

**VOLUME 3 ISSUE 6 : NOV - DEC 2022**



**INTERNATIONAL JOURNAL OF  
SCIENTIFIC ADVANCES**

**ISSN : 2708 - 7972**

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### **Dietary Intake and Physical Activity in Relation to Obesity in 6-12 Years Old Children at SDN Banyu Urip III/364 Surabaya**

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### **Exercise Intensity and Its Relation to Sperm Count on Healthy Male Adults**

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Exercise Intensity and Its Relation to Sperm Count on Healthy Male Adults Samuel Davin<sup>1</sup>, Wardina Halim<sup>2</sup>, and Sundari Indah Wiyasihati<sup>3\*</sup>

Read More »

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### **Relationship Between Obesity and Menstrual Cycle Disorders in Adolescent Girls at SMP AL-Izzah International Islamic Boarding School Batu in 2021**



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<https://doi.org/10.51542/ijscia.v3i6.23>

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Performance Comparison Between Convolutional Neural Network-Based Artificial Intelligence SiCoSa with a Combination of 2 Radiology Specialists at Universitas Airlangga Hospital

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### **Quality Assurance of Professional Studies and The Development of 21st C Skills Among Students in Cameroon Private Universities: The Case of Private Universities in Mfoundi Division**

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### **Clinical Profile of Multidrug-Resistant Organisms at Burn Center Dr. Soetomo General Hospital Surabaya from June 2020 to June 2021**

🕒 27 December 2022 • 📖 Volume3 Issue 6

Clinical Profile of Multidrug-Resistant Organisms at Burn Center Dr. Soetomo General Hospital Surabaya from June 2020 to June 2021 Malikulsaleh1,

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<https://doi.org/10.51542/ijscia.v3i6.20>

### **Association Analysis of Individual Characteristics with Dietary Adherence of T2DM Patients as an Effort to Control Blood Glucose Levels**

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Association Analysis of Individual Characteristics with Dietary Adherence of T2DM Patients as an Effort to Control Blood Glucose Levels Fadhilah

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<https://doi.org/10.51542/ijscia.v3i6.19>

### **The Correlation Between Maternal Care for Breastfeeding and Complementary Foods with the Nutritional Status of Infants in Puskesmas Panekan Magetan Regency**

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<https://doi.org/10.51542/ijscia.v3i6.18>

### Is Vitamin D the Elixir of Life?

24 December 2022 • Volume3 Issue 6

Is Vitamin D the Elixir of Life? Miew Leng Khoo<sup>2</sup>, Kris Ke Shyang See<sup>2\*</sup>, Romel Mario Soyza<sup>1</sup>, Kishan Kanan Yogarathnam<sup>1</sup>,

Read More »

<https://doi.org/10.51542/ijscia.v3i6.17>

### The Correlation Between Age at Onset and Metabolic Control with Anthropometrics Status in Children with Type 1 Diabetes

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The Correlation Between Age at Onset and Metabolic Control with Anthropometrics Status in Children with Type 1 Diabetes Khalimatus Sa'diyah<sup>1</sup>,

Read More »

<https://doi.org/10.51542/ijscia.v3i6.16>

### Policy Issues Affecting the Health of Older Individuals in the United States

23 December 2022 • Volume3 Issue 6

Policy Issues Affecting the Health of Older Individuals in the United States Oyintoun-emi Ozobokeme MD<sup>1</sup>, Okelue Edwards Okobi MD<sup>2\*</sup>, Uduak

Read More »

<https://doi.org/10.51542/ijscia.v3i6.15>

### Efficacy and Safety of Stem Cell Therapy in Diabetic Retinopathy: A Scoping Review

23 December 2022 • Volume3 Issue 6

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Read More »

<https://doi.org/10.51542/ijscia.v3i6.14>

### Correlation Between Gender and Random Plasma Glucose on The Outcome of Sepsis Patients with Type 2 Diabetes Mellitus in The Internal Medicine Room of Dr. Soetomo General Hospital

19 December 2022 • Volume3 Issue 6

Correlation Between Gender and Random Plasma Glucose on The Outcome of Sepsis Patients with Type 2 Diabetes Mellitus in The

Read More »

<https://doi.org/10.51542/ijscia.v3i6.13>





## Music Enhances Brain Development in Premature Infants: A Literature Review

🕒 18 December 2022 • 📖 Volume3 Issue 6

Music Enhances Brain Development in Premature Infants: A Literature Review Inggil Wirya Pranata<sup>1</sup>, Maulana Bagus Adi Cahyono<sup>1</sup> and Nur Aisiyah

Read More »

🔗 <https://doi.org/10.51542/ijscia.v3i6.12>

## The Comparison of Quality of Life in Children with Type 1 Diabetes Mellitus Based on Parents and Children Report

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The Comparison of Quality of Life in Children with Type 1 Diabetes Mellitus Based on Parents and Children Report Hafidz

Read More »

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## Time Wave Function of the Universe

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🔗 <https://doi.org/10.51542/ijscia.v3i6.9>

