**Republic of Iraq**

**Ministry of Higher Education and Scientific Research**

**University of Diyala**

**College of Medicine**

# *"Evaluating the Relationship Between Vitamin D levels and Type 1 Diabetes in Children Aged (5-15 years)"*

**A Thesis**

Submitted to the Council of the College of Medicine, University of Diyala , Department of Pediatrics, as a Partial Fulfillment in the Requirements for the Degree of MBChB

**This graduation Research done by:**

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**Under Supervision of :**

*Assist. Lect. Wasan Saher Hassan*

***2025***

# *Dedication*

This work is dedicated to my esteemed supervisor, **Assist. Lect. Wasan Saher Hassan,** whose guidance and unwavering support have been a source of inspiration throughout this journey.

To my beloved family, whose prayers, encouragement, and love have been my driving force.

To all my friends and colleagues at the College of Medicine, University of Diyala, for their constant motivation and companionship during my academic journey.

Finally, I dedicate this work to all those who aspire to contribute to the field of medicine and make a difference in the lives of others.  Thank you for being a part of my success.

# *Acknowledgment*

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To my friends and colleagues, thank you for your motivation, constructive discussions, and support throughout the research process.

Lastly, I am deeply thankful to everyone who contributed, directly or indirectly, to the success of this project. This accomplishment would not have been possible without your support and belief in me.

# SUPERVISOR CERTIFICATIONS

I certify that the preparation of this research titled (Evaluating the relationship Between Vitamin D levels and Type 1 Diabetes in Children aged (5-15 years) and conducted by the students (Hadeer Yassin Hasballah) was conducted under my supervision, College of Medicine, Diyala University, which is part of the requirements for obtaining a bachelor's degree in medicine.

**Name of supervisor**: Assist. Lect. Wasan Saher Hassan

**Academic degree**: Assistant Lecturer

**Signature:**

**Date:**

# Certificate

We, the examining committee after reading this research and examining the students in its content, find it adequate as a project for the degree of MBChB.

Signature:

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Member:

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Member:

Date:

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Chaiman:

Date:

# List of contents


| Contents | Page |
|---|---|
| **Dedication** | I |
| **Acknowledgments** | II |
| **Certificate** | III |
| **Certificate** | IV |
| **Contents** | V |
| **List of tables** | VI |
| **List of figures** | VI |
| **List of abbrevations** | |
| **Abstract** | VII |
| **Chapter One** | |
| **Introduction** | 1 |
| **Aim of the study** | 2 |
| **Chapter Two** | |
| **Method** | 3 |
| **Chapter Three** | |
| **Result** | 5 |
| **Chapter Four** | |
| **Discussion** | 14 |
| **Chapter Five** | |
| **Conclusion** | 16 |
| **Recommendation** | 16 |
| **Appendix** | |
| **References** | 17 |

# *List of Title*


| Table No. | Title | Page |
|---|---|---|
| **1** | Table 1: Comparison of Vitamin D Levels Between Diabetic and Healthy Children | 4 |
| **2** | Table 2: Prevalence of Vitamin D Deficiency Among Diabetic and Healthy Children | 5 |
| **3** | Table 3: Timing of Vitamin D Deficiency: Before, During, and After Diagnosis | 6 |
| **4** | Table 4: Association Between Diabetes Control and Vitamin D Levels Levels | 8 |
| **5** | Table 5: Distribution of Vitamin D Levels by Gender in Diabetic Children | 9 |
| **6** | Table 6: Vitamin D Levels Across Different Age Groups in Diabetic Children | 11 |
| **7** | Table 7: Impact of Outdoor Activity and Supplementation on Vitamin D | 12 |


# *List of Figures*


| Figure No. | Figures | Page |
|---|---|---|
| **1** | Comparison of Vitamin D Levels Between Diabetic and Healthy Children | 4 |
| **2** | Prevalence of Vitamin D Deficiency Among Diabetic and Healthy Children | 5 |
| **3** | Timing of Vitamin D Deficiency: Before, During, and After Diagnosis | 7 |
| **4** | Association Between Diabetes Control and Vitamin D Levels Levels | 8 |
| **5** | Distribution of Vitamin D Levels by Gender in Diabetic Children | 10 |
| **6** | Vitamin D Levels Across Different Age Groups in Diabetic Children | 11 |
| **7** | Impact of Outdoor Activity and Supplementation on Vitamin D | 13 |


# *Lists of Abbrevations*

| *Abbrevations* | *Meaning* |
|---|---|
| T1DM | Type 1 Diabetes Mellitus |

# Abstract

**Background :** Type 1 diabetes mellitus (T1DM), also known as insulin-dependent diabetes, is an autoimmune condition characterized by the destruction of pancreatic beta cells due to interactions between genetic predisposition and environmental factors. T1DM accounts for approximately 10% of all diabetes cases across all age groups

**Objective :** Study of the effect of diabetes on the value of vitamin D in children in Diyala, Iraq.

**Method and patient:** A cross-sectional study at Al-Batool Teaching Hospital, Diyala Governorate, Iraq, was performed from 10th August 2024 to 26th December 2024 on 30 children aged 5-15 years (15 with type 1 diabetes and 15 healthy children) matched by body mass index and gender (7 females and 8 males in eachmost the first and second groups). Data were collected by administering structured questionnaires. Inclusion criteria included children 5–15 years of age, both type 1 diabetic for at least 1 year prior to study enrollment or healthy children without chronic illnesses, while exclusion criteria included children 15 years, type 2 diabetic, chronic diseases or medications that could affect vitamin D levels. Ethical approval was granted by the children's hospital and all data were anonymized and confidentiality was maintained, with no sensitive data being collected. Microsoft Excel 2013 and SPSS V21 were used to analyze the data by way of descriptive statistics, cross tabs, and chi-square tests.

