitations of the present study:

1. Since it is a time-bound study, age and sex-matched controls were not included and comparison of anthropometric profile and pubertal status between the normal population and diabetic population was not done.
2. Subsequent follow-ups are needed to study the dynamicity in the growth pattern and final adult heights.

SUMMARY

Type 1 diabetes mellitus being one of the most common chronic metabolic disorders of childhood, possesses a significant impact on linear growth and pubertal development. In our study, we have evaluated the anthropometric profile and pubertal status of children with type 1 diabetes mellitus in both cross-sectional and longitudinal aspects.

Materials and methods:

This is an observational cohort study done in the department of Pediatrics, AIIMS Jodhpur. We have enrolled 100 patients with the diagnosis of Type 1 Diabetes mellitus in the age group between 1 and 18 years, visiting the Pediatric Endocrinology OPD, Pediatric Emergency, and the patients admitted in the inpatient ward. We have subcategorized the study population based on gender (Males and Females), age at diagnosis(<5 years, 6 to 10 years, and 11 to 18 years), and duration of diagnosis(New and Old patients). Detailed clinical, anthropometric (Height, Weight, BMI along with their Z scores) and pubertal evaluation(Tanner staging, menstrual irregularities if any) was done and baseline HbA1c was recorded. The subjects were followed up for a minimum duration of 6 months. Detailed anthropometric evaluation (including Height velocity and the corresponding Z scores) and HbA1c were done in the follow-up. The anthropometric profile was analysed both in a cross-sectional manner between the different groups and in a longitudinal fashion between the baseline records and their changes in the follow-up. These changes (Height velocity Z scores) were correlated with the duration of diabetes mellitus and change in HbA1c.

Results:

The mean age at diagnosis is 9.13 ± 4.19 years. The mean Weight for age, Height for age, and BMI for age Z scores are -1.10 ± 1.31, -0.67± 1.44, and -0.99±1.19 respectively. The median height for age is significantly lower in old patients when compared to new patients (p-value - 0.022). There were no other significant differences found in the median values of Weight for age, Height for age, and BMI for age Z scores on the cross-sectional analysis between different groups. The overall prevalence of short stature in children with type 1 diabetes mellitus is 21%, among which 25% of children are severely stunted. The prevalence of short stature in new

and old patients is 10% and 28.3% respectively. Short stature is 2.83 times more prevalent in patients with a disease duration of more than 6 months when compared to newly diagnosed patients with statistical significance (p-value - 0.028). On further analysis of stunted patients, it is found that some proportion of patients has additional co-morbidities including celiac disease (9.5%), autoimmune hypothyroidism (9.5%), Mauriac syndrome(4.76%) and hypogonadotropic hypogonadism(4.76%) that are associated with growth faltering. Among the total patients with proven celiac disease, 66% of patients had short stature. Among the total patients with autoimmune hypothyroidism, 37% of patients had short stature. The prevalence of wasting/thinness in the total study population is 16%, upon which 18.75% of patients have severe thinning/wasting. Thinness is 2.2 times more prevalent in females when compared to males. It is found that thinning is 1.5 times more prevalent in new patients. Out of 10 newly diagnosed patients with thinness, 8 patients presented with diabetic ketoacidosis. In our study population, the prevalence of biopsy-proven celiac disease and autoimmune hypothyroidism are 3% and 9% respectively. There is a significant positive correlation between Del HbA1C and HV Z Score (r=0.307, p=0.01) and this correlation is stronger in females (r=0.422, p=0.018) and in children less than 10 years of age (r=0.460, p=0.027). There is a significant Negative correlation between the duration of diabetes and Height Z Score (r=-0.277, p=0.005). Among the study population in the adolescent age group, it is found that the prevalence of pubertal delay in males and females is 6.25% and 25.8% respectively. The prevalence of menstrual irregularities in females is 9.6%. It was found in the present study that prevalence of pubertal delay in males is 6.25% (Only one male patient had a pubertal delay and was diagnosed with hypogonadotropic hypogonadism) and in females it is 25.8% after excluding the thyroid disorders, celiac disease and other chronic systemic illness. Among 25.8% (frequency – 8) of female patients with delayed puberty, 9.6% (frequency – 3) had delayed thelarche and the remaining 16.1%(frequency – 5) had delayed menarche. On evaluation for delayed menses, 9.6% of the population had hypogonadotropic hypogonadism and the other patients are under follow-up. For adolescent females with menstrual irregularities, detailed evaluation was done by the pediatrics and the Gynecology team. The cause of menstrual irregularities kept was immature Hypothalamo – pituitary gonadal axis and poorly controlled diabetes mellitus.

CONCLUSION:

Based on the observations obtained in our study, we conclude that Type 1 diabetes mellitus possess a significant impact on longitudinal growth and pubertal development in children and adolescents with type 1 diabetes mellitus. Growth monitoring becomes an integral part of multi-centred care of type 1 diabetes mellitus.

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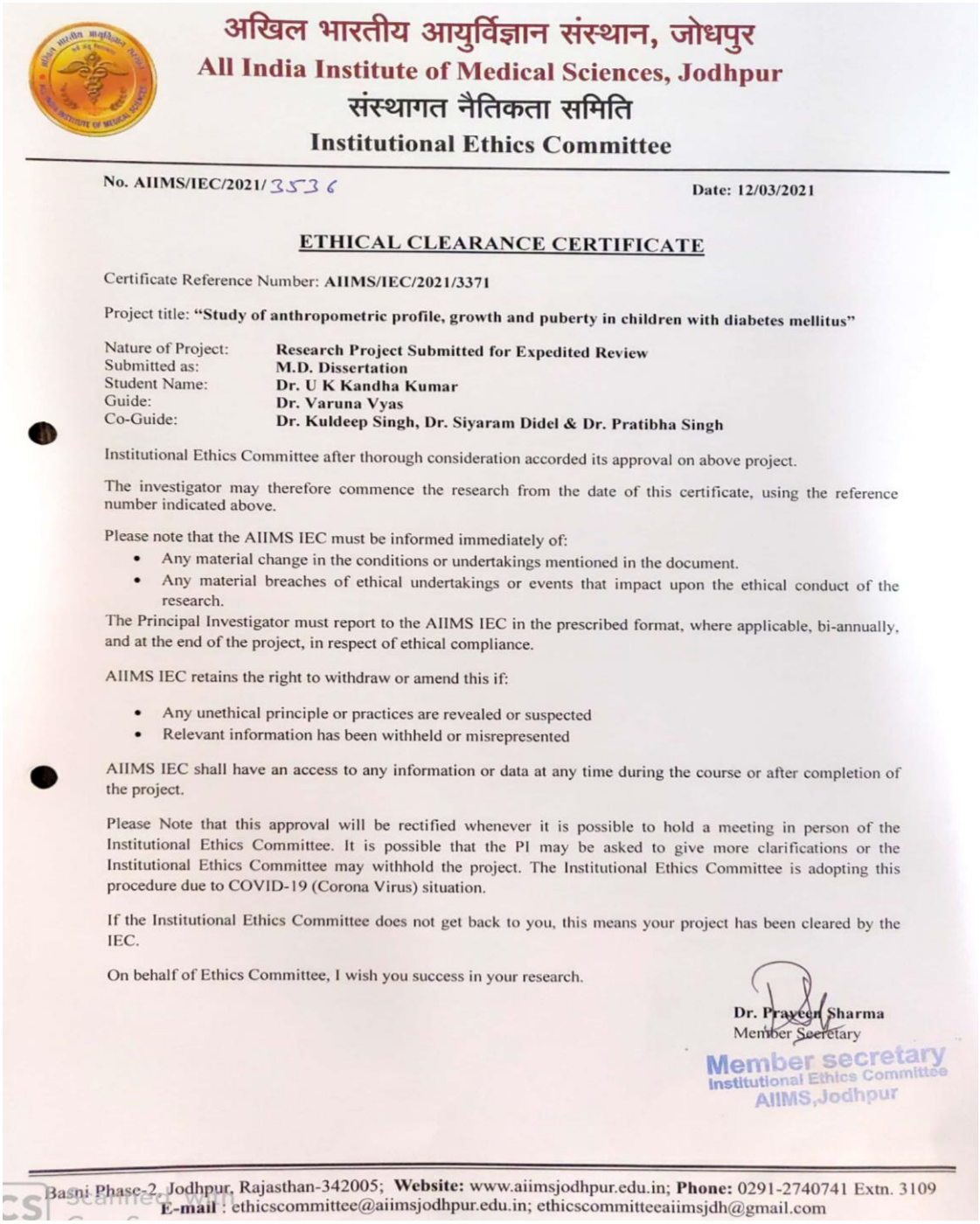
ANNEXURE- 1

ETHICAL CLEARANCE CERTIFICATE



अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर
All India Institute of Medical Sciences, Jodhpur
संस्थागत नैतिकता समिति
Institutional Ethics Committee

No. AIIMS/IEC/2021/3536 Date: 12/03/2021

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: **AIIMS/IEC/2021/3371**

Project title: **"Study of anthropometric profile, growth and puberty in children with diabetes mellitus"**

Nature of Project:	**Research Project Submitted for Expedited Review**
Submitted as:	**M.D. Dissertation**
Student Name:	**Dr. U K Kandha Kumar**
Guide:	**Dr. Varuna Vyas**
Co-Guide:	**Dr. Kuldeep Singh, Dr. Siyaram Didel & Dr. Pratibha Singh**

Institutional Ethics Committee after thorough consideration accorded its approval on above project.

The investigator may therefore commence the research from the date of this certificate, using the reference number indicated above.

Please note that the AIIMS IEC must be informed immediately of:

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The Principal Investigator must report to the AIIMS IEC in the prescribed format, where applicable, bi-annually, and at the end of the project, in respect of ethical compliance.

AIIMS IEC retains the right to withdraw or amend this if:

- Any unethical principle or practices are revealed or suspected
- Relevant information has been withheld or misrepresented

AIIMS IEC shall have an access to any information or data at any time during the course or after completion of the project.

Please Note that this approval will be rectified whenever it is possible to hold a meeting in person of the Institutional Ethics Committee. It is possible that the PI may be asked to give more clarifications or the Institutional Ethics Committee may withhold the project. The Institutional Ethics Committee is adopting this procedure due to COVID-19 (Corona Virus) situation.

If the Institutional Ethics Committee does not get back to you, this means your project has been cleared by the IEC.

On behalf of Ethics Committee, I wish you success in your research.

Dr. Praveen Sharma
Member Secretary

Member secretary
Institutional Ethics Committee
AIIMS,Jodhpur

Basni Phase-2, Jodhpur, Rajasthan-342005; **Website:** www.aiimsjodhpur.edu.in; **Phone:** 0291-2740741 Extn. 3109
E-mail : ethicscommittee@aiimsjodhpur.edu.in; ethicscommitteeaiimsjdh@gmail.com

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Annexure- 2

CONSENT FORM

Title: STUDY OF ANTHROPOMETRIC PROFILE, GROWTH AND PUBERTY IN CHILDREN WITH DIABETES MELLITUS

Investigators:

Dr. U K Kandha Kumar; Junior Resident, Department of Pediatrics, AIIMS Jodhpur.

Dr. Varuna Vyas, Associate Professor, Department of Pediatrics, AIIMS Jodhpur.

I…….. (father/mother/guardian) of …….....UHID No…… have been explained about the nature of the study in my own language. I have read and understood the parent information sheet and the consent form and the information provided to me.I am aware that height, weight, BMI, Tanners Staging, clinical examination, HbA1c will be carried out in my child during this study. I was free to ask any questions and they have been answered. I have been explained about the risks and benefits to my child associated with participation in the study and I am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my baby's future treatment in the hospital. I am also aware that the investigators may terminate participation of my child in the study at any time, for any reason, without my consent. I have decided for the participation of my child in the research study. I am aware, that if I have any questions during this study, I should contact at one of the addresses listed above. By signing this consent from, I attest that the information given in this document has been clearly explained to me and apparently understood by me. So, I hereby give consent for inclusion of my child in the above explained study program.

Signature of the patient: **Signature of the guardian:**

Signature of witness-1: **Signature of witness-2:**

Name: Name:

Date: Date:

Signature of the investigator:

ASSENT FORM

Title: STUDY OF ANTHROPOMETRIC PROFILE, GROWTH AND PUBERTY IN CHILDREN WITH DIABETES MELLITUS

Investigators:

Dr. U K Kandha Kumar; Junior Resident, Department of Pediatrics, AIIMS Jodhpur.

Dr. Varuna Vyas, Associate Professor, Department of Pediatrics, AIIMS Jodhpur.

ASSENT : In case of 7-11 years of age

The above information has also been explained to my child by the treating doctors, in a language that he/she understands. My child has agreed to be included in above study.

Name of the Researcher taking assent:

Signature of the Researcher taking the assent:

ASSENT: For children between 12-18 years

Information for student participant: This study is being done to assess the growth and pubertal trends in children with Diabetes Mellitus. You can say 'No' if you do not want to participate in the study. No one will get angry with you. If you say 'Yes' now, you can change your mind later and say 'No'.No one will scold you for this.

If you have any questions, you can ask the person taking signature in this form.

Statement by the participant: I……. s/o or d/o…….r/o……agree to participate in the above study. I understand that my parent/legally authorized guardian has already consented for my participation the study. I understand that my participation is voluntary am m aware of my right to opt out of the study at any time without giving any reason.

Name of the Participant:

Signature of the Participant:

Date:

अनुबंध 1

सहमति पत्र

शीर्षक: डाईबेटिस मेलाइटिस वाले बच्चों में विकास और यौवनावस्था !