## Use of Rainwater in a Hydroponic Greenhouse

🕒 18 November 2022 • 📖 Volume3 Issue 6

Use of Rainwater in a Hydroponic Greenhouse José Luis Hernández Corona<sup>1</sup>, Jonny Carmona Reyes<sup>2\*</sup> and Noe Cervantes SanLuis<sup>1</sup> Abstract The

Read More »

🔗 <https://doi.org/10.51542/ijscia.v3i6.8>

## Beta Cell Death Mechanism in Type 2 Diabetes: An Overview

🕒 17 November 2022 • 📖 Volume3 Issue 6

Beta Cell Death Mechanism in Type 2 Diabetes: An Overview Mikhael Akbar Rizky Siagian<sup>1</sup>, Bellinda Zalzabillah Tazkira<sup>1</sup> and Lilik Herawati<sup>2\*</sup>

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ISSN: 2708-7972



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# The Correlation Between Age at Onset and Metabolic Control with Anthropometrics Status in Children with Type 1 Diabetes

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## ABSTRACT

**Background:** Type 1 Diabetes is the most prevalent chronic disease in childhood. The most common cause of T1DM is an autoimmune process. Age at onset and metabolic control can affect the anthropometric status of children with T1DM. This research intends to find the correlation between age at onset and metabolic control with the anthropometrics status of children with T1DM because it is still controversial. **Methods:** The design was a cross-sectional study. The inclusion criteria were medical records of patients with Type 1 Diabetes aged 2-18 years old who regularly control to pediatric endocrinology outpatient clinic, Dr. Soetomo Hospital, Surabaya from January 2020 - December 2021. Data collected were age at onset, HbA1c levels, height, and weight. The correlation between variables was analyzed by using Pearson test. **Result:** Twenty-six patients joined the study. The mean onset was  $8.38 \pm 3.07$  years. One (3.8%) patient had good metabolic control, 8 (30.8%) intermediate, and 17 (65.4%) had poor metabolic control. Around 73.1% had normal height and 65.4% had normal weight. The correlation of age at onset, height, and weight was [( $r=0.774$ ,  $p<0.000$ ); ( $r=0.555$ ,  $p=0.003$ )] respectively. The correlation of metabolic control, height, and weight was [( $r=0.224=0.271$ );  $-0.36$ ,  $p=0.86$ ]]. **Conclusion:** There is a correlation between age at onset and anthropometrics status. It is very important to monitor height and weight in Type 1 Diabetes Mellitus patient.

**Keywords:** age at onset; height; metabolic control; type 1 diabetes; weight

## INTRODUCTION

Diabetes mellitus (DM) is defined as a chronic metabolic disease because of abnormalities in insulin secretion, insulin action, or both<sup>1</sup>. In children and young adults Type 1 Diabetes Mellitus (T1DM) is more prevalent than Type 2. Data shows that the increment in diabetes cases globally has reached 51%. In Indonesia, the incidence of T1DM in children increased by 700% (28.19 per 100 million population) from 2000-2010<sup>2</sup>.

The most common cause of T1DM is an autoimmune process that damages pancreatic beta cells and impairs the ability to produce insulin. Polyuria, polydipsia, polyphagia with weight loss, nocturia, and enuresis are the typical symptoms of this disease. If this abnormality is not treated appropriately, it will slow down children's growth rates<sup>1</sup>. Poor glycemic control may cause growth problems<sup>3</sup>. The age of onset also affects the T1DM child's growth in height and weight<sup>4</sup>. T1DM is incurable but good metabolic control efforts can help children to maintain the quality of their growth<sup>4</sup>.

The correlation of age at onset and metabolic control with the anthropometrics status is still controversial. Studies on this subject are quite limited in Indonesia. This research aims to determine the correlation between age at onset and metabolic control with anthropometric status in children with T1DM in Dr. Soetomo Hospital Surabaya.

## METHODS

This research was an analytic observational study with a cross-sectional design using secondary data. Medical record was taken randomly. Data obtained from the medical records of T1DM patients who were routinely controlled at the Children's Endocrine Outpatient Clinic at Dr. Soetomo Hospital Surabaya. Inclusion criteria were: 1) Medical records of T1DM children aged 2-18 years who are treated at Dr. Soetomo Hospital Surabaya with a period from January 2020 – December 2021; 2) Contains the data needed, such as: age at onset, HbA1c levels, height, and weight. This study using a consecutive sampling technique.

## Operational definition

Age at onset is the time when the patients are initially diagnosed with T1DM. The age of onset is recorded by rounding up if the age if  $>6$  months and rounding down if the age is  $<6$  months. Metabolic control (HbA1C levels) were analyzed in Dr. Soetomo Hospital Surabaya. Height and weight as anthropometric status were measured using a stadiometer and standing scale done by the healthcare professionals in the pediatric endocrinology outpatient clinic, Dr. Soetomo Hospital, Surabaya. The height scale used was in centimeter while body weight was in kilogram. This study was approved by the Faculty of Medicine Health Research and Ethics Committee with ethical clearance number 0735/LOE/301.4.2/XII/2021 on 28 December 2021.