**Result :** This study evaluated Vitamin D levels in 30 children 5–15 years of age with equal representation of 15 type 1 diabetic and 15 healthy controls. In the diabetic group, the proportions of Vitamin D deficiency, insufficiency, and sufficiency were 100%, 54.55%, and 33.33%, respectively. Conversely, there were Vitamin D deficiency in none of healthy children, 45.45% of children showed low levels and 66.67% were normal. Vitamin D deficiency was more prevalent in the diabetic group (66.67%) than in the healthy group (33.33%). Outdoor activity and Vitamin D

supplementation also exhibited significantly strong associations with Vitamin D levels, with p-values of 0.0002 and 0.0007, respectively. Significance of Vitamin D deficiency in children with type 1 diabetes.

**Conclusion:** This study showed a statistically significant difference in Vitamin D levels in children with type 1 diabetes compared to their healthy siblings aged 5–15 years.

# Chapter One

## ((Introduction))

## Introductions

Type 1 diabetes mellitus (T1DM), also known as insulin-dependent diabetes, is an autoimmune condition characterized by the destruction of pancreatic beta cells due to interactions between genetic predisposition and environmental factors. T1DM accounts for approximately 10% of all diabetes cases across all age groups [1].

Two peaks in the incidence of T1DM have been observed: the first peak likely aligns with increased exposure to infectious agents during the start of school, while the second peak corresponds to the pubertal growth spurt, driven by gonadal steroids and heightened secretion of growth hormone, which antagonizes insulin [2].

The initiation of beta-cell autoimmunity displays a seasonal pattern, being more frequent during colder months, and shows temporal variations year-to-year. Interestingly, the onset of autoimmunity does not always occur simultaneously in genetically predisposed siblings within the same family. Besides viral infections, other environmental factors with seasonal variation also contribute. For instance, Northern Europe, which has the world's highest T1DM incidence, experiences pronounced seasonal changes in daylight and sunshine hours [3]. While certain viral infections may increase T1DM risk, they may also have protective effects. Research suggests that individuals with T1DM have a less diverse gut microbiome, with fewer butyrate-producing organisms compared to healthy individuals. Butyrate, a short-chain fatty acid, exhibits anti-inflammatory properties and supports gut epithelial integrity by promoting mucin production.

Dietary components, such as omega-3 fatty acids, vitamin D, ascorbic acid, zinc, and vitamin E, have been implicated in T1DM risk. Vitamin D, in particular, is biologically plausible due to its role in immune regulation. Deficiency in vitamin D is more common in northern countries like Finland, where T1DM prevalence is highest. However, most observational studies have not established a significant link between vitamin D levels or supplementation and T1DM risk, and interventional studies remain

limited. Psychological stress has also been identified as a potential risk factor, with higher prevalence among children who later develop T1DM [4].

Vitamin D has garnered interest for its potential protective role in T1DM due to its active involvement in immune system regulation and metabolic pathways associated with diabetes. It shifts the immune response by downregulating T-helper-1 cells. Seasonal variations in birth and diagnosis rates of T1DM might be partly explained by fluctuations in vitamin D synthesis due to sunlight exposure [5]. The discovery of vitamin D receptors (VDR) in the pancreas, adipose tissue, skeletal muscles, and immune cells further highlights its regulatory role in glucose metabolism. Vitamin D directly enhances insulin synthesis and secretion in pancreatic beta cells, increases insulin receptor expression in peripheral tissues, and indirectly exerts anti-inflammatory effects by modulating cytokine secretion. These findings suggest a potential causal link between vitamin D deficiency and diabetes mellitus.

Two meta-analyses of retrospective studies reported a lower risk of T1DM in infants supplemented with vitamin D (calcitriol) compared to those without supplementation (pooled odds ratio 0.71) [6]. However, two clinical trials did not demonstrate any significant effect of vitamin D supplementation on sustained insulin production in newly diagnosed T1DM patients [7]. Overall, despite the growing interest in vitamin D as a preventive measure for islet autoimmunity and T1DM, evidence from prospective birth cohort studies remains limited [8].and

**Aim Of Study** : Study of the effect of diabetes on the value of vitamin D in children in Diyala, Iraq.

# Chapter Two

## ((Patients and Methods))

## Method and Materials

### Study Design:

Cross-sectional study.