-

जांचकर्ता:

Dr. U K Kandha Kumar; Junior Resident, Department of Pediatrics, AIIMS Jodhpur

Dr. Varuna Vyas, Associate Professor, Department of Pediatrics, AIIMS Jodhpur

मुझे मेरी भाषा मेँ अध्ययन के बारे में बता दिया गया है। मैंने इस सहमती फॉर्म को पढ़ और समझ लिया है। मुझे ज्ञात है की इस अध्ययन के दौरान मेरे बच्चे का वजन, ऊंचाई और BMI,Taners staging, और HbA1c की जाँच भी की जायेगी। मैं कोई भी प्रश्न पूछने के लिए स्वतंत्र था, और उसका उत्तर भी दिया गया। मुझे इस अध्ययन में बच्चे को होने वाले नफा नुकसान के बारे में बता दिया गया है। मैंने इस शोध अध्ययन में अपने बच्चे की भागीदारी का निर्णय दिया है। मुझे पता है की इस अध्ययन के दौरान कोई सवाल हो तो सूचीबद्ध पते पर संपर्क करना चाहिए। इस सहमती पत्र पर हस्ताक्षर करने से पहले इस दस्तावेज में दी गई जानकारी मुझे स्पष्ट रूप से बता दी गई है और मेरे द्वारा स्पष्ट रूप से समझी गई है। इस शोध अध्ययन के दौरान कभी भी अध्ययन को बीच में छोड़ सकता हूँ , जिसका मेरे बच्चे के इलाज में कोई असर नहीं पड़ेगा। इसलिए मैं उपरोक्त वर्णित अध्ययन कार्यक्रम में अपने बच्चे को शामिल करने की सहमति देता हूँ।

गवाह -1 का हस्ताक्षर:

नाम

गवाह -2 के हस्ताक्षर:

नाम:

ANNEXURE - 3

PATIENT INFORMATION SHEET

Title: "**STUDY OF ANTHROPOMETRIC PROFILE, GROWTH AND PUBERTY IN CHILDREN WITH DIABETES MELLITUS "**

Introduction: This statement describes the purpose, procedures, benefits, risks and discomforts of the study and your right to withdraw from the study at any point of time.

Purpose:

1. To study the anthropometric profile and pubertal stage of children with Diabetes and to co-relate them with clinical profile of the patient.

Study Procedure: Your relevant clinical history, anthropometric details including height ,weight, BMI sexual maturity rating using Tanner score and HbA1c will be recorded. Clinical examination will be conducted and findings noted.

Benefits: No monetary benefits will be given to you. However, any new information that can come to light regarding any findings in the study will help in further management of the disease and help all other ailing patients suffering from this problem.

Confidentiality: Records of your study participation will be kept confidential, under safe custody. Any publication of data will not identify you by name. By signing the consent form you authorize the sharing of your study related medical records to the regulatory authorities and the Institutional Ethical Committee.

Information regarding withdrawal: You have the right to withdraw yourself from the study at any time during the course of the study.

Contact for additional information: Any time during or after the study, you can obtain further information about the study from Dr. U K Kandha Kumar, All India Institute of Medical Science, Jodhpur, and Rajasthan.

रोगी सूचना पत्रक

शीर्षक: डाईबेटिस मेलाइटिस वाले बच्चों में विकास और यौवनावस्था !

परिचय: यह कथन अध्ययन के उद्देश्य, प्रक्रियाओं, लाभों, जोखिमों और असुविधाओं और किसी भी समय अध्ययन से पीछे हटने के आपके अधिकार का वर्णन करता है।

उद्देश्य:

1. मधुमेह वाले बच्चों के एंथ्रोपोमेट्रिक प्रोफाइल और यौवनावस्था चरण का अध्ययन करना और रोगी के नैदानिक प्रोफ़ाइल के साथ उनका संबंध स्थापित करना

अध्ययन प्रक्रिया: आपका प्रासंगिक नैदानिक इतिहास दर्ज किया जाएगा तथा मानवमिति वजन, ऊंचाई और BMI,Tanners staging, और HbA1c का मूल्यांकन किया जाएगा।

लाभ: कोई मौद्रिक लाभ आपको नहीं दिया जाएगा। हालांकि, किसी भी नई जानकारी जो अध्ययन में किसी भी निष्कर्ष के बारे में प्रकाश में आ सकती है, बीमारी के आगे प्रबंधन में मदद करेगी और इस समस्या से पीड़ित अन्य सभी बीमार रोगियों की मदद करेगी।

गोपनीयता: सुरक्षित अभिरक्षा के तहत, आपके अध्ययन की भागीदारी के रिकॉर्ड को गोपनीय रखा जाएगा।

डेटा का कोई भी प्रकाशन आपको नाम से नहीं पहचानेगा। सहमति फॉर्म पर हस्ताक्षर करके आप अपने अध्ययन से संबंधित मेडिकल रिकॉर्ड को नियामक अधिकारियों और संस्थागत नैतिक समिति को साझा करने के लिए अधिकृत करते हैं।

वापसी के बारे में जानकारी: आपको अध्ययन के दौरान किसी भी समय अध्ययन से खुद को वापस लेने का अधिकार है।

अतिरिक्त जानकारी के लिए संपर्क करें: अध्ययन के दौरान या बाद में किसी भी समय, आप डॉ। U K Kandha Kumar, अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर और राजस्थान से अध्ययन के बारे में अधिक जानकारी प्राप्त कर सकते हैं।

ANNEXURE - 4

DEFINITIONS:

Criteria for the diagnosis of diabetes mellitus

Ref: ISPAD Clinical Practice Consensus Guidelines 2018: Definition, epidemiology, and classification of diabetes in children and adolescents by Elizabeth J. Mayer-Davis et all[8]

Classic symptoms of diabetes or hyperglycaemic crisis, with plasma glucose concentration,≥11.1 mmol/L (200 mg/dL).

Or

Fasting plasma glucose ≥7.0 mmol/L (≥126 mg/dL). Fasting is defined as no caloric intake for at least 8 hours

Or

Two-hour post-load glucose ≥11.1 mmol/L (≥200 mg/dL) during an OGTT. The test should be performed using a glucose load containing the equivalent of 75 g of anhydrous glucose dissolved in water or 1.75 g/kg of body weight to a maximum of 75 g.

Or

HbA1c ≥6.5%b

ANNEXURE - 5

Definitions:

Stunting – Height for age Z score less than -2 SD from the mean in children less than 5 years of age according to WHO growth standards.

Short stature - Height for age Z score less than -2 SD from the mean in children more than 5 years of age according to revised IAP growth standards.

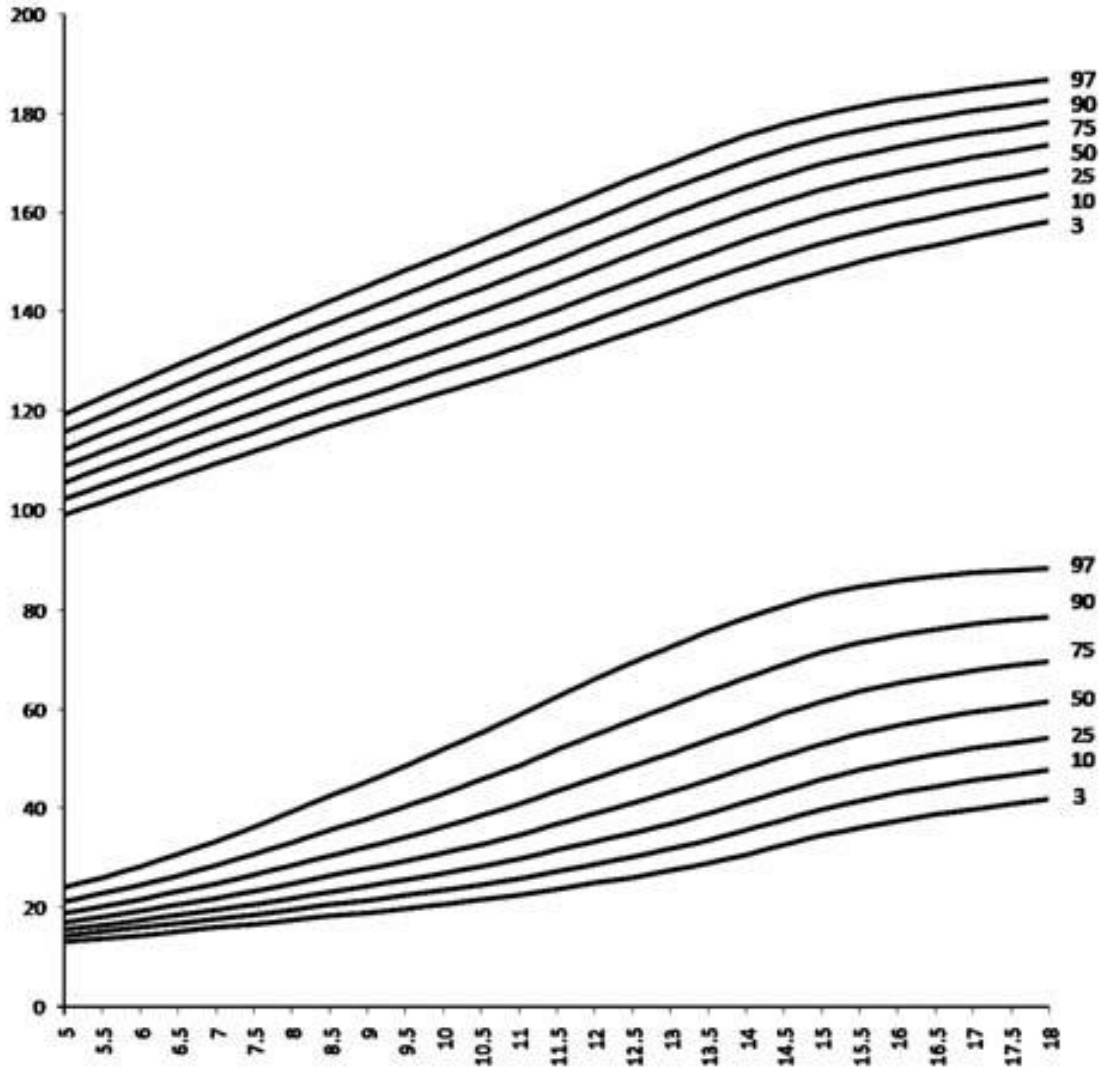
Wasting - BMI for age Z score less than -2 SD from the mean in children less than 5 years of age according to WHO growth standards.

Thinness: BMI for age Z score less than -2 SD from the mean in children more than 5 years of age according to revised IAP growth standards.

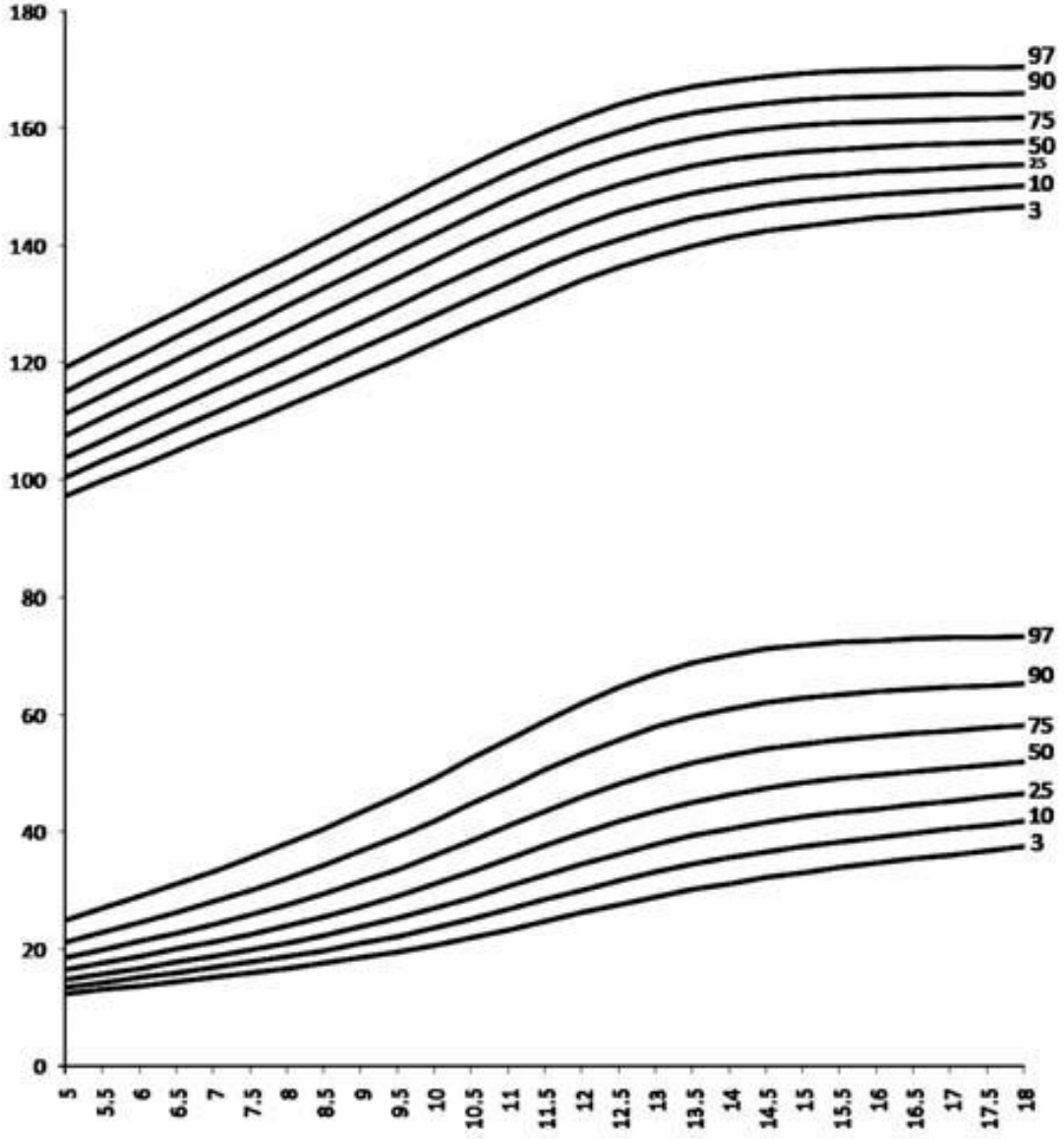
REVISED IAP GROWTH CHARTS

Ref: Revised IAP Growth Charts for Height, Weight and Body Mass Index for 5- to 18-year-old Indian Children by VAMAN KHADILKAR et all[49]