The data that has been collected will be tested for normality using the Kolmogorov-Smirnov test and then analyzed using the Pearson test to determine the correlation between the two variables and measure the strength of the correlation between research variables. The data is statistically processed through the Statistical Product and Service Solution (SPSS) program.

**RESULT**

This study involved 26 medical records of children with T1DM. The age range is from 2 to 18 years. The characteristic of the participants is shown in Table 1. The mean age of the subjects is 11,5 ± 3,14 years old. The age onset distribution of subjects at least 2 years and 14 years of the oldest with an average of 8.38 ± 3.07 years. HbA1c levels showed various results with the lowest value being 6.9% and the highest being 16.1%, dominated by the patients with poor HbA1c levels of as much as 17 (65.4%). The shortest and tallest individuals measured 93 cm and 168 cm, respectively, with the average final height coming in at 137 ± 17.51 cm. Additionally, weight ranges from 12.5 kg to 68 kg, with a mean of 33.6 ± 12.38 kg. The comparison between onset height and final height had a significance value of p = 0.013 (<0.05). Whereas the onset weight and final weight have significance with a value of p = 0.018 (<0.05).

**TABLE 1:** Characteristics of the research subjects.

Characteristics	Frequency (n)
<b>Gender</b>	
Girls	19
Boys	7
<b>Age</b>	
2-5 years	2
6-10 years	7
10-18 years	17
<b>Age at Onset</b>	
0-5 years	6
6-10 years	12
11-15 years	8
<b>HbA1c Level</b>	
Good <7.5%	1
Intermediate 7.5-9.0%	8
Poor >9.0%	17
<b>Anthropometrics Status</b>	
<b>Height</b>	
Normal (p5-p95)	19
Short stature (<p5)	7
<b>Weight</b>	
Normal (p5-p95)	17
Underweight (<p5)	9

**TABLE 2:** The comparison of the z score height and weight of onset according to age at onset group.

	0-5 years	6-10 years	11-15 years
<b>HAZ</b>	-1,44 ± 14,5	-1,23 ± 1,19	-0,66 ± 1,15
<b>WAZ</b>	-1,6 ± 2,14	-2,35 ± 2,34	-1,18 ± 2,24

In the comparison of z scores (Table 4), it was found that children diagnosed at 0-5 years were the shortest and the lowest weight was in the 6-10 years age group.

**TABLE 3:** The correlation between age at onset and metabolic control with anthropometrics status.

Correlation			
Variable		Anthropometrics status	
		Height	Weight
Age at onset	Coefficient correlation	0.774	0.555
	p value	<0.000	0.003
Metabolic control	Coefficient correlation	0.224	-0,36
	p value	0.271	0.86

Based on the data analysis, it shows that there is a correlation between age at onset and anthropometrics status, indicate by a significance value of p = <0.000 and 0.003 (<0.05). But there is no correlation between metabolic control and anthropometrics status cause the significance value was p= 0.271 and 0.86 (>0.05).

**DISCUSSION**

This study found a correlation between age at onset and anthropometric status. Data showed that children with onset age between 0 and 5 had the shortest heights (HAZ - 1.44 to 1.45). The findings of several studies that have been conducted confirm this conclusion. According to research from Pakistan, a child's age and age of onset of T1DM will have an impact on their growth. Poorer growth is related to younger onset age<sup>5</sup>. Children diagnosed before 3 years are the most affected, while those diagnosed after 14 years have the least impact<sup>4</sup>.

The correlation between age at onset and the body weight of children with T1DM was also found to be related in this study. It is well known that children with T1DM tend to be underweight than normally healthy children<sup>4</sup>. The lack of the hormone insulin is the primary cause of the common weight loss that occurs in children with T1DM, which causes glucosuria, an increase in blood glucose levels, and then weight loss<sup>6</sup>.

The examination of HbA1c levels is used as a standard parameter of metabolic control<sup>3</sup>. This study was dominated by subjects with poor HbA1c levels. Similar to Saudi Arabian research which examined 189 T1DM children, the largest percentage of subjects was 43.2% with poor metabolic control (HbA1c > 9.0%), 32.2% with intermediate metabolic control (7.5-9.0 %), and another 17.8% at a good level of metabolic control (<7.5%)<sup>6</sup>.

This study shows that there is no correlation between metabolic control and anthropometric status. The majority of the subjects had normal heights and weights even if 65.4% of them had poor metabolic control (HbA1c > 9.0%). Assar et al conducted that growth in T1DM children is not solely determined by metabolic control<sup>7</sup>.

In this study, most of the subjects aged 10-18 years (65.4%) and 73.1% are female. This result is in line with the earlier research in Sudan, which discovered that the majority of T1DM patients were female and that over 70% of T1DM cases were in the 11-19 age group and another 8.5% were under 5 years old<sup>8</sup>.

However, the limitations of this study are not examining the factors of insulin therapy, nutrition, education, and physical activity which can also affect the level of metabolic control in children with T1DM. Therefore, it is necessary to do similar research that includes these factors as research variables.

**CONCLUSION**

According to this study, most of the children had normal height and weight. Dominated by children with poor metabolic control. There is a correlation between age at onset and anthropometrics status. But there is no correlation between metabolic control and anthropometrics status.

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