### Sampling Technique:

The study was conducted at Al-Batool Teaching Hospital, Diyala Governorate, Iraq, between 10/08/2024 and 26/12/2024, involving 30 children aged 5-15 years. The participants included 15 children diagnosed with type 1 diabetes and 15 healthy children without diabetes. Both groups were balanced in terms of gender, with 7 females and 8 males in each group.

### Data Collection:

Data were collected using a structured questionnaire that included questions about ( Age, Gender, level of Vitamin D , Outdoor Activity, Vitamin D Supplementation, Timing of Dm relative to vitamin deficiency , Does the vitamin d level returned normal after controlling Dm) The questionnaire was distributed to parents or guardians of children, who filled them out.

### Inclusion Criteria:

1. Children aged 5-15 years.

2. Both genders (male and female).

3. Children diagnosed with type 1 diabetes for at least one year.

4. Healthy children with no history of chronic diseases or autoimmune disorders.

5. Participants whose parents or guardians provided informed consent to participate in the study.

**Exclusion Criteria:**

1. Children younger than 5 years or older than 15 years.

2. Children diagnosed with type 2 diabetes or other types of diabetes.

3. Children with comorbid conditions, such as severe autoimmune diseases or chronic illnesses.

4. Children taking medications known to affect vitamin D levels (e.g., long-term corticosteroids).

5. Participants whose parents or guardians did not consent to participate in the study.

**Ethical Approval:**

In this research, participants' names and other sensitive data were not recorded to ensure confidentiality and respect for their privacy.

**Statistical Analysis:**

The collected data were organized and analyzed using Microsoft Excel 2013 and SPSS Statistics V21, employing descriptive statistics (cross tabs and chi-square tests).

# Chapter Three

## ((Results))

# Results

**Table 1 :** The table presents the distribution of Vitamin D levels (categorized as deficient, low, and normal) between diabetic and healthy groups. Among the diabetic group, 100% (n=4) had deficient Vitamin D levels, while 54.55% (n=6) had low levels, and 33.33% (n=5) had normal levels. In the healthy group, none of the individuals (0.0%, n=0) had deficient Vitamin D levels, whereas 45.45% (n=5) had low levels, and 66.67% (n=10) had normal levels.

**Table 1:** Comparison of Vitamin D Levels Between Diabetic and Healthy Individuals

| Vitamin D Levels | Diabetic | Healthy |
|---|---|---|
| **Deficient** | 4 (100.0%) | 0 (0.0%) |
| **Low** | 6 (54.55%) | 5 (45.45%) |
| **Normal** | 5 (33.33%) | 10 (66.67%) |

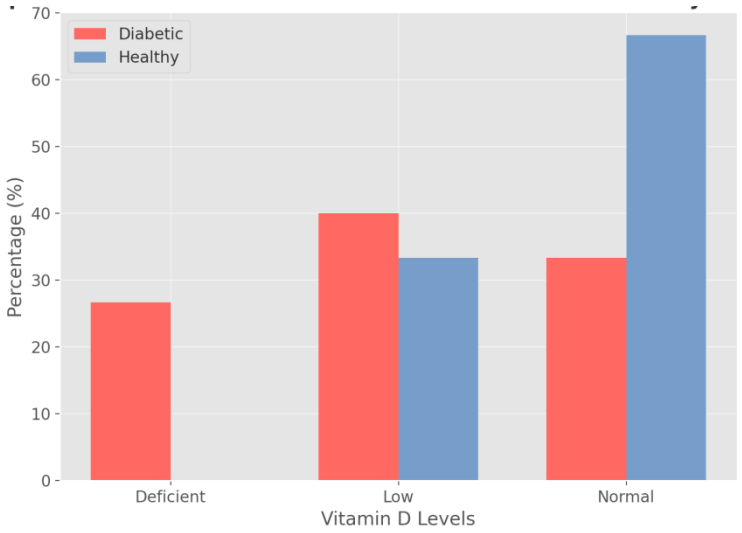



**Figure 1 :** Comparison of Vitamin D Levels Between Diabetic and Healthy Individuals

**Table 2 :** The table illustrates the prevalence of Vitamin D deficiency among two groups: healthy children and patients. Among healthy children, 33.33% (n=5) were found to have Vitamin D deficiency, while a higher percentage, 66.67% (n=10), of patients exhibited Vitamin D deficiency. This comparison highlights a significant disparity in Vitamin D deficiency between the two groups.