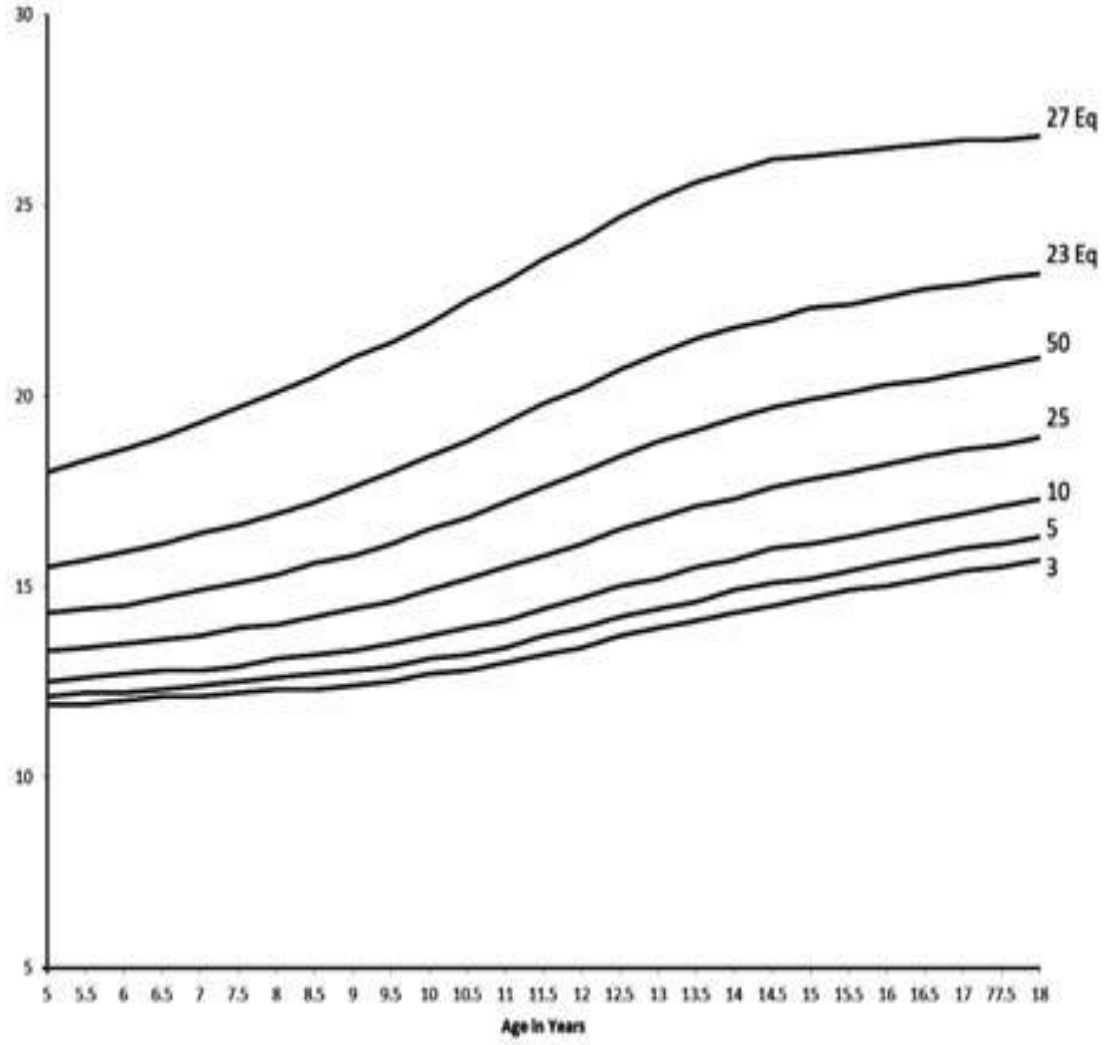
IAP Boys Height and Weight Charts 5-18 y



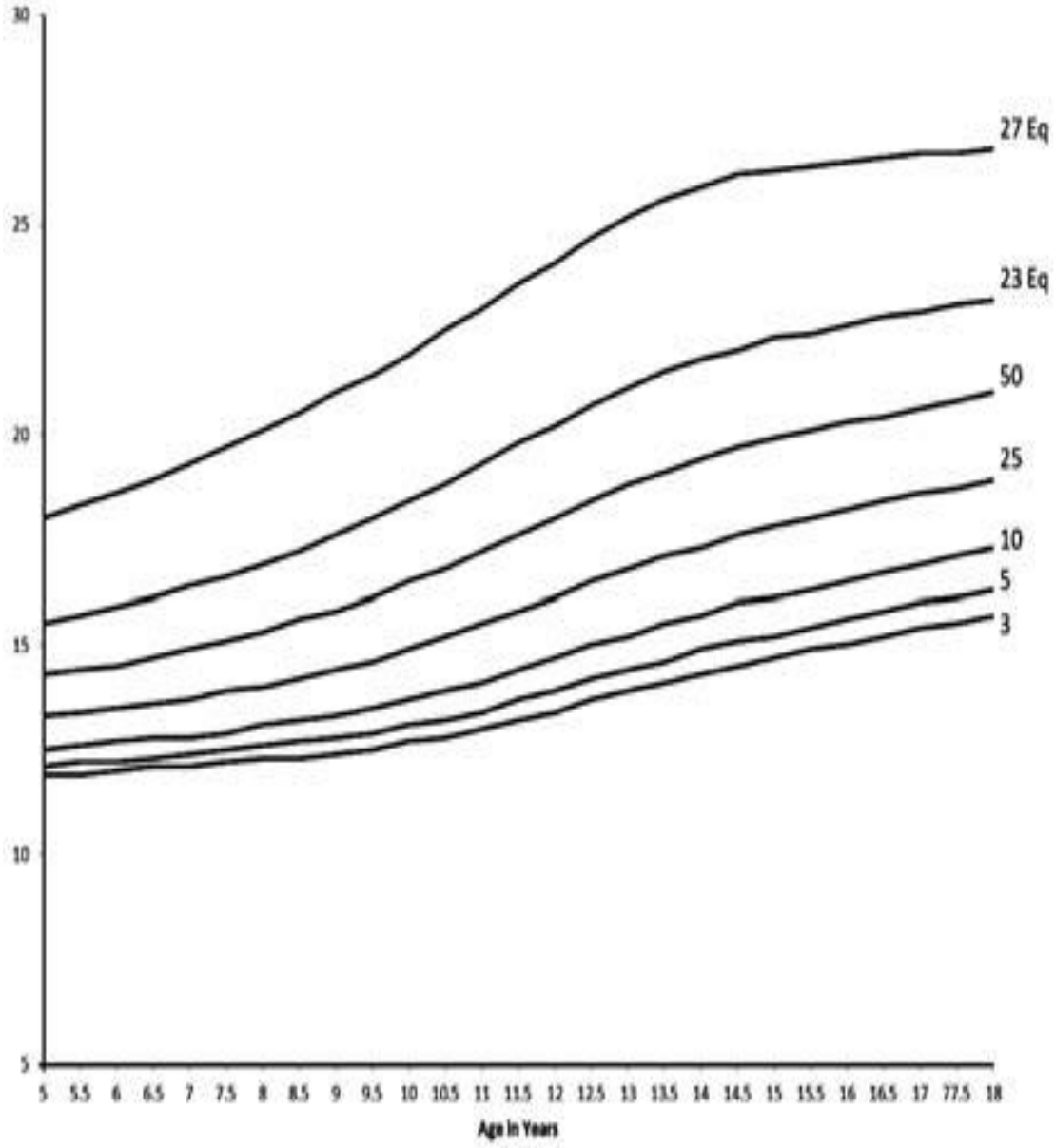
IAP Girls Height and Weight Charts 5-18 y



IAP Girls BMI Charts 5-18 y



IAP Girls BMI Charts 5-18 y



HEIGHT (CM) CENTILES AND STANDARD DEVIATION FOR BOYS

Age	*3*	*10*	*25*	*50*	*75*	*90*	*97*	*SD*
5.0	99.0	102.3	105.6	108.9	112.4	115.9	119.4	5.7
5.5	101.6	105.0	108.4	111.9	115.4	119.0	122.7	5.3
6.0	104.2	107.7	111.2	114.8	118.5	122.2	126.0	5.6
6.5	106.8	110.4	114.0	117.8	121.6	125.4	129.3	5.5
7.0	109.3	113.0	116.8	120.7	124.6	128.6	132.6	5.9
7.5	111.8	115.7	119.6	123.5	127.6	131.7	135.9	5.7
8.0	114.3	118.2	122.3	126.4	130.5	134.8	139.1	6.3
8.5	116.7	120.8	124.9	129.1	133.4	137.8	142.2	6.1
9.0	119.0	123.2	127.5	131.8	136.3	140.7	145.3	6.4
9.5	121.3	125.6	130.0	134.5	139.1	143.7	148.3	6.4
10.0	123.6	128.1	132.6	137.2	141.9	146.6	151.4	6.8
10.5	125.9	130.5	135.2	139.9	144.7	149.5	154.4	6.5
11.0	128.2	133.0	137.8	142.7	147.6	152.5	157.5	7.6
11.5	130.7	135.6	140.6	145.5	150.5	155.6	160.6	7.3
12.0	133.2	138.3	143.3	148.4	153.5	158.6	163.7	8.1
12.5	135.7	141.0	146.2	151.4	156.5	161.7	166.8	7.9
13.0	138.3	143.7	149.0	154.3	159.5	164.7	169.9	9.0
13.5	140.9	146.4	151.8	157.2	162.4	167.6	172.7	8.4
14.0	143.4	149.0	154.5	159.9	165.1	170.3	175.4	9.0
14.5	145.8	151.5	157.0	162.3	167.6	172.7	177.7	7.8
15.0	148.0	153.7	159.2	164.5	169.7	174.8	179.7	7.9
15.5	150.0	155.7	161.2	166.5	171.6	176.5	181.4	6.6
16.0	151.8	157.4	162.9	168.1	173.1	178.0	182.7	7.2
16.5	153.4	159.1	164.5	169.6	174.5	179.3	183.8	6.7
17.0	155.0	160.6	165.9	171.0	175.8	180.4	184.8	6.9
17.5	156.6	162.1	167.3	172.3	177.0	181.5	185.8	6.1
18.0	158.1	163.6	168.7	173.6	178.2	182.5	186.7	6.9

WEIGHT (KG) CENTILES AND STANDARD DEVIATION FOR BOYS

Age	*3*	*10*	*25*	*50*	*75*	*90*	*97*	*SD*
5.0	13.2	14.3	15.6	17.1	19.0	21.3	24.2	3.2
5.5	13.8	15.0	16.5	18.2	20.3	22.9	26.1	2.9
6.0	14.5	15.8	17.4	19.3	21.7	24.6	28.3	3.6
6.5	15.3	16.8	18.6	20.7	23.3	26.6	30.8	3.8
7.0	16.0	17.6	19.6	21.9	24.9	28.6	33.4	4.2
7.5	16.7	18.5	20.7	23.3	26.6	30.8	36.2	4.9
8.0	17.5	19.5	21.9	24.8	28.5	33.2	39.4	5.7
8.5	18.3	20.5	23.2	26.4	30.5	35.7	42.6	6.5
9.0	19.1	21.5	24.3	27.9	32.3	38.0	45.5	6.3
9.5	19.9	22.4	25.6	29.4	34.3	40.5	48.6	7.0
10.0	20.7	23.5	26.9	31.1	36.3	43.0	51.8	7.9
10.5	21.6	24.6	28.3	32.8	38.5	45.8	55.2	8.3
11.0	22.6	25.9	29.8	34.7	40.9	48.7	58.7	8.9
11.5	23.8	27.3	31.6	36.9	43.5	51.8	62.5	9.3
12.0	24.9	28.7	33.3	39.0	46.0	54.8	66.1	10.0
12.5	26.1	30.2	35.1	41.2	48.6	57.8	69.5	10.6
13.0	27.5	31.8	37.0	43.3	51.1	60.7	72.6	11.3
13.5	29.0	33.6	39.1	45.7	53.8	63.6	75.6	11.4
14.0	30.7	35.5	41.3	48.2	56.4	66.3	78.3	12.1
14.5	32.6	37.7	43.7	50.8	59.1	69.1	80.9	11.6
15.0	34.5	39.8	45.9	53.1	61.6	71.5	83.1	12.1
15.5	36.1	41.6	47.9	55.2	63.6	73.4	84.7	11.2
16.0	37.5	43.1	49.5	56.8	65.2	74.8	85.8	12.2
16.5	38.7	44.4	50.9	58.2	66.6	76.1	86.8	12.6
17.0	39.8	45.6	52.1	59.5	67.8	77.1	87.5	12.3
17.5	40.8	46.7	53.2	60.6	68.7	77.8	88.0	12.3
18.0	41.8	47.7	54.3	61.6	69.7	78.6	88.4	11.3