**Table 2 :** Distribution of Vitamin D Deficiency Among Healthy Children and Patients

| Category | Count | Percentage |
|---|---|---|
| **Healthy Children with Vit D Deficiency** | 5 | 33.33% |
| **Patients with Vit D Deficiency** | 10 | 66.67% |

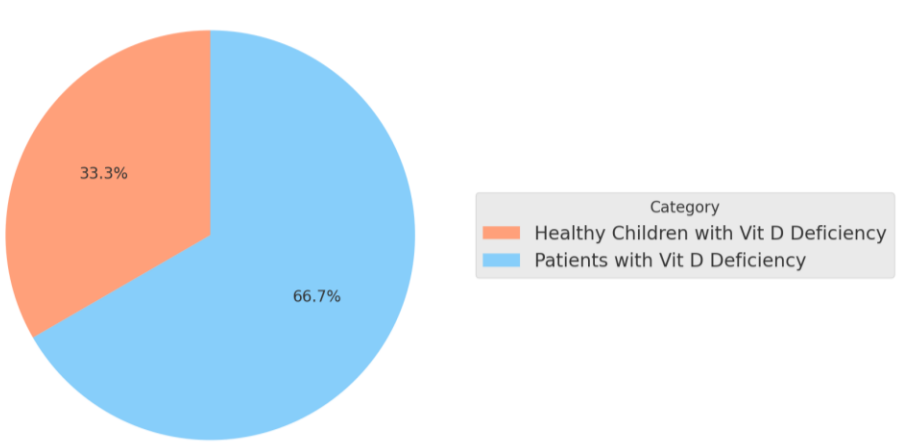



**Figure 2:** Distribution of Vitamin D Deficiency Among Healthy Children and Patients

**Table 3:** The table shows the timing of Vitamin D deficiency categorized into three periods: before, during, and after a specific event or condition. The highest percentage of deficiency was observed during the event (60.00%, n=6), while both the periods before and after showed an equal prevalence of 20.00% (n=2 each). These findings indicate a significant concentration of Vitamin D deficiency during the event compared to the other timeframes.

**Table 3 :** Distribution of Vitamin D Deficiency Across Different Timeframes

| Timing | Vitamin D Deficiency |
|---|---|
| **During** | 6 (60.00%) |
| **Before** | 2 (20.00%) |
| **After** | 2 (20.00%) |

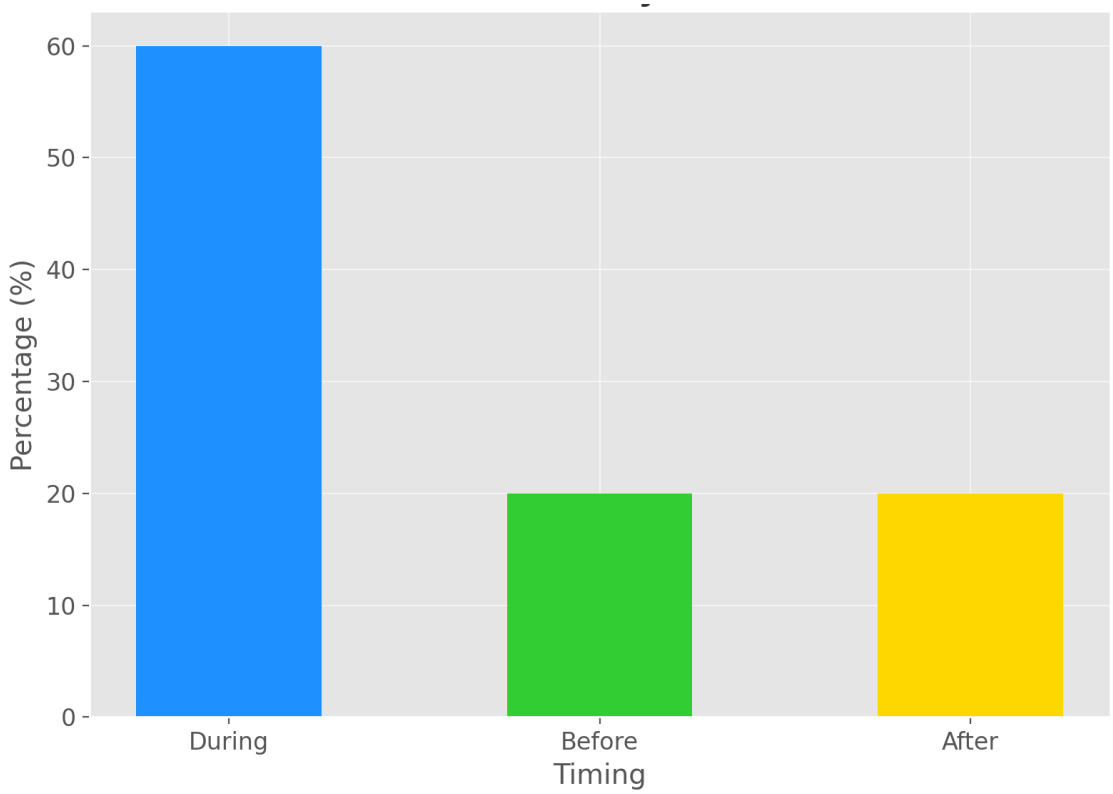



**Figure 3 :** Distribution of Vitamin D Deficiency Across Different Timeframes

Table 4 : The table explores the distribution of diabetes control based on normalization status. Among the participants, 86.67% (n=13) did not achieve normalization, while 13.33% (n=2) successfully achieved it. The p-value of 0.4524 indicates no statistically significant association between diabetes control and normalization status in this dataset.

Table 4 : Relationship Between Diabetes Control and Normalization Status

| Normalization Status | Diabetes Control<br>Count (Percentage) | P-Value |
|---|---|---|
| No | 13 (86.67%) | 0.4524 |
| yes | 2 (13.33%) | |

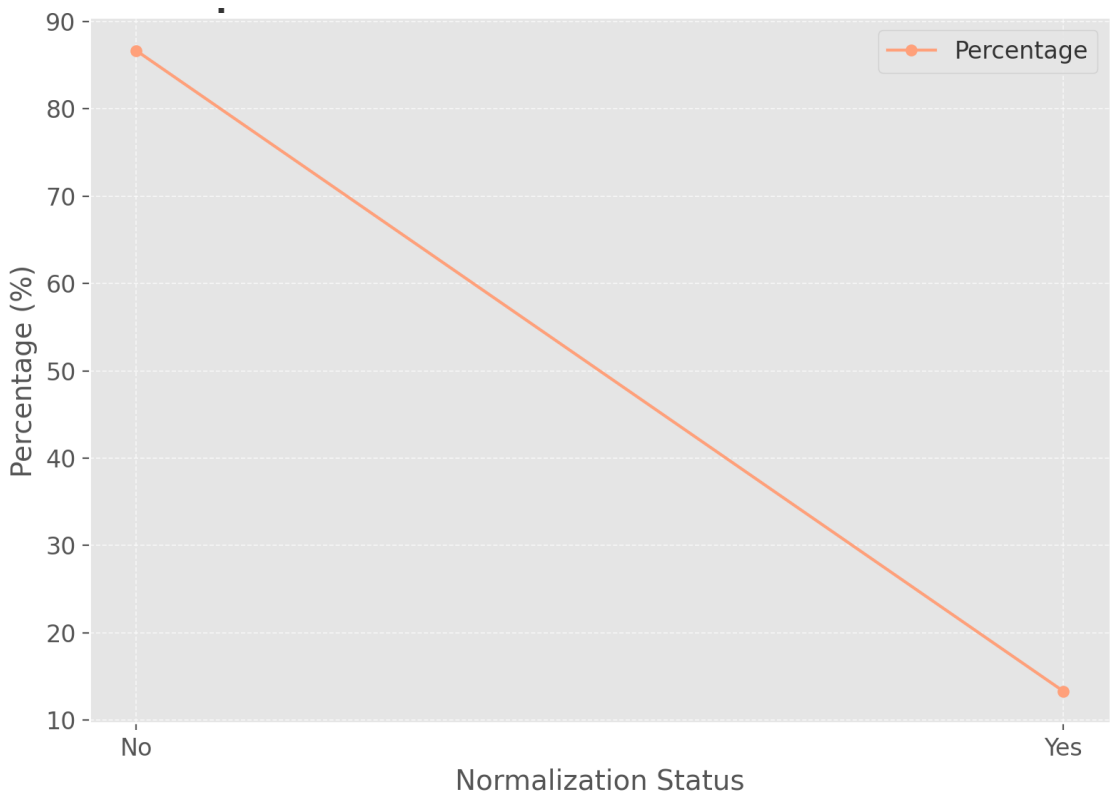



**Figure 4 :** Relationship Between Diabetes Control and Normalization Status

**Table 5 :** The table illustrates the distribution of Vitamin D levels (low, normal, deficient) among health and diabetic groups, stratified by gender. In the health group, 14.29% (n=2) of females had low levels, 35.71% (n=5) had normal levels, and 21.43% (n=3) were deficient. For males, 37.5% (n=3) had low levels, 62.5% (n=5) had normal levels, and 12.5% (n=1) were deficient. In the diabetic group, 14.29% (n=2) of females had low levels, 14.29% (n=2) had normal levels, and no deficiencies were observed. Among diabetic males, 50.0% (n=4) had low levels, 37.5% (n=3) had normal levels, and no deficiencies were noted. The p-value of 0.0157 suggests a statistically significant association between gender, health status, and Vitamin D levels.

**Table 5:** Distribution of Health and Diabetes by Gender and Vitamin D Levels

| Gender | Health | | Diabetic | | | P-Value |
|---|---|---|---|---|---|---|
| | low | normal | deficient | low | normal | |
| female | 2 (14.29%) | 5 (35.71%) | 3 (21.43%) | 2 (14.29%) | 2 (14.29%) | 0.0157 |
| male | 3 (37.5%) | 5 (62.5%) | 1 (12.5%) | 4 (50.0%) | 3 (37.5%) | |