HEIGHT (CM) CENTILES AND STANDARD DEVIATIONS FOR GIRLS

Age	*3*	*10*	*25*	*50*	*75*	*90*	*97*	*SD*
5.0	97.2	100.5	103.9	107.5	111.3	115.2	119.3	5.4
5.5	99.8	103.2	106.8	110.5	114.4	118.3	122.5	5.7
6.0	102.3	106.0	109.7	113.5	117.4	121.5	125.6	5.8
6.5	104.9	108.7	112.5	116.5	120.5	124.6	128.7	5.5
7.0	107.4	111.4	115.4	119.4	123.5	127.7	131.9	6.1
7.5	110.0	114.1	118.2	122.4	126.6	130.8	135.0	6.0
8.0	112.6	116.8	121.1	125.4	129.6	133.9	138.1	6.2
8.5	115.2	119.6	124.0	128.4	132.7	137.0	141.3	6.8
9.0	117.8	122.4	126.9	131.4	135.8	140.2	144.5	6.9
9.5	120.5	125.2	129.9	134.4	138.9	143.3	147.6	6.6
10.0	123.3	128.1	132.8	137.4	142.0	146.4	150.8	7.8
10.5	126.1	130.9	135.7	140.4	145.0	149.5	153.9	7.3
11.0	128.8	133.7	138.6	143.3	147.9	152.4	156.8	7.9
11.5	131.5	136.4	141.2	145.9	150.6	155.1	159.6	7.1
12.0	134.0	138.9	143.7	148.4	153.0	157.5	162.0	7.0
12.5	136.3	141.1	145.8	150.5	155.1	159.6	164.1	6.7
13.0	138.2	142.9	147.6	152.2	156.8	161.3	165.9	6.9
13.5	139.9	144.5	149.1	153.6	158.2	162.7	167.2	6.0
14.0	141.3	145.8	150.2	154.7	159.2	163.7	168.2	6.6
14.5	142.4	146.8	151.1	155.5	160.0	164.5	169.0	5.9
15.0	143.3	147.5	151.8	156.1	160.5	165.0	169.5	6.6
15.5	144.1	148.1	152.3	156.6	160.9	165.3	169.8	5.9
16.0	144.7	148.6	152.7	156.9	161.2	165.6	170.1	6.1
16.5	145.2	149.1	153.1	157.2	161.4	165.7	170.2	6.4
17.0	145.7	149.5	153.4	157.4	161.6	165.9	170.4	6.5
17.5	146.2	149.8	153.6	157.6	161.7	166.0	170.5	6.7
18.0	146.6	150.2	153.9	157.8	161.9	166.1	170.6	6.6

WEIGHT (KG) CENTILES AND STANDARD DEVIATIONS FOR GIRLS

Age	*3*	*10*	*25*	*50*	*75*	*90*	*97*	*SD*
5.0	12.3	13.4	14.8	16.4	18.5	21.3	25.0	2.5
5.5	13.0	14.3	15.7	17.6	19.9	22.9	27.0	3.5
6.0	13.7	15.1	16.7	18.7	21.3	24.6	29.1	3.4
6.5	14.4	15.9	17.7	19.9	22.7	26.3	31.2	4.1
7.0	15.1	16.8	18.7	21.2	24.2	28.2	33.4	4.4
7.5	15.9	17.7	19.9	22.5	25.9	30.1	35.7	4.8
8.0	16.7	18.7	21.1	24.0	27.6	32.2	38.1	5.2
8.5	17.5	19.7	22.3	25.5	29.5	34.4	40.7	6.4
9.0	18.5	20.9	23.7	27.2	31.5	36.7	43.4	6.4
9.5	19.5	22.1	25.3	29.0	33.6	39.3	46.3	6.9
10.0	20.7	23.5	26.9	31.0	36.0	42.0	49.4	7.7
10.5	22.0	25.1	28.8	33.2	38.4	44.8	52.6	8.3
11.0	23.3	26.7	30.7	35.4	41.0	47.7	55.9	8.5
11.5	24.8	28.4	32.6	37.6	43.6	50.6	59.1	9.1
12.0	26.2	30.0	34.5	39.8	46.0	53.4	62.1	9.0
12.5	27.6	31.6	36.3	41.8	48.2	55.8	64.8	9.7
13.0	28.9	33.1	37.9	43.6	50.2	57.9	67.1	9.4
13.5	30.2	34.4	39.4	45.1	51.8	59.7	69.0	9.8
14.0	31.3	35.6	40.6	46.4	53.2	61.1	70.4	9.6
14.5	32.3	36.6	41.7	47.5	54.3	62.2	71.4	9.4
15.0	33.1	37.5	42.5	48.4	55.1	62.9	72.1	9.6
15.5	34.0	38.3	43.3	49.1	55.8	63.5	72.5	8.7
16.0	34.7	39.1	44.0	49.7	56.3	64.0	72.8	8.7
16.5	35.5	39.8	44.7	50.3	56.9	64.4	73.1	9.2
17.0	36.2	40.5	45.3	50.9	57.3	64.7	73.3	8.8
17.5	36.9	41.1	46.0	51.5	57.8	65.0	73.4	9.5
18.0	37.6	41.8	46.6	52.0	58.2	65.3	73.5	10.2

BODY MASS INDEX PERCENTILES AND STANDARD DEVIATIONS FOR BOYS

Age	*3*	*5*	*10*	*25*	*50*	*23 Eq(71)*	*27 Eq(90)*	*SD*
5.0	12.1	12.4	12.8	13.6	14.7	15.7	17.5	1.6
5.5	12.2	12.4	12.9	13.7	14.8	15.8	17.6	1.5
6.0	12.2	12.5	12.9	13.7	14.9	16.0	17.8	1.8
6.5	12.3	12.5	13.0	13.8	15.0	16.1	18.0	1.8
7.0	12.3	12.6	13.1	13.9	15.1	16.3	18.2	1.9
7.5	12.4	12.7	13.2	14.1	15.3	16.5	18.5	2.2
8.0	12.5	12.8	13.3	14.2	15.5	16.7	18.8	2.5
8.5	12.6	12.9	13.4	14.4	15.7	17.0	19.2	2.8
9.0	12.7	13.0	13.5	14.5	15.9	17.3	19.6	2.6
9.5	12.8	13.1	13.7	14.7	16.2	17.6	20.1	2.8
10.0	12.9	13.2	13.8	14.9	16.4	18.0	20.5	3.1
10.5	13.0	13.3	14.0	15.1	16.7	18.3	21.0	3.2
11.0	13.1	13.5	14.1	15.4	17.0	18.7	21.5	3.2
11.5	13.2	13.6	14.3	15.6	17.3	19.1	22.1	3.3
12.0	13.3	13.8	14.5	15.8	17.7	19.5	22.6	3.4
12.5	13.5	13.9	14.6	16.0	17.9	19.8	23.0	3.6
13.0	13.6	14.0	14.8	16.3	18.2	20.2	23.4	3.5
13.5	13.7	14.2	14.9	16.5	18.5	20.5	23.8	3.7
14.0	13.8	14.3	15.1	16.7	18.7	20.8	24.2	3.7
14.5	14.0	14.5	15.3	16.9	19.0	21.1	24.5	3.5
15.0	14.2	14.7	15.5	17.2	19.3	21.4	24.9	3.7
15.5	14.4	14.9	15.8	17.4	19.6	21.7	25.2	3.4
16.0	14.6	15.1	16.0	17.7	19.9	22.0	25.5	3.7
16.5	14.9	15.4	16.3	18.0	20.2	22.4	25.8	3.8
17.0	15.1	15.6	16.6	18.3	20.5	22.6	26.0	3.8
17.5	15.4	15.9	16.8	18.6	20.8	22.9	26.3	3.6
18.0	15.6	16.2	17.1	18.9	21.1	23.2	26.6	3.2

BODY MASS INDEX PERCENTILES AND STANDARD DEVIATIONS FOR GIRLS

Age	*3*	*5*	*10*	*25*	*50*	*23 Eq(75)*	*27 Eq(95)*	*SD*
5.0	11.9	12.1	12.5	13.3	14.3	15.5	18.0	1.4
5.5	11.9	12.2	12.6	13.4	14.4	15.7	18.3	1.7
6.0	12.0	12.2	12.7	13.5	14.5	15.9	18.6	1.7
6.5	12.1	12.3	12.8	13.6	14.7	16.1	18.9	2.0
7.0	12.1	12.4	12.8	13.7	14.9	16.4	19.3	2.1
7.5	12.2	12.5	12.9	13.9	15.1	16.6	19.7	2.2
8.0	12.3	12.6	13.1	14.0	15.3	16.9	20.1	2.3
8.5	12.3	12.7	13.2	14.2	15.6	17.2	20.5	2.7
9.0	12.4	12.8	13.3	14.4	15.8	17.6	21.0	2.7
9.5	12.5	12.9	13.5	14.6	16.1	18.0	21.4	2.8
10.0	12.7	13.1	13.7	14.9	16.5	18.4	21.9	2.9
10.5	12.8	13.2	13.9	15.2	16.8	18.8	22.5	3.1
11.0	13.0	13.4	14.1	15.5	17.2	19.3	23.0	3.1
11.5	13.2	13.7	14.4	15.8	17.6	19.8	23.6	3.3
12.0	13.4	13.9	14.7	16.1	18.0	20.2	24.1	3.2
12.5	13.7	14.2	15.0	16.5	18.4	20.7	24.7	3.3
13.0	13.9	14.4	15.2	16.8	18.8	21.1	25.2	3.2
13.5	14.1	14.6	15.5	17.1	19.1	21.5	25.6	3.5
14.0	14.3	14.9	15.7	17.3	19.4	21.8	25.9	3.4
14.5	14.5	15.1	16.0	17.6	19.7	22.0	26.2	3.3
15.0	14.7	15.2	16.1	17.8	19.9	22.3	26.3	3.4
15.5	14.9	15.4	16.3	18.0	20.1	22.4	26.4	3.1
16.0	15.0	15.6	16.5	18.2	20.3	22.6	26.5	3.1
16.5	15.2	15.8	16.7	18.4	20.4	22.8	26.6	3.2
17.0	15.4	16.0	16.9	18.6	20.6	22.9	26.7	3.0
17.5	15.5	16.1	17.1	18.7	20.8	23.1	26.7	3.1
18.0	15.7	16.3	17.3	18.9	21.0	23.2	26.8	3.6

ANNEXURE - 6

Height Velocity Percentiles :

Ref: Height Velocity Percentiles in Indian Children Aged 5-17 Years by VAMAN KHADILKAR et all[52]

BOYS HEIGHT VELOCITY PERCENTILES (IN CM)

Age years	*n*	*Percentile*						
		3rd	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*
5	91	5.3	5.7	6.1	6.6	7.1	7.7	8.3
5.5		5.1	5.5	6.0	6.5	7.0	7.6	8.2
6	200	4.9	5.3	5.8	6.3	6.8	7.4	8.0
6.5		4.6	5.1	5.6	6.1	6.6	7.3	7.9
7	280	4.4	4.9	5.4	5.9	6.5	7.1	7.8
7.5		4.2	4.7	5.2	5.7	6.3	7.0	7.7
8	347	4.0	4.5	5.0	5.6	6.2	6.9	7.7
8.5		3.9	4.3	4.8	5.4	6.1	6.8	7.7
9	388	3.7	4.2	4.7	5.3	6.0	6.8	7.7
9.5		3.5	4.0	4.5	5.2	5.9	6.8	7.8
10	374	3.4	3.9	4.4	5.1	5.9	6.8	8.0
10.5		3.3	3.8	4.4	5.1	6.0	7.0	8.3
11	378	3.3	3.8	4.4	5.2	6.1	7.3	8.8
11.5		3.3	3.8	4.5	5.3	6.4	7.7	9.4
12	377	3.3	3.9	4.6	5.6	6.7	8.2	10.1
12.5		3.4	4.1	4.9	6.0	7.4	9.1	11.2
13	337	3.4	4.2	5.3	6.5	8.1	10.0	12.3
13.5		3.2	4.2	5.4	6.8	8.6	10.6	12.9
14	267	2.7	3.8	5.1	6.6	8.4	10.4	12.6
14.5		2.0	3.2	4.5	6.0	7.7	9.5	11.4
15	216	1.4	2.5	3.7	5.1	6.5	8.1	9.8
15.5		0.9	1.8	2.9	4.0	5.3	6.6	8.1
16	101	0.6	1.3	2.2	3.2	4.3	5.4	6.6
16.5		0.4	1.0	1.7	2.4	3.3	4.3	5.3
17	32	0.3	0.7	1.2	1.8	2.5	3.3	4.2
17.5		0.2	0.5	0.8	1.3	1.9	2.5	3.3

GIRLS HEIGHT VELOCITY PERCENTILES (IN CM)

Age years	*n*	*Percentile*						
		3rd	*10th*	*25th*	*50th*	*75th*	*90th*	*97th*
5	51	5.0	5.5	6.1	6.6	7.3	7.9	8.6
5.5		4.7	5.3	5.8	6.4	7.0	7.7	8.5
6	157	4.5	5.0	5.5	6.2	6.8	7.5	8.3
6.5		4.2	4.7	5.3	5.9	6.6	7.4	8.2
7	212	3.9	4.5	5.1	5.7	6.5	7.3	8.1
7.5		3.7	4.3	4.9	5.7	6.4	7.3	8.2
8	282	3.6	4.2	4.9	5.7	6.5	7.4	8.5
8.5		3.5	4.2	4.9	5.8	6.7	7.8	9.0
9	294	3.4	4.2	5.0	6.0	7.1	8.3	9.7
9.5		3.3	4.2	5.1	6.3	7.5	9.0	10.6
10	296	3.2	4.1	5.2	6.5	7.9	9.6	11.5
10.5		3.0	4.0	5.2	6.6	8.2	10.1	12.3
11	324	2.6	3.6	4.9	6.4	8.2	10.2	12.7
11.5		2.2	3.1	4.4	5.9	7.7	9.9	12.4
12	329	1.6	2.5	3.7	5.1	6.9	9.0	11.5
12.5		1.1	1.9	2.9	4.2	5.8	7.8	10.2
13	318	0.7	1.3	2.1	3.2	4.7	6.4	8.5
13.5		0.4	0.9	1.5	2.4	3.6	5.0	6.8
14	208	0.2	0.6	1.1	1.9	3.0	4.3	5.9
14.5		0.1	0.4	0.8	1.5	2.4	3.5	4.9
15	117	0.1	0.2	0.6	1.1	1.8	2.8	4.0
15.5		0.0	0.2	0.4	0.9	1.6	2.4	3.5
16	20	-	0.1	0.4	0.8	1.4	2.2	-
16.5		-	0.0	0.2	0.6	1.1	1.7	-
17	20	-	0.0	0.1	0.4	0.7	1.2	-
17.5		-	0.0	0.1	0.3	0.5	0.9	-

ANNEXURE -7

Definitions[50] :

Delayed puberty in males :

- Lack of testicular enlargement i.e., the volume of testis less than 2.5 cm by 14 years of age.
- Delay of more than 5 years between testicular enlargement and completion of puberty

Delayed puberty in females :

- Lack of breast development by 13 years of age.
- Lack of menarche by 16 years of age.
- Delay of over 4 years between thelarche and completion of puberty

TANNERS STAGING:

Pubic hair growth in females is staged as follows:

•Stage I (Preadolescent) - Vellos hair develops over the pubes in a manner not greater than that over the anterior wall. There is no sexual hair.