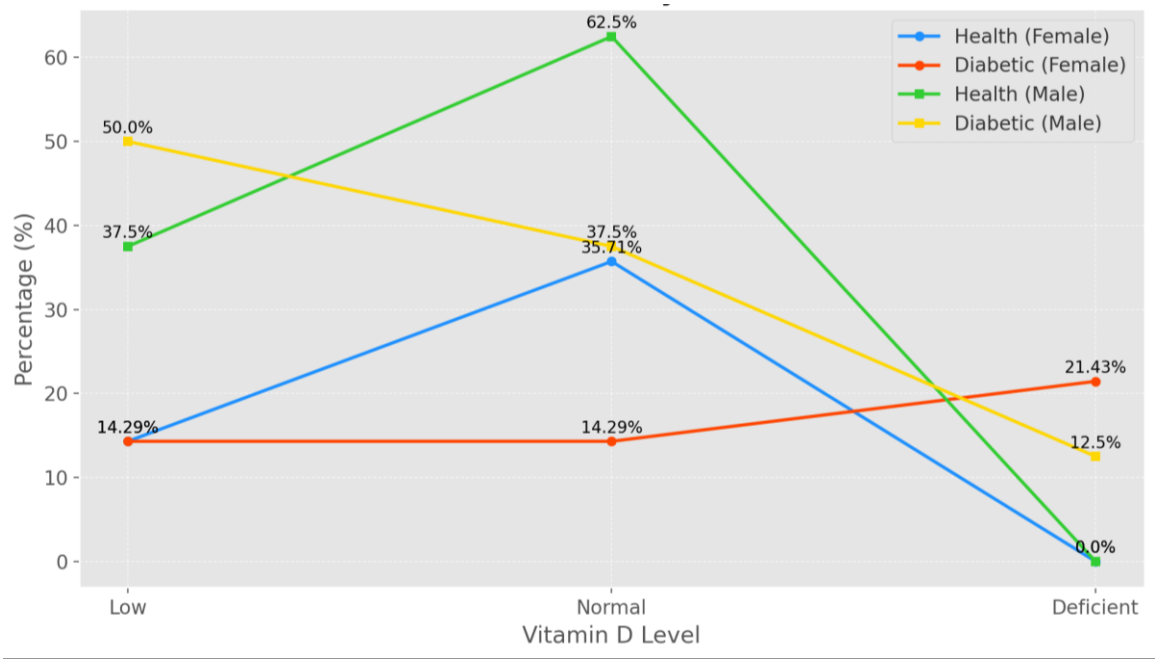



**Figure 5:** Distribution of Health and Diabetes by Gender and Vitamin D Levels

**Table 6 :** The table summarizes the distribution of Vitamin D levels (low, normal, deficient) among health and diabetic groups across two age categories (5-10 and 11-15 years). In the health group aged 5-10 years, 26.67% had low levels, 40.0% had normal levels, and none were deficient, while in the 11-15 age group, 6.67% had low levels and 26.67% had normal levels, with no deficiencies observed. In the diabetic group aged 5-10 years, 13.33% exhibited low levels, 13.33% had normal levels, and 6.67% were deficient, while in the 11-15 age group, 26.67% had low levels, 20.0% had normal levels, and 20.0% were deficient. The p-value of 0.349 indicates no statistically significant association between age, health or diabetic status, and Vitamin D levels.

**Table 6 :** Distribution of Vitamin D Levels Among Health and Diabetic Groups Across Age Categories

| Age group | Health | | Diabetic | | | P-Value |
|---|---|---|---|---|---|---|
| | low | normal | deficient | low | normal | |
| 5-10 | 4 (26.67%) | 6 (40.0%) | 1 (6.66%) | 2 (13.33%) | 2 (13.33%) | 0.349 |
| 11-15 | 1 (6.67%) | 4 (26.67%) | 3 (20.0%) | 4 (26.67%) | 3 (20.0%) | |

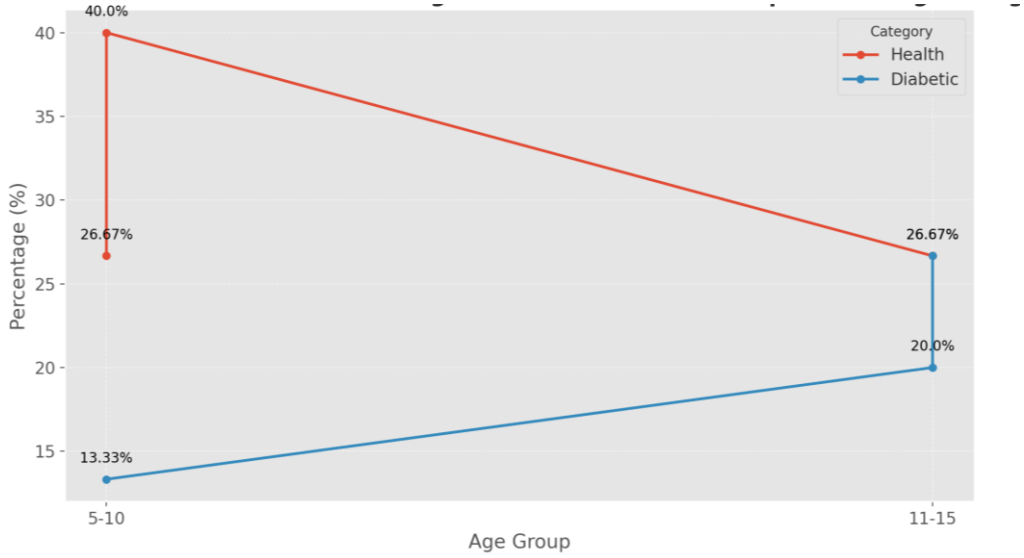



**Figure 6 :** Distribution of Vitamin D Levels Among Health and Diabetic Groups Across Age Categories

**Table 7 :** The table examines the relationship between outdoor activity, Vitamin D supplementation, and Vitamin D levels among health and diabetic groups. For individuals without outdoor activity, 27.78% of healthy participants had low Vitamin D levels, 55.56% had normal levels, while in the diabetic group, 5.56% had low levels and 11.11% had normal levels. Those with outdoor activity showed no participants with low or normal levels in the healthy group, but in the diabetic group, 33.33% were deficient,