•Stage II - Sparse, long, pigmented, downy hair, which is straight or only slightly curled, appears. These hairs are seen mainly along the labia. This stage is difficult to quantitate on black and white photographs, particularly when pictures are of fair-haired su bjects. •Stage III - Considerably darker, coarser, and curlier sexual hair appears. The hair has now spread sparsely over the junction of the pubes.

•Stage IV - The hair distribution is adult in type but decreased in total quantity. There is no spread to the medial surface of the thighs.

•Stage V - Hair is adult in quantity and type and appears to have an inverse triangle of the classically feminine type. There is spread to the medial surface of the thighs but not above the base of the inverse triangle.

The stages in male pubic hair development are as follows:

•Stage I (Preadolescent) - Vellos hair appears over the pubes with a degree of development similar to that over the abdominal wall. There is no androgen-sensitive pubic hair.

•Stage II - There is sparse development of long pigmented downy hair, which is only slightly curled or straight. The hair is seen chiefly at the base of penis. This stage may be difficult to evaluate on a photograph, especially if the subject has fair hair.

•Stage III - The pubic hair is considerably darker, coarser, and curlier. The distribution is now spread over the junction of the pubes, and at this point that hair may be recognized easily on black and white photographs.

•Stage IV - The hair distribution is now adult in type but still is considerably less that seen in adults. There is no spread to the medial surface of the thighs.

•Stage V - Hair distribution is adult in quantity and type and is described in the inverse triangle. There can be spread to the medial surface of the thighs.

In young women, the Tanner stages for breast development are as follows:

•Stage I (Preadolescent) - Only the papilla is elevated above the level of the chest wall. •Stage II - (Breast Budding) - Elevation of the breasts and papillae may occur as small mounds along with some increased diameter of the areolae.

•Stage III - The breasts and areolae continue to enlarge, although they show no separation of contour.

•Stage IV - The areolae and papillae elevate above the level of the breasts and form secondary mounds with further development of the overall breast tissue.

•Stage V - Mature female breasts have developed. The papillae may extend slightly above the contour of the breasts as the result of the recession of the aerolae.

The stages for male genitalia development are as follows:

•Stage I (Preadolescent)- The testes, scrotal sac, and penis have a size and proportion similar to those seen in early childhood.

•Stage II - There is enlargement of the scrotum and testes and a change in the texture of the scrotal skin. The scrotal skin may also be reddened, a finding not obvious when viewed on a black and white photograph.

•Stage III - Further growth of the penis has occurred, initially in length, although with some increase in circumference. There also is increased growth of the testes and scrotum.

•Stage IV - The penis is significantly enlarged in length and circumference, with further development of the glans penis. The testes and scrotum continue to enlarge, and there is distinct darkening of the scrotal skin. This is difficult to evaluate on a black-and-white photograph.

•Stage V - The genitalia are adult with regard to size and shape

ANNEXURE - 8

CASE RECORD FORM

Enrollment number	
UHID	
Date:	

STICKER

Part A: Baseline characteristics of the patient			
S. No.	**Items**		**Response**
1.	Name		
2.	Date of birth (dd/mm/yy)		
3.	Age (completed years)		
4.	Gender (Male=1/female=2)		
5.	Father's name		
6.	Mother's education		Illiterate/ Primary/ Middle/ Secondary/ Higher secondary/ Graduate/ Post graduate/ Professional
7.	Mother's occupational status		Professional/ Semiprofessional/ Clerk/ Business/ Skilled/ Semiskilled/ Unskilled/ Unemployed
8.	Father's education		Illiterate/ Primary/ Middle/ Secondary/ Higher secondary/ Graduate/ Post graduate/ Professional
9.	Father's occupation		Professional/ Semiprofessional/ Clerk/ Business/ Skilled/ Semiskilled/ Unskilled/ Unemployed
10.	Number of family members		
11.	Monthly income of family		
12.	Socio-economic scale (MKS)		
13.	Address 1:		Address 2:
	Landmark		Landmark
	Pin code		Pin code
14.	Contact numbers	Landline	
		Mobile 1	
		Mobile 2	

Part A 1: History and Details of disease		
S. No.	**Items**	**Response**
1.	Date of diagnosis	
2.	Duration since diagnosis(approx.)	
3.	Duration of symptoms before diagnosis	
4.	Duration of treatment	
5.	Outside treatment if any?	
6.	Previous HbA1c records.	Date and Records:
7.	Parent's opinion whether Blood sugar is well controlled? (Y/N)	
8.	Known case of Thyroid disorder?	
	If yes age at diagnosis?	
	How was it diagnosed ?	
	Hypo/Hyperthyroidism ?	
	Treatment if any?	
9.	Known case of celiac disease?	
	If yes age at diagnosis?	
	How was it diagnosed ?	
10.	Any other significant co-morbidities?	
11.	**Medications**	
	When insulin was started?	
	Current treatment regimen?	
	Use of any anti thyroid medication? **(Y=1/N=2)**	
	Use of levothyroxine ? **(Y=1/N=2)**	
	Use of oral corticosteroid? **(Y=1/N=2)**	
	Use of immunosuppressant? **(Y=1/N=2)**	
12.	**Past History (Yes=1/No=2)**	
	Diabetes ketoacidosis Number and date of episodes	
13.	When? Duration of onset after diagnosis :	
14.	Frequency of hypoglycemic episodes?	
15.	**PERSONAL HISTORY**	
	Diet history	
	Veg/Non-Veg	
	Type of Cereal intake	
	Type of oil medium for cooking	
	Exercise	
	Routine exercises if any?	
	Hours of active play per day?	
	Hours of sleep per day?	
	Addiction	

	Smoking(Y/N) If yes – Duration /Frequency/No of cigarettes per day	
	Alcohol(Y/N) If yes – Duration/Frequency/Brand/Quantity	
	Any other substance abuse(Y/N) If yes -Duration/Frequency/Type of substance	

Part A2: Family History (Yes=1/No=2)				
	Father	**Mother**	**Sibling**	**Grand parents**
Age				
Diabetes Mellitus				

Part B 2: Anthropometry							
1.	Height						
	IAP Z score for Age > 5 years and WHO Z score for age < 5 years						
	Short stature(Y=1/N=2)						
	Reason for short stature						
	Evaluations for SS if any?						
2.	Weight						
	IAP Z score						
3.	BMI (kg/m^2)						
	IAP Z score						
4.	Waist circumference						
5.	Mother's Height						
6.	Father's Height						
7.	Midparentral height						
8.	Z Score for MPH						
9.	Sexual maturity rating(Tanner Stage) (if done)						
10.	Menstrual status? (Attained Menarche-Y/N)						
11.	Age at menarche?						
12.	Duration of menses?						

13.	Duration of each cycle?						
15.	Menstrual abnormalities if any?						
16.	Treatment for menstrual abnormalities if any?						
17.	Does the child qualify for delayed puberty/ precocious puberty						
18.	If yes what is the work up?						
19.	HbA1c						
21.	Growth velocity • Duration taken for measurement						

Part B3: Systemic Examination	
Respiratory system	
Cardiovascular system	
Gastrointestinal system	
Central nervous system	
Others	

Follow up visit

Date

Height

Weight

BMI

Change from previous visit

Growth velocity

Growth velocity Z score

HbA1c during this period

Any other significant clinical / lab details on follow up

Insulin regimen and dose

Name	UHID	Date of enrolment	DOB	Age (YRS)	Age at diagnosis	Sex (Male=1 Female=2)	History of polyuria?	History of polydypsia?	History of nocturia?	Histor1 of polyphagia?	Duration of Diabetes in months	Insulin regimen Basal bolus=1 Split mix=2	No. of DKA Episodes	Family history of DM?	Thyroid disorder 1=Autoimmune hypothyroidism 2=Anti-TPO negative with normal TFT 3=Anti-TPO positive with noraml TFT 4=Autoimmune hyperthyroidism	Celiac Disease 1=Biopsy proven celiac 2=Negative serology 3=Positive serology under follow up	Other significant Co-morbidities
Kavita	2020/02/002903	20-10-2021	26-02-2007	14	8	2	1	1	2	2	132	2	2	2	1	2	2
Jaya Rathore	2019/12/006767	21-09-2021	23-03-2017	5	2	2	1	1	1	1	36	2	2	2	2	3	2
Yuvraj	2021/09/005849	13-09-2021	06-08-2018	3	3	1	1	2	2	2	0	1	1	2	2	2	2
Mayank	2021/06/001254	13-12-2021	06-12-2012	4	4	1	1	1	1	1	6	1	1	2	2	2	2
Bhwana	2021/09/019233	08-10-2021	03-08-2013	8	7	2	1	1	1	1	12	2	0	2	2	2	2
Sandhya	2021/10/017029	27-10-2021	30-08-2013	8	8	2	1	1	1	2	2	1	1	2	2	2	2
Jogendra	2021/10/002547	10-10-2021	04-09-2014	8	7	1	1	1	1	2	12	1	0	2	2	2	2
Gyana	2019/06/016272	22-10-2021	08-12-2007	14	11	2	1	2	2	2	36	2	1	2	2	2	2
Priyanka	2021/08/011487	21-08-2021	08-10-2005	16	15	2	1	1	1	2	12	2	1	2	2	2	2
Monika	2021/12/019574	01-01-2022	07-12-2020	1	1	2	1	1	2	1	0	2	0	2	2	2	2
Lalita	2021/12/018970	01-01-2022	27-10-2017	4	4	2	1	1	1	1	0	1	1	2	2	2	2
Sakshi	2021/09/005463	18-09-2021	05-07-2017	4	4	2	1	1	2	2	0	1	1	2	2	2	2
Piyush	2021/02/009800	23-02-2021	25-03-2016	5	5	1	1	1	2	1	0	1	0	2	2	2	2
Yash	2018/05/014036	01-01-2022	19-03-2014	8	4	1	1	1	2	1	48	1	3	2	2	1	2
Lakshika Kanwar	2021/09/000351	06-10-2021	12-07-2012	9	8	2	1	2	2	2	12	1	0	2	1	3	2
Lakshika Singh	2021/10/013980	27-10-2021	06-07-2010	12	10	1	1	1	2	1	18	2	1	2	2	2	2
Tanshika	2022/02/005689	09-01-2022	05-03-2005	16	15	2	1	1	1	1	12	1	0	2	2	2	2
Priyanka	2021/08/011487	08-12-2021	08-10-2005	16	16	2	1	1	1	1	3	1	2	2	1	2	2
Sarla	2021/07/013275	15-12-2021	22-07-2004	18	15	2	1	1	2	2	36	2	1	2	2	2	2
Rohit	2021/09/001245	18-09-2021	16-04-2020	1	1	1	1	2	2	2	0	1	0	2	2	2	2
Divyansh	2022/04/010452	26-04-2022	13-10-2019	2	2	1	1	1	1	1	0	1	0	2	2	2	2
Bhanu Pratap	2022/03/022555	06-05-2022	26-12-2019	2	2	2	1	1	1	1	0	1	0	2	2	2	2
Lalita	2022/05/001463	04-05-2022	08-07-2018	4	1	2	1	1	1	1	36	1	1	2	2	1	2
Vinay	2021/08/016133	13-09-2021	09-06-2016	5	5	1	1	2	2	2	0	1	1	2	2	2	2
Arjun Jakhar	2019/10/000265	20-10-2021	01-01-2016	5	3	1	1	1	2	2	24	1	0	2	2	2	2
Pratibha Choudhary	2022/01/033089	08-06-2022	18-10-2017	5	5	2	1	1	1	1	0	1	0	2	2	2	2
Virendra Choudhary	2021/10/015771	08-06-2022	06-04-2017	5	5	1	1	1	1	1	6	1	0	2	2	2	2
Pratak	2022/05/000761	07-05-2022	15-05-2017	5	5	1	1	1	1	1	0	1	0	2	1	2	2
Pratak	2022/05/000761	02-05-2022	07-05-2017	5	5	1	1	1	1	1	0	1	1	2	2	2	2
Sawai ram	2022/02/009097	24-02-2022	01-05-2016	6	6	1	1	2	2	2	0	1	1	2	2	2	2
Rasal	2021/10/011385	27-10-2021	02-01-2015	7	6	2	1	2	2	2	10	2	2	2	2	2	2
Khusboo	2022/02/000851	06-05-2022	06-07-2015	7	7	2	1	1	1	1	0	1	1	2	1	2	2
Samina	2021/10/008609	13-10-2021	01-01-2013	8	7	2	1	1	1	2	7	1	0	2	2	2	2
Ganesh	2022/03/018402	28-03-2022	04-08-2013	8	8	1	1	1	1	1	0	2	1	2	2	2	2
Pranjal	2022/06/003187	16-06-2022	28-11-2013	9	9	1	1	1	1	1	6	2	2	2	2	2	SAM with intususeption
Khusboo	2017/04/002044	10-06-2022	25-09-2013	9	4	2	1	1	1	2	60	1	2	2	3	3	2
Hemraj	2019/09/004645	21-02-2021	05-07-2012	10	8	1	1	2	1	1	24	1	2	2	2	2	2
Rinku	2022/01/033618	26-01-2022	25-12-2013	10	10	2	1	1	2	2	0	1	1	2	2	2	2
Jagrat	2022/04/005874	11-05-2022	18-11-2012	10	10	1	1	1	1	1	0	1	0	2	2	2	2
Kana Ram	2021/03/014963	05-04-2021	06-04-2010	11	11	1	1	2	2	2	2	1	1	2	2	2	2
Lavanya	2021/08/011630	21-08-2021	30-05-2010	11	9	2	1	1	1	2	24	1	2	2	2	2	2
Manisha	2021/03/007594	16-03-2021	01-05-2010	11	11	1	1	1	1	1	0	1	1	2	2	2	2
Aayushi	2022/05/004373	08-05-2022	04-01-2011	11	5	2	1	1	1	1	132	1	0	2	2	2	2
Ishan	2021/09/014390	08-10-2021	11-06-2010	11	11	1	1	1	1	1	6	1	0	2	2	2	2
Pinky	2018/05/005141	13-10-2021	01-09-2009	12	12	2	1	1	1	2	5	2	0	2	1	1	2
Lakshman	2022/02/001245	04-02-2022	09-04-2010	12	11	1	1	1	1	1	12	2	0	2	2	2	2
Bhanwara Ram	2021/10/008166	13-10-2021	07-09-2009	12	9	1	1	1	2	2	36	1	1	2	2	2	2
Khushi Khoja	2019/07/006698	06-10-2021	01-09-2009	12	8	2	1	1	2	2	60	1	2	2	2	2	2
Swaroop	2022/02/000695	31-01-2022	12-05-2010	12	11	1	1	1	1	1	12	2	0	2	2	2	2
Dilip Kumar	2019/06/008180	16-06-2022	14-04-2010	12	9	1	1	1	1	1	36	1	1	2	2	2	2
Jhalak	2015/12/001124	29-12-2021	23-09-2010	12	12	2	1	1	1	1	6	1	2	2	2	2	anti-GADA positive
Vinay	2022/02/000015	07-02-2022	22-04-2010	12	9	1	1	2	1	1	36	1	5	2	2	2	2
Bhavesh	2022/06/011298	16-06-2022	17-07-2008	12	12	1	1	1	1	2	0	1	2	2	2	2	2
Aarush choudhary	2022/02/006001	16-02-2022	04-08-2010	12	12	1	1	1	2	1	0	2	1	2	2	2	2
Lalitha	2022/02/002456	16-02-2022	10-12-2008	13	5	2	1	1	1	2	96	1	2	2	2	2	Brittle diabetes disease/DR with bilateral cataract/ Diabetic nephropathy/Peripheral neuropathy
Harshita Choudhary	2021/12/012542	12-01-2022	27-11-2007	13	13	2	1	1	1	1	0	1	1	2	2	2	2
Anil	2022/05/011451	25-05-2022	15-05-2009	13	7	1	1	1	1	1	84	3	3	2	2	2	2
Kanwar lal	2022/04/0012457	05-04-2022	05-07-2008	13	13	1	1	1	1	1	0	1	0	2	2	2	2
Swaroop	2022/02/000695	16-02-2022	12-05-2010	13	13	1	1	1	1	1	0	2	1	2	2	2	2
Pratibha Hans	2022/06/011127	15-06-2022	16-01-2009	13	9	2	1	1	1	2	48	1	1	2	2	3	2
Kriti Sharma	2019/12/012641	01-04-2022	24-08-2008	13	10	2	1	1	1	2	36	1	2	2	2	2	2
Mohammed Junaid	2017/09/003663	01-06-2022	26-02-2008	14	9	1	1	1	1	1	60	2	0	2	2	2	2
Khushi Khoja	2022/02/012443	24-02-2022	10-01-2008	14	14	2	1	2	2	2	0	1	3	2	2	3	2
Gowtam	2022/02/017344	04-02-2022	04-03-2008	14	14	1	1	1	1	1	0	1	1	2	2	2	2
Rakesh	202/02/005426	06-05-2022	24-04-2008	14	12	1	1	1	1	1	24	2	2	2	2	2	2
Ravindra	2022/05/002800	06-05-2022	29-03-2008	14	14	1	1	1	1	1	0	1	0	2	2	2	2
Jeevesh Gaur	2019/02/004630	01-06-2022	15-03-2007	15	12	1	1	1	1	1	36	1	0	2	2	2	2
Sawai ram	2022/05/021458	25-06-2022	01-05-2007	15	15	1	1	1	1	1	0	1	1	2	2	2	2
Jethu	2021/08/015828	07-01-2022	20-09-2007	15	15	1	1	1	2	1	5	2	1	2	2	2	Right foot drop secondary to right peroneal neuropathy
Rahul	2022/06/002008	12-06-2022	24-12-2007	15	14	1	1	1	1	1	12	1	2	2	3	2	2
Sakshi	2022/05/000933	08-05-2022	20-07-2007	15	15	2	1	1	1	1	0	1	1	2	2	2	2
Prince Pawar	2022/06/007502	03-02-2021	09-05-2005	16	7	1	1	1	1	1	108	1	2	2	2	2	2
Sanju	2022/01/003256	07-01-2022	02-05-2005	16	11	2	1	2	2	1	108	2	1	2	2	2	2
Simran Pal	2021/03/007688	16-03-2021	05-08-2006	16	14	2	1	1	2	2	24	1	0	2	2	2	2
Annu Kanwar	2022/03/017703	25-05-2022	29-09-2005	16	16	2	1	1	1	1	0	2	0	2	2	2	2
Fiza	2022/06/003169	12-06-2022	01-04-2005	17	16	1	1	1	1	1	12	1	2	2	2	2	2
Krishna Meevara	2016/03/008119	08-07-2022	25-11-2010	12	8	1	1	1	1	1	60	2	1	2	2	3	2
Ekta	2019/08/001756	13-07-2022	23-04-2011	11	8	2	1	1	1	1	36	2	0	2	1	3	2
Rohit Kachawaha	2016/10/000917	13-07-2022	16-10-2005	17	12	1	1	1	1	1	60	1	1	2	2	2	2
Nitesh	2022/07/005712	15-07-2022	10-10-2021	1	1	1	1	1	1	1	0	1	1	2	2	2	2
Nandani Singh	2022/03/018410	26/04/2022	24-12-2019	2	2	2	1	1	1	1	0	1	1	2	2	3	2
Ayana	2022/08/001952	16-07-2022	21-07-2017	5	4	2	1	1	1	1	12	1	1	2	2	2	2
Aruna	2022/07/016309	15-07-2022	09-04-2022	9	9	2	1	1	1	1	0	2	1	2	2	2	2
Muskan	2022/07/014898	15-07-2022	23-07-2022	10	10	2	1	1	1	1	0	1	1	2	2	2	2
Bhawna	2022/07/002356	15-07-2022	06-04-2010	12	7	2	1	1	1	1	60	2	0	2	2	2	2
Sushila	2022/07/020611	16-07-2022	25-04-2012	12	11	2	1	1	1	1	12	2	1	2	2	3	2
Mahesh	2022/07/008016	15-07-2022	05-04-2009	13	7	2	1	1	1	1	72	2	1	2	2	2	2
Priyanka	2022/08/000603	16-07-2022	04-04-2009	13	12	2	1	1	1	1	12	2	1	2	2	2	2
Krati Purohit	2020/10/005946	15-07-2022	12-09-2009	13	9	1	1	1	1	1	48	1	1	2	2	2	2
Tanu	2022/07/009755	15-07-2022	01-01-2008	14	11	2	1	1	1	1	120	1	1	2	2	3	2
Vikshakha	2022/07/017012	15-07-2022	29-09-2008	14	14	2	1	1	1	2	0	1	1	2	2	2	2
Mohit	2022/07/016491	15-07-2022	21-03-2022	14	14	1	1	1	1	2	0	1	1	2	2	2	2
Josh Nath	2022/06/018837	08-07-2022	01-01-2007	15	7	1	1	1	1	1	96	1	0	2	2	2	Mauriac syndrome
Dheeraj	2018/07/004194	15-07-2022	15-06-2007	15	11	1	1	1	1	1	48	2	0	2	1	2	2
Sunil Saini	2022/07/006787	15-07-2022	01-01-2006	16	9	1	1	1	1	1	72	1	1	2	2	2	2
Jeethi Kanwar	2021/10/010670	27/10/2021	26-01-2006	16	14	2	1	1	2	2	24	2	1	2	2	2	2
Dolly	2022/04/011537	22-06-2022	09-12-2006	16	9	2	1	1	1	1	72	1	2	2	4	2	2
Pramod	2022/07/012086	16-07-2022	04-12-2005	17	16	1	1	1	1	1	12	2	0	2	2	2	2
Saida	2022/06/005061	16-07-2022	01-01-2005	17	16	2	1	1	1	1	12	2	2	2	3	2	2
Yashoda	202/07/014056	16-07-2022	01-05-2005	17	16	2	1	1	1	1	12	2	6	2	2	2	Upper GI bleed with EHPVO