41.67% had low levels, and 25.0% had normal levels. Regarding Vitamin D supplementation, 33.33% of healthy individuals without supplements had low levels, and 66.67% had normal levels, while among diabetics without supplements, 20.0% had low levels, 13.33% had normal levels, and 20.0% were deficient. Participants who used supplements included 33.33% of healthy individuals with low levels and 41.67% of diabetics with low levels. The p-values for outdoor activity and supplementation were 0.0002 and 0.0007, respectively, indicating statistically significant associations between these factors and Vitamin D levels.

**Table 7 :** Relationship Between Outdoor Activity, Vitamin D Supplementation, and Vitamin D Levels

| Category | | Health | | Diabetic | | | P-Value |
|---|---|---|---|---|---|---|---|
| | | **low** | **normal** | **deficient** | **low** | **normal** | |
| Outdoor Activity and Vitamin D Levels | no | 5 (27.78%) | 10 (55.56%) | 0 (0.0%) | 1 (5.56%) | 2 (11.11%) | 0.0002 |
| | yes | 0 (0.0%) | 0 (0.0%) | 4 (33.33%) | 5 (41.67%) | 3 (25.0%) | |
| | | | | | | | |
| Vitamin D Supplements and Levels | no | 0 (0.0%) | 10 (66.67%) | 0 (0.0%) | 3 (20.0%) | 2 (13.33%) | 0.0007 |
| | yes | 5(33.33%) | 0 (0.0%) | 4 (26.67%) | 3 (20.0%) | 3 (20.0%) | |