HbA1CNUM	Name	HbA1C	Date	Weight(Kg)	Z score	Height(cm)	Z score	BMI	Z score	Waist Circumference	Mid parental height	MPH Z Score	SMR stage	Sex(Male=1 Female=2)	DOB
9.9	Kavita	9.90%	02-09-2021	34.3	-1.85	141	-2.57	12.1	-0.61	54	162	0.47267431	4	2	26-02-2007
8.7	Jaya Rathore	8.70%	22-01-2021	15.2	-1.01	104	-0.71	14.2	-0.87	48	159	0.046296011	1	2	23-03-2017
11	Yuvraj	10.60%	10-09-2021	13.1	-0.41	99	1.09	13	-0.73	44	166	-1.143314642	1	1	06-08-2018
13	Mayank	12.60%	15-07-2022	15.9	-1.04	110	0.99	15.9	-1.85	58	161	-1.741608165	1	1	06-12-2012
11	Bhwana	11%	02-10-2021	19	-1.34	114	-2.08	14.8	-0.23	52	160	0.237124294	1	2	03-08-2013
12	Sandhya	12.40%	28-10-2021	19.1	-1.33	122	-0.67	12.8	-1.47	45	164	0.858081351	1	2	30-08-2013
9.6	Jogendra	9.60%	10-10-2021	20.5	-0.91	122	-0.07	13.7	-1.41	56	165	1.009	1	1	04-09-2014
12	Gyana	11.60%	27-06-2019	62	1.43	172	2.04	20.4	0.57	60	177	2.661130279	1	2	08-12-2007
13	Priyanka	12.90%	21-08-2021	35.7	-0.09	152	1.08	15.5	-0.73	55	163	0.6278998	4	2	08-10-2005
8.6	Monika	8.60%	03-01-2022	6.6	-2.73	70	-1.91	28.6	-2.22	33	158	-0.082123918	1	2	07-12-2020
9.3	Lalita	9.30%	01-01-2022	13	-1.75	100	-0.92	13	-1.8	38	164	0.781704787	1	2	27-10-2017
14	Sakshi	14%	13-09-2021	13.6	-1.45	104	-0.07	12.5	-2.19	48	172	2.034625613	1	2	05-07-2017
13	Piyush	12.60%	23-02-2021	16	-0.83	106	-0.61	14.2	-0.73	50	165	-1.210159623	1	1	25-03-2016
11	Yash	10.70%	30-07-2021	17.8	-2.15	110	-2.68	15.8	-0.55	40	168	-0.875021509	1	1	19-03-2014
10	Lakshika Kanwar	10%	12-08-2021	23.4	-0.89	127	-0.86	14.5	-0.65	48	164	0.858081351	2	2	12-07-2012
13	Lakshika Singh	13.30%	22-10-2022	26	-1.65	131	-1.93	15.2	-0.88	65	177	0.350155945	3	1	06-07-2010
14	Tanshika	14.40%	09-01-2022	32	-2	142	-2.65	17.9	-0.89	56	168	1.456816267	4	2	05-03-2005
13	Priyanka	12.90%	17-08-2021	34.9	-2.3	151	-0.97	15.3	-1.78	62	161	0.394522009	4	2	08-10-2005
13	Sarla	12.60%	10-11-2021	26	-3.98	145	-2.21	12.5	-3.2	56	166	1.160142982	5	2	22-07-2004
10	Rohit	10.30%	13-09-2021	8	-2.95	76	-2.61	13.9	-1.96	33	161	-1.74	1	1	16-04-2020
9.9	Divyansh	9.90%	25-04-2022	9.3	-2.94	82	-2.72	13.8	-1.78	52	167	-1.009350416	1	1	13-10-2019
11	Bhanu Pratap	11.00%	25-04-2022	10.6	-1.28	87	-0.71	14	-1.29	65	162	0.47267431	1	2	26-12-2019
7.2	Lalita	7.20%	03-02-2022	13.2	-1.31	97	-1.08	14	-0.96	62	162	0.47267431	1	2	08-07-2018
14	Vinay	14%	09-09-2021	13	-2.92	97	-3.08	13.8	-1.04	53	163	-1.54300713	1	1	09-06-2016
13	Arjun Jakhar	12.70%	10-10-2021	18.4	-0.51	110	-0.77	15.2	-0.05	33	166	-1.143314642	1	1	01-01-2016
7.2	Pratibha Choudhary	7.20%	01-06-2022	14	-1.66	105	-0.7	12.8	-1.9	56	162	0.47267431	1	2	18-10-2017
8.6	Virendra Choudhary	8.60%	01-06-2022	16.5	-0.19	110	0.15	13.6	-0.46	46	183	1.252848495	1	1	06-04-2017
11	Pratak	11.30%	03-05-2022	17.3	-0.04	113	0.63	13.5	-0.75	50	0.63	-16.38051863	1	1	15-05-2017
11	Pratak	11.30%	02-05-2022	17.3	-0.42	113	0.68	13.6	-1.37	60	171	-0.402015602	1	1	07-05-2017
13	Sawai ram	12.80%	24-02-2022	30.4	2.44	124	2.48	16.9	1.1	31	155	-2.527611438	1	1	01-05-2016
15	Rasal	14.60%	21-10-2021	16.3	-1.93	115	-1.32	12.4	-1.74	36	167	1.234810153	1	2	02-01-2015
13	Khusboo	13%	06-05-2022	19.9	0.55	118	-0.36	17.2	1	56	165	1.009795882	1	2	06-07-2015
6.8	Samina	6.80%	12-06-2021	18.8	-2.44	117	-2.26	13.7	-1.4	43	165	1.009795882	1	2	01-01-2013
14	Ganesh	13.60%	26-03-2022	19.9	-2.37	126	-0.9	12.5	-2.98	56	170	-0.605274415	1	1	04-08-2013
11	Pranjal	10.80%	06-06-2022	11.4	-4.4	116	-1.89	8.92	-4.72	36	167	-1.009350416	2	1	28-11-2013
15	Khusboo	14.50%	30-12-2021	22.9	0.73	122	-1.23	15.4	-0.13	56	157	-0.244021469	2	2	25-09-2013
14	Hemraj	14.10%	14-05-2020	20.3	-1.79	119	-1.92	14.3	-0.75	52	158	-2.136298656	2	1	05-07-2012
16	Rinku	15.70%	27-01-2022	23	-0.28	128	0.29	14	-0.66	56	165	1.009795882	2	2	25-12-2013
8.5	Jagrat	8.50%	15-04-2022	31.4	0.26	146	1.56	14.8	-0.62	52	171	-0.469858581	2	1	18-11-2012
16	Kana Ram	15.60%	05-04-2021	31.8	-2.38	150	-1.77	14.1	-1.91	55	159	-2.005108731	2	1	06-04-2010
9.6	Lavanya	9.60%	01-12-2021	36.2	-0.03	147	0.35	16.8	-0.22	51	165	1.009795882	2	2	30-05-2010
14	Manisha	14%	12-03-2021	21.5	-2.41	146	0.39	10	-3.75	54	163	-1.476621794	2	1	01-05-2010
14	Aayushi	14.10%	08-02-2022	32.5	-0.6	154	1.29	13.7	-1.56	46	168	1.456816267	2	2	04-01-2011
13	Ishan	12.70%	08-10-2020	52	1.62	164	2.66	19.5	0	48	158	-2.136298656	2	1	11-06-2010
5.4	Pinky	5.40%	15-09-2021	21.9	-2.94	122	-3.01	15.2	-1.8	56	157	-0.244021469	3	2	01-09-2009
13	Lakshman	12.60%	05-02-2022	36	-0.26	132	-2.04	20.7	0.86	54	168	-0.807720674	3	1	09-04-2010
17	Bhanwara Ram	17.30%	17-10-2021	24.8	-2.07	136	-1.7	8.5	-1.78	44	171	-0.402015602	1	1	07-09-2009
11	Khushi Khoja	11.00%	06-10-2021	34.8	-0.68	141	-1.1	17.5	-0.18	52	165	0.934110841	4	2	01-09-2009
14	Swaroop	13.60%	31-01-2022	40	0.23	145	-0.24	19	0.47	68	175	0.143950819	3	1	12-05-2010
5	Dilip Kumar	5%	01-04-2022	29	-1.4	150	-0.05	13	-2.04	68	171	-0.402015602	2	1	14-04-2010
14	Jhalak	14%	29-12-2021	29.1	-0.88	144	0.04	14	-1.31	54	165	1.009795882	2	2	23-09-2010
12	Vinay	12%	01-02-2022	33	-0.62	151	0.49	14.5	-1.19	73	159	-2.070750524	2	1	22-04-2010
14	Bhavesh	14%	18-06-2022	33.3	-1.62	164	0.53	12.4	-2.68	65	176	0.212597326	3	1	17-07-2008
14	Aarush choudhary	13.80%	18-02-2022	36	-0.23	156	1.44	14.8	-1.1	64	161	-1.741608165	3	1	04-08-2010
12	Lalitha	11.80%	07-02-2022	29.5	-2.13	132	-3.4	16.9	0.8	54	163	0.6278998	1	2	10-12-2008
7.9	Harshita Choudhary	7.90%	21-01-2022	34	-1.61	148	-1.04	15.5	-1.37	66	168	1.456816267	4	2	27-11-2007
15	Anil	15%	22-05-2022	31.4	-1.4	147	-0.94	14.5	-1.36	56	174	0.006924099	3	1	15-05-2009
12	Kanwar lal	11.80%	03-04-2022	52	0.43	151	-0.93	22.8	1.04	65	164	-1.343574565	3	1	05-07-2008
14	Swaroop	13.80%	05-02-2022	40	0.14	145	-0.32	19	0.4	56	167	-1.009350416	4	1	12-05-2010
12	Pratibha Hans	11.60%	03-01-2021	35.6	-1.16	152	-0.23	15.4	-1.3	64	156	-0.407466896	3	2	16-01-2009
13	Kriti Sharma	13.20%	17-01-2020	62.1	1.44	162	1.12	23.6	1.2	66	171	1.820321461	3	2	24-08-2008
7.3	Mohammed Junaid	7.30%	15-03-2019	33.5	-1.8	153	-1.13	14.4	-1.64	66	173	-0.197948145	3	1	26-02-2008
15	Khushi Khoja	14.50%	24-02-2022	30.5	-2.17	151	-0.66	13.5	-2.29	56	151	-1.248802479	3	2	10-01-2008
9.3	Gowtam	9.30%	04-03-2022	47	-0.11	160	0.02	18.3	-0.11	64	168	-0.807720674	2	1	04-03-2008
11	Rakesh	11.30%	06-05-2022	45.5	-0.27	165	0.62	16.7	-0.65	68	171	-0.402015602	2	1	24-04-2008
14	Ravindra	13.90%	03-05-2022	53.3	0.38	168	0.98	18.9	0.03	68	175	0.07539303	1	1	29-03-2008
14	Jeevesh Gaur	13.70%	22-10-2021	39.7	-1.47	148	-2.14	18.1	-0.4	64	157	-2.332379463	2	1	15-03-2007
10	Sawai ram	10.20%	24-05-2021	34.4	-1.88	155	-1.24	14.8	-1.24	64	167	-1.009350416	3	1	01-05-2007
14	Jethu	13.50%	30-08-2021	36.3	-1.32	159	0.49	14.5	-1.86	64	158	-2.136298656	3	1	20-09-2007
12	Rahul	12.40%	12-06-2022	45.6	-0.45	167	0.61	16.4	-0.85	71	177	0.350155945	4	1	24-12-2007
12	Sakshi	11.50%	08-05-2022	46.2	-0.2	169	1.96	16.2	-1.22	54	171	1.820321461	4	2	20-07-2007
12	Prince Pawar	12.00%	01-02-2022	26.8	-3.45	130	-4.2	15.9	-1.31	56	162	-1.609300075	1	1	09-05-2005
10	Sanju	10.30%	07-01-2022	42	0.98	147	-1.66	19.4	0.31	64	166	1.160142982	2	2	02-05-2005
14	Simran Pal	14%	19-05-2021	32	-2.47	150	-1.11	14.3	-2.2	58	161	0.394522009	4	2	05-08-2006
9.4	Annu Kanwar	9.40%	01-06-2022	34.1	-2.29	153	-0.7	14.6	-2.14	56	158	-0.082123918	4	2	29-09-2005
16	Fiza	16.10%	12-06-2022	40	-2.02	154	-2.18	16.9	-1.22	64	164	-1.343574565	4	1	01-04-2005
12	Krishna Meevara	12.40%	30-06-2022	27.5	-1.35	131	-2.02	16	-0.49	65	180	0.834385603	3	1	25-11-2010
6.7	Ekta	6.70%	28-07-2020	26.8	0.43	121	-0.83	18.3	1.12	68	159	-0.001747976	2	2	23-04-2011
13	Rohit Kachawaha	12.90%	19-11-2022	66	0.58	171	0.1	22.6	0.61	75	176	0.281332415	4	1	16-10-2005
7.8	Nitesh	7.80%	15-07-2022	9.9	1.39	66	-1.94	22.7	3.35	42	175	0.143950819	1	1	10-10-2021
11	Nandani Singh	10.60%	27-02-2022	13.4	0.64	90	0.14	16.5	0.71	53	163	0.6278998	1	2	24-12-2019
13	Ayana	12.80%	16-07-2022	14	-1.89	104	-1.19	12.9	-1.77	48	172	2.034625613	1	2	21-07-2017
13	Aruna	13.40%	16-07-2022	24.9	-0.61	142	1.34	12.4	-1.93	55	167	1.234810153	2	2	09-04-2022
8.6	Muskan	8.60%	25-07-2022	23	-1.45	141	-0.53	11.6	-2.66	54	166	1.085139073	2	2	23-07-2022
13	Bhawna	12.60%	15-07-2022	24.9	-2.43	127	-3.22	15.6	-0.97	58	157	-0.244021469	4	2	06-04-2010
16	Sushila	15.60%	16-07-2022	30	-0.33	156	2.54	12.3	-2.12	54	168	1.456816267	2	2	25-04-2012
11	Mahesh	11.20%	13-07-2022	24.4	-3.02	137	-2.34	13	-2.39	64	166	1.160142982	2	2	05-04-2009
11	Priyanka	10.60%	16-07-2022	40.9	-0.36	145	-1.12	19.5	0.2	58	172	2.034625613	2	2	04-04-2009
8.3	Krati Purohit	8.30%	23-06-2022	44.5	0.1	157	0.47	18.1	-0.02	74	163	-1.476621794	3	1	12-09-2009
14	Tanu	14.20%	16-07-2022	29.3	-2.4	149	-1	13.5	-2.33	66	154	-0.82301698	1	2	01-01-2008
11	Vikshakha	11.40%	27-07-2022	50.8	0.49	156	0.17	21	0.53	64	143	-2.779006145	3	2	29-09-2008
12	Mohit	12.30%	16-07-2022	16.9	-0.06	113	1.7	13.2	-1.77	64	165	-1.276912982	3	1	21-03-2022
13	Josh Nath	12.80%	25-06-2022	32.3	-2.54	146	-2.45	15.2	-1.56	66	176	0.212597326	4	1	01-01-2007
13	Dheeraj	13.40%	14-07-2022	48.6	-0.44	172	0.92	16.4	-0.95	65	166	-1.076378189	3	1	15-06-2007
11	Sunil Saini	11.4	15-08-2022	41.5	-1.67	157	-1.67	16.8	-1.1	66	169	-0.67284698	4	1	01-01-2006
19	Jeethi Kanwar	18.70%	17-10-2021	38	-1.27	155	-0.17	15.8	-1.39	46	162	0.550465984	3	2	26-01-2006
10	Dolly	10.30%	20-04-2022	58.3	0.89	160	0.44	22.9	0.8	64	161	0.31600628	4	2	09-12-2006
14	Pramod	13.80%	18-06-2022	34	-2.65	150	-2.43	15.1	-1.83	60	171	-0.469858581	4	1	04-12-2005
19	Saida	18.60%	16-07-2022	30	-3.3	146	-2.05	14.1	-2.45	52	174	2.316059765	2	2	01-01-2005
11	Yashoda	11.30%	16-07-2022	40	-1.44	150	-1.26	17.7	-0.96	68	168	1.456816267	3	2	01-05-2005

Name	Menstrual abnormalities if any	Date of enrolment	Date of 1st FU	DF	HbA1C	1st Follow up Weight(Kg)	Z score	1st Follow up Height(cm)	Z score	1 st Follow up BMI	Z Score	DF	Height velocity	HV Z Score	Del HbA1C
Kavita		20-10-2021	07-11-2022	12	9.30%	42.7	-0.79	145	-1.89	20.3	0.05	12	4	-1.242797514	0.60%
Jaya Rathore		21-09-2021	25-06-2022	9	8.40%	16.1	-0.33	107.5	-0.28	14.1	-0.24	9	5.333333333	-1.865524563	0.30%
Yuvraj		13-09-2021	05-05-2022	8	8.40%	19	1.61	104	0.9	17.6	1.58	8	7.5	#N/A	2.20%
Mayank		13-12-2021	15-07-2022	8	8.40%	18.6	0.16	114.5	1.05	14.2	-0.79	8	6.75	#N/A	4.20%
Bhwana		08-10-2021	04-06-2022	8	7.40%	24	-0.39	118	-1.66	17.2	0.7	8	6.75	1.243449586	3.40%
Sandhya		27-10-2021	13-07-2022	8	9.70%	19	-1.36	126	-0.84	12	-2.17	8	6	0.48	2.70%
Jogendra		10-10-2021	04-06-2022	8	8.40%	25	0.74	126	0.97	15.8	0.36	8	6	0.476269047	1.20%
Gyana	Delayed thelarche	22-10-2021	06-06-2022	8	10.10%	60	1.16	175	2.88	19.6	0.02	8	4.5	-0.97	1.50%
Priyanka		21-08-2021	04-04-2022	8	7.40%	39	-1.91	158	-1.39	15.6	-1.54	8	9	2.763144185	5.50%
Monika		01-01-2022	06-07-2022	7	8.20%	8	-2.23	74	-2.59	14.6	-0.82	7	6.857142857	#N/A	0.40%
Lalita		01-01-2022	06-07-2022	7	7.40%	16	-0.65	104	-0.74	14.8	-0.32	7	6.857142857	#N/A	1.90%
Sakshi		18-09-2021	04-04-2022	7	9.60%	15	-1.16	108	0.04	12.9	-1.86	7	6.857142857	#N/A	4.10%
Piyush		23-02-2021	24-09-2021	7	9.60%	19	0.15	110	-0.54	15.7	0.55	7	6.8	0.2	3.00%
Yash		01-01-2022	06-07-2022	7	9.40%	20	-2	114	-2.58	15.4	-0.29	7	6.857142857	1.299588632	1.30%
Lakshika Kanwar		06-10-2021	06-05-2022	7	8.20%	25.5	-0.03	130	-1.06	14.8	-0.7	7	5.142857143	-0.147658438	2.10%
Lakshika Singh		27-10-2021	15-06-2022	7	9.60%	31.2	-0.85	138	-0.8	15.5	-0.66	7	10.5	2.110428711	3.70%
Tanshika		09-01-2022	01-07-2022	7	10.20%	39	-1.62	145	-2.19	18.6	-0.71	7	5.142857143	1.10948432	4.20%
Priyanka	Delayed puberty. Attained menarche at 16 years. Irregularv cycles flb amerrohoea for 3 months	08-12-2021	06-07-2022	7	10.30%	39	-1.5	154	-0.54	16.4	-1.39	7	5.142857143	1.10948432	2.60%
Sarla		15-12-2021	09-07-2022	7	7.40%	32	-2.82	148	-1.63	14.6	-2.18	7	5.142857143	3.827475387	5.20%
Rohit		18-09-2021	27-03-2022	6	9.40%	12	-0.01	81	-1.4	17.4	1.24	6	10	#N/A	0.90%
Divyansh		26-04-2022	09-10-2022	6	10.20%	10.9	-2.28	86	-2.7	14.7	-0.73	6	8	#N/A	-0.30%
Bhanu Pratap		06-05-2022	12-11-2022	6	8.60%	15	0.47	90	-1.47	18.5	2.08	6	6	#N/A	2.40%
Lalita		04-05-2022	08-11-2022	6	7.40%	15	-0.81	99	-1.36	15.3	0.04	6	4	#N/A	-0.20%
Vinay		13-09-2021	09-03-2022	6	9.60%	15.5	-1.35	101	-2.45	15.2	0.25	6	8	1.691733904	4.80%
Arjun Jakhar		20-10-2021	16-03-2022	6	10.40%	20	0.04	114	-0.37	15.4	0.3	6	8	1.691733904	2.30%
Pratibha Choudhary		08-06-2022	21-11-2022	6	8.30%	17	-1.13	108	-0.8	15.8	-1	6	7	0.490254754	-1.10%
Virendra Choudhary		08-06-2022	20-11-2022	6	9.10%	17.2	-0.46	112	-0.11	14.4	-0.67	6	4	-4.294439852	-0.50%
Pratak		07-05-2022	12-11-2022	6	8.30%	20.4	0.68	117	0.93	14.9	0.12	6	8	1.691733904	3.00%
Pratak		02-05-2022	08-11-2022	6	10.20%	18	-0.07	115.5	0.39	13.9	-0.56	6	5	-2.4	1.10%
Sawai ram		24-02-2022	09-08-2022	6	10.80%	34	2.56	128	2.03	20.8	2.25	6	8	1.950247605	2.00%
Rasal		27-10-2021	06-05-2022	6	9.60%	19	-0.86	120	-0.31	13.2	-1.07	6	10	4.02256121	5.00%
Khusboo		06-05-2022	08-11-2022	6	11.40%	23	0.2	119	-0.4	16.2	0.58	6	2	-6.611536667	1.60%
Samina		13-10-2021	10-04-2022	6	8.20%	24	-0.73	120	-1.83	16.7	0.3	6	6	0.482540614	-1.40%
Ganesh		28-03-2022	08-08-2022	6	10.20%	21.6	-1.46	128	-0.85	13.2	-1.52	6	4	-2.062718351	3.40%
Pranjal		04-06-2022	23/11/20022	6	8.60%	16	-2.65	120	-1.68	11.5	-2.56	6	8	2.185965243	2.20%
Khusboo		02-06-2022	20-11-2022	6	12.20%	24	-0.6	123	-1.23	16.3	0.15	6	2	-4.589115245	2.30%
Hemraj		21-02-2021	23-08-2021	6	9.30%	22	-1.66	124	-1.92	14	-0.95	6	10	2.949793498	4.80%
Rinku		26-01-2022	15-07-2022	6	9.60%	24.7	-0.21	132	0.95	13.6	-1.03	6	8	2.285876868	6.10%
Jagrat		11-05-2022	09-11-2022	6	7.60%	36	0.64	148	1.55	16.4	0.01	6	4	-1.182960954	0.90%
Kana Ram		05-04-2021	08-10-2021	6	10.40%	33	-2.44	152	-1.77	14.3	-1.96	6	4	-1.116984316	5.20%
Lavanya		21-08-2021	01-02-2022	6	9.20%	38	-0.05	148	0.17	17.4	-0.12	6	2	-3.367577243	0.40%
Manisha		16-03-2021	18-09-2021	6	8.60%	24	-2.59	148	-0.22	11	-3.36	6	4	-1.116984316	5.40%
Aayushi		08-05-2022	09-11-2022	6	8.60%	39	0.07	156	1.11	16	-0.54	6	4	-1.031078728	5.50%
Ishan		08-10-2021	08-04-2022	6	10.80%	56	1.48	165	2.31	20.6	0.84	6	3	-2.443373875	1.90%
Pinky		13-10-2021	06-04-2022	6	7.60%	23	-2.97	124	-3.72	15	-1.29	6	4	-1.120573824	-2.20%
Lakshman		04-02-2022	06-08-2022	6	11.40%	38	-0.26	136	-1.85	20.5	0.74	6	8	1.23861865	1.20%
Bhanwara Ram		13-10-2021	06-04-2022	6	9.40%	28	-1.76	139	-1.75	14.5	-1.34	6	6	0.258519918	7.90%
Khushi Khoja	Polymennorhoea 4/50 days cycle followed by ameneorhea for 2 months	06-10-2021	08-04-2022	6	9.40%	35.8	-0.96	145	-1.05	17	-0.57	6	8	1.372730319	1.60%
Swaroop		31-01-2022	20-07-2022	6	8.40%	34	-0.69	148.5	-0.18	15.4	-0.85	6	7	0.791301586	5.20%
Dilip Kumar		04-06-2022	24-11-2022	6	6.80%	30	-1.42	150.5	-0.2	14	-1.94	6	2	-4.101978452	-1.80%
Jhalak		29-12-2021	09-06-2022	6	8.60%	33.3	-0.56	149	0.79	14.2	-1.31	6	10	2.313197631	5.40%
Vinay		07-02-2022	06-08-2022	6	9.40%	37	-0.35	154	0.6	15.6	-0.79	6	6	0.258519918	2.60%
Bhavesh		02-06-2022	23-11-2022	6	7.40%	41.4	-0.83	166	0.56	15	-1.36	6	4	-1.231074465	6.60%
Aarush choudhary		16-02-2022	06-08-2022	6	9.60%	39.5	0.06	160	1.52	15.4	-0.8	6	8	1.23861865	4.20%
Lalitha	Not attained thelarche	16-02-2022	06-08-2022	6	8.40%	33	-1.49	137	-2.56	17.6	-0.3	6	10	1.423361702	3.40%
Harshita Choudhary		12-01-2022	28-06-2022	6	8.20%	35.5	-1.52	150	-0.86	15.8	-1.34	6	4	-1.397939556	-0.30%
Anil		25-05-2022	23-11-2022	6	9.60%	36	-1.02	148	-1.14	16.4	-0.67	6	2	-3.544841132	5.40%
Kanwar lal		05-04-2022	04-10-2022	6	9.40%	55	0.66	154	-0.57	23.2	1.12	6	6	-0.271499604	2.40%
Swaroop		16-02-2022	06-09-2022	6	9.60%	44	0.38	148	-0.24	20.1	0.64	6	6	-0.271499604	4.20%
Pratibha Hans		02-06-2022	23-11-2022	6	10.60%	38	-0.95	154	-0.06	17.3	-0.65	6	4	-1.397939556	1.00%
Kriti Sharma		01-04-2022	06-10-2022	6	12.40%	60	0.91	163	0.37	22.6	0.96	6	2	-2.973513973	0.80%
Mohammed Junaid		01-06-2022	21-11-2022	6	8.20%	40.4	-1.12	155	-1.02	16.8	-0.73	6	5	-0.722298448	-0.90%
Khushi Khoja		24-02-2022	18-08-2022	6	10.80%	33	-1.9	154	-0.25	13.9	-2.14	6	7	0.140996001	3.70%
Gowtam		04-02-2022	28-07-2022	6	12.60%	49	0.14	163	0.14	18.4	-0.14	6	6	-0.270935452	-3.30%
Rakesh		06-05-2022	08-11-2022	6	8.60%	52	0.09	168	-0.56	20.8	0.49	6	6	-0.270935452	2.70%
Ravindra		06-05-2022	09-11-2022	6	9.40%	58	0.52	168	0.63	20.8	0.4	6	0	-5.90826284	4.50%
Jeevesh Gaur		01-06-2022	20-11-2022	6	9.40%	45	-0.5	150	-1.07	20	-0.04	6	4	-0.512483819	4.30%
Sawai ram		05-06-2022	23-11-2022	6	10.40%	36	-2.01	156	-1.29	15.6	-1.71	6	3	-1.030605873	-0.20%
Jethu		07-01-2022	08-06-2022	6	9.60%	39	-1.2	160	-0.32	15.2	-1.32	6	3	-1.030605873	3.90%
Rahul		02-06-2022	21-11-2022	6	10.20%	47	-0.56	169	0.57	17.2	-0.92	6	4	-0.512483819	2.20%
Sakshi	Irregular menstrual period -4/60 days cycle since 6 months	08-05-2022	12-11-2022	6	7.20%	50	0.12	171	2.19	17.1	-0.95	6	4	-0.529706853	4.30%
Prince Pawar	Delayed puberty - Hypogonadotropic hypogonadism, received gonodotrpin injections from outside hospital	03-02-2021	22-07-2022	6	8.40%	29.5	-3.2	136	-3.75	15.9	-1.38	6	12	4.69682446	3.60%
Sanju	not attained menarche	07-01-2022	05-06-2022	6	8.40%	45	-0.73	150	-1.25	20	-0.21	6	6	1.522845019	1.90%
Simran Pal		16-03-2021	16-09-2021	6	9.40%	33	-2.19	151	-0.89	15.5	-2.04	6	2	-0.866524634	4.60%
Annu Kanwar	Irregular menstrual periods since 5 months	25-05-2022	21-11-2022	6	7.80%	45.8	-0.58	154	-0.88	19.8	-0.24	6	2	-0.866524634	1.60%
Fiza		04-06-2022	21-11-2022	6	12.20%	48	-1.23	159	-1.77	19	-0.56	6	8	4.423641769	3.90%
Krishna Meevara		08-07-2022	21-11-2022	5	8.70%	31.6	-1.18	135	-1.66	16.4	-0.55	6	9.6	1.828803535	3.70%
Ekta		13-07-2022	10-11-2022	4	7.20%	32	-0.47	123	-2.83	20.2	0.93	6	9	2.474546555	-0.50%
Rohit Kachawaha		13-07-2022	10-11-2022	4	9.60%	64	0.37	171	-0.52	23	0.67	6	0	-3.031385131	3.30%
Nitesh		15-07-2022													
Nandani Singh		26/04/2022										6.417721519			
Ayana		16-07-2022										0.936024382			
Aruna		15-07-2022										12			
Muskan		15-07-2022													
Bhawna		15-07-2022													
Sushila		16-07-2022													
Mahesh		15-07-2022													
Priyanka	not attained	16-07-2022													
Krati Purohit		15-07-2022													
Tanu	Delayed thelarche	15-07-2022													
Vikshakha		15-07-2022													
Mohit		15-07-2022													
Josh Nath		08-07-2022													
Dheeraj		15-07-2022													
Sunil Saini		15-07-2022													
Jeethi Kanwar	Not attained menarche	27/10/2021													
Dolly		22-06-2022											5.321212121		
Pramod		16-07-2022													
Saida	not attained menarche	16-07-2022													
Yashoda	Delayed menarche	16-07-2022													