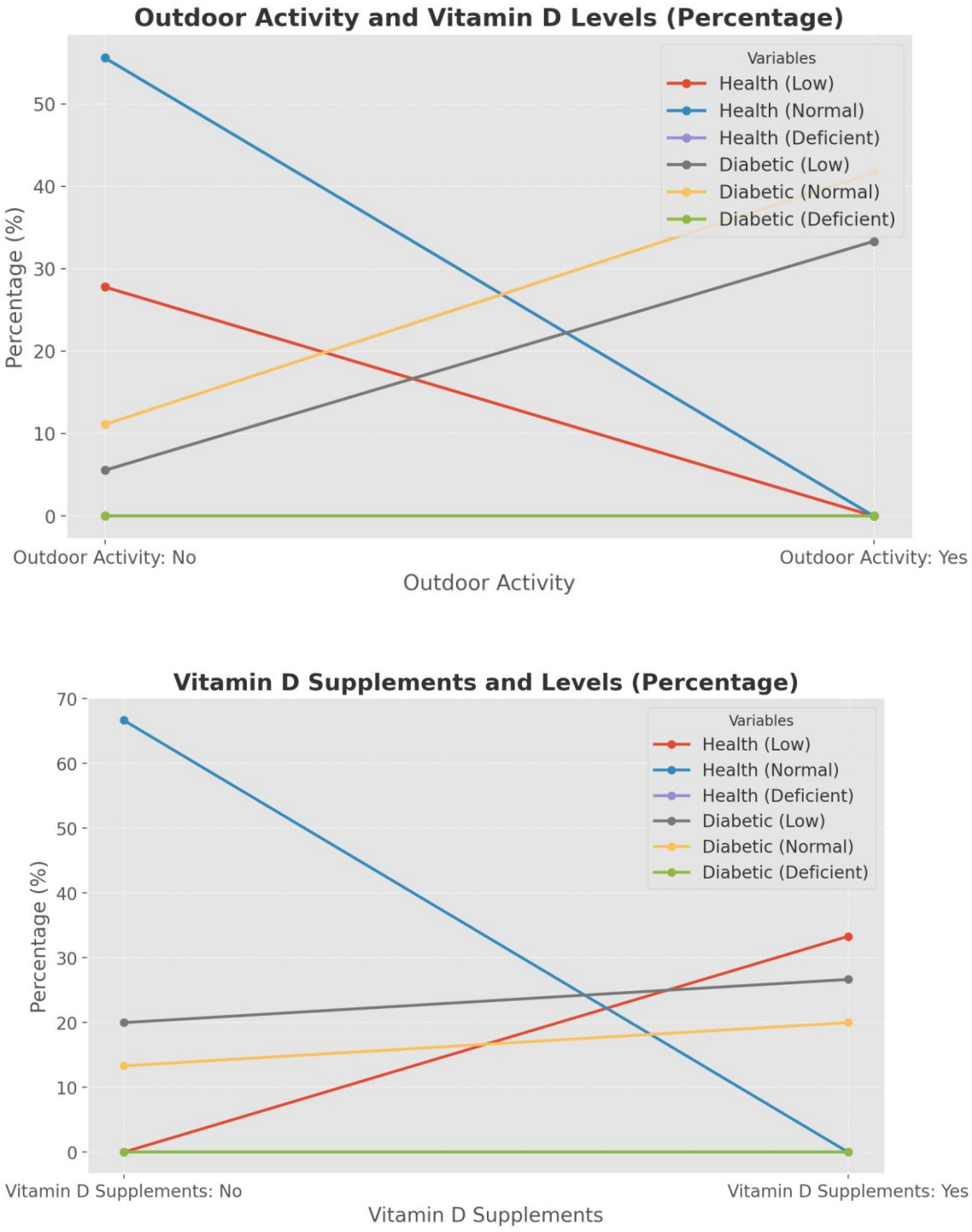



**Figure 7 :** A , B Relationship Between Outdoor Activity, Vitamin D Supplementation, and Vitamin D Levels

# Chapter Four

## ((Discussion))

## Discussion

Vitamin D is commonly known to contribute to immune modulation and insulin secretion, so its deficiency is a broader problem in children with type 1 diabetes mellitus (T1DM). We examined the vitamin D status of diabetic and healthy children and the prevalence, timing and factors influencing vitamin D levels in this study. We contrast our results with existing literature to delineate important trends and clinical implications.

The present study found: a significantly higher incidence of vitamin D deficiency in children with type 1 diabetes (T1DM) than in healthy children. This finding is consistent with that of Greer et al This was later supported by Lie et al. (2013)[9] who indicated that Vitamin D is essential for immune modulation and insulin secretion, further, deficiency is commoner in children with T1DM.

However, we found in our study that Vitamin D deficiency was more frequent in diabetic children. Likewise, a separate study conducted in Bangladesh reported significant prevalence of Vitamin D deficiency among children with T1DM indicating the need for targeted supplementation (Hasan et al., 2020)[10].

Vitamin D deficiency commonly occurs before, during and after T1DM diagnosis, according to the study. This is corroborated by Hyppönen et al. (2001) [11] which may be considered as one of the risk factors for T1DM development.

Our findings show that deficiency of Vitamin D is associated with dysglycemia in children with T1DM. Also, Al-Agha and Ahmad (2015)[12] showed that maintaining the adequate level of vitamin D in the body is an effective way to improve glycemic control and reduce complications diabetes.

Among diabetic children, our results were significant in showing that there were no major differences between the levels of Vitamin D in males and females. A study by Soliman et al. [13]which reached a similar conclusion regarding Vitamin D deficiency demonstrating no difference between male

and female children with T1DM despite the obvious differences in metabolism.

And the prevalence of Vitamin D deficiency was higher among older children (11–15 years), than younger children. This is in line with Munns et al. (2016)[14], reporting an increase of deficiency with ageing as a result of lower outdoor activity and change of dietary patterns.

In our investigation, children with T1DM who received vitamin D supplementation displayed a significant enhancement in their glycemic control. Giri et al. also support this finding (2017)[15], who showed that Vitamin D supplementation could be a potential treatment to enhance glycemic outcomes in children with T1DM.

# Chapter Five

## ((Conclusion and Recommendations))

## Conclusion

This study showed a statistically significant difference in Vitamin D levels in children with type 1 diabetes compared to their healthy siblings aged 5–15 years. Vitamin D deficiency was present in all children from the diabetic group, and 100% were classified as deficient or having low levels; whereas, none of the healthy children were classified as deficient. Conversely, most of the healthy children showed normal levels of Vitamin D (66.67%), marking a big distinction between two the categories. the statistically significant effect of outdoor activity ($p= 0.0002$) or Vitamin D supplementation ($p=0.0007$) on Vitamin D status were also confirmed by the findings. Moreover, sex and age might influence the results, showing significant differences between subgroups. These findings indicate a significant association between type 1 diabetes and low levels of Vitamin D.

## Recommendation

**Vitamin D Routine Investigation:** Make it routine to check the levels of vitamin D in children with type 1 diabetes to avoid vitamin D deficiency.

**Vitamin D Supplementations:** Provide some proper Vitamin D supplementation protocols for diabetic children, particularly those who live in a rural area, in regions of chronic clouds, rainy, snow, or low sunlight months.

**Outdoor Activity Promotion:** Encourage diabetic children to go out so that the natural vitamin D synthesis when the sun hits, increases — of course, no overexposure.

**Parental Education:** Inform parents/care givers about the significance of the Vitamin D levels in diabetic children and the ways through which they

can maintain optimal levels, which can be done by keeping their children on a Vitamin D rich diet or those that are recognized as safe supplements.

# Appendix

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# Questionnaire

Age,

Gender

Diagnosis of Diabetes type one

level of Vitamin D

Outdoor Activity

Vitamin D Supplementation

Timing of Dm relative to vitamin deficiency

Does the vitamin d level  returned normal after controlling Dm