A Study on Mathematical Analysis of Diabetes Patients Using Statistics

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Abstract: **Diabetes was mathematically analyzed using t-Test method in the statistics of diabetic patients at Tamil Nadu Government Hospital, Mannargudi, Thiruvarur (Dt.) in 2020 – 2021.**

Keywords: **Data analysis, Statistics.**

1. Introduction

The most important word quality of the word quality is Statistical quality of the word is statistical quality control. Quality control is a powerful manufacturing technique for effectively detecting defects or non-compliance with standards in materials, processes, machinery or finishing materials. The main purpose of Statistical Quality Control (S.Q.C) is to develop statistical technique that will help us in sorting out assignments.

- T-test definition
- Independent of t-test for two samples

A. T-test definition

A t-test is a type of statistical test that is used to compare the means of two groups. T-test is a type of para-metric method. A t-test is a type of inferential statistics used to determine if there is a significant difference between the means of two groups, which may be related in certain features.

T-test has three types: They are,
- One sample t-test.
- Two sample t-test.
- Paired t-test.

B. Independent of t-test for two samples

The independent t-test also called the Two-Sample t-test, independent. Samples t-test or student t-test is an inferential statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups.

2. Diabetes Overview

A. Diabetes

Diabetes Mellitus, commonly known as Diabetes, is a metabolic disease that causes high blood sugar. The hormone insulin moves sugar from the blood into your cells to be stored or used for energy. With diabetes, your body does not produce enough insulin or does not use the insulin it makes effectively.

Untreated high blood sugar from diabetes can damage your nerves, eyes, kidneys, and other organs.

1) Symptoms of diabetes

Diabetes general symptoms include:
- Increased thirst and urination.
- Increased hunger.
- Fatigue.
- Blurred vision.
- Numbness.
- Sores that do not heal.
- Unexplained weight loss.

2) Classification of diabetes
- Type 1 Diabetes.
- Type 2 Diabetes.
- Genetic defects of β cell function.
- Genetic defects in insulin action.

3) Symptoms of Type 1 diabetes

Type 1 signs and symptoms can appear relatively suddenly and may include:
- Irritability.
- Mood changes.
- Weakness and the above general symptoms also.

4) Symptoms of Type 2 diabetes

Signs and symptoms of type 2 diabetes often develop slowly. When signs and symptoms are present, they may include:
- Slow healing sores.
- Tingling in the hands or feet and the above general symptoms also.

5) Treatment for diabetes

Doctors treat diabetes with a few different medications. Some of these drugs are taken by mouth, while others are available as injections.
- *Type 1 Diabetes:* Insulin is the main treatment for type 1 diabetes. It replaces the hormone your body isn't able to produce.

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- *Type 2 Diabetes:* Diet – exercise can help some people manage type 2 diabetes. If lifestyle changes aren't enough to lower your blood sugar, you'll need to take medication.

6) Prevention

Healthy lifestyle choices can help to prevent from diabetes and that's true if you have biological relatives living with diabetes. If you've received a diagnosis of prediabetes, lifestyle changes may slow or stop the progression to diabetes.

3. Diabetes Patients Details

A. Diabetes Details

The details of the diabetic patient at the Government Hospital in Mannargudi for the year 2020-2021 were collected from the Diabetes Division Medical Officer at the hospital.

Table 1
Diabetes patient's details

Months	Male	Female
January	08	04
February	06	08
March	06	13
April	05	12
May	08	07
June	09	14
July	13	18
August	08	04
September	10	31
October	12	17
November	17	07
December	04	07

B. Application of t-test in diabetes

1) Male patient details
The table 1 shows the male patient details.

2) Female patient details
The table 2 shows the female patient details.

3) T-test calculation for male patients

$$\bar{X}_i = \sum \frac{X_i}{n}$$

$$\bar{X}_1 = \sum \frac{X_1}{n}$$

$$= \frac{106}{12}$$

$$\bar{X}_1 = 8.83$$

$$\sigma_1^2 = \frac{\sum(X_1 - \bar{X}_1)^2}{n-1}$$

$$= \frac{151.6668}{12-1}$$

$$= \frac{151.6668}{11}$$

$$\sigma_1^2 = 13.7879$$

$$\sigma_1 = \sqrt{13.7879}$$

Table 1
T-test for male patients

Month	Male X_1	$\bar{X}_1$	$\sum(X_1 - \bar{X}_1)$	$\sum(X_1 - \bar{X}_1)^2$
January	08	8.83	-0.83	0.6889
February	06	8.83	-2.83	8.0089
March	06	8.83	-2.83	8.0089
April	05	8.83	-3.83	14.6689
May	08	8.83	-0.83	0.6889
June	09	8.83	0.17	0.0289
July	13	8.83	4.17	17.3889
August	08	8.83	-0.83	0.6889
September	10	8.83	1.17	1.3689
October	12	8.83	3.17	10.0489
November	17	8.83	8.17	66.7489
December	04	8.83	-4.83	23.3289
	$\sum X_1 = 106$		$\sum(X_1 - \bar{X}_1) = 0.04$	$\sum(X_1 - \bar{X}_1)^2 = 151.6668$

Table 2
T-test for male patients

Month	Female X_2	$\bar{X}_2$	$\sum(X_2 - \bar{X}_2)$	$\sum(X_2 - \bar{X}_2)^2$
January	04	11.83	-7.83	61.3089
February	08	11.83	-3.83	14.6689
March	13	11.83	1.17	1.3689
April	12	11.83	0.17	0.0289
May	07	11.83	-4.83	23.3289
June	14	11.83	2.17	4.7089
July	18	11.83	6.17	38.0689
August	04	11.83	-7.83	61.3089
September	31	11.83	19.17	367.4889
October	17	11.83	5.17	26.7289
November	07	11.83	-4.83	23.3289
December	07	11.83	-4.83	23.3289
	$\sum X_2 = 142$		$\sum(X_2 - \bar{X}_2) = 0.04$	$\sum(X_2 - \bar{X}_2)^2 = 622.3379$

$$= 3.7132$$

$$t_1 = \frac{\bar{X}_1}{\sigma_1 \times \frac{\sqrt{n_1}}{n}}$$

$$t_1 = \frac{8.83}{3.7132 \times \frac{\sqrt{12}}{12}}$$

$$= \frac{8.83}{3.7132 \times 0.2887}$$

$$= \frac{8.83}{1.0720}$$

$$t_1 = 8.2369$$

4) T-test calculation for female patients

$$\bar{X}_i = \sum \frac{X_i}{n}$$

$$\bar{X}_2 = \sum \frac{X_2}{n}$$

$$= \frac{142}{12}$$

$$\bar{X}_2 = 11.83$$

$$\sigma_2^2 = \frac{\sum (X_2 - \bar{X}_2)^2}{n - 1}$$

$$= \frac{622.3379}{12 - 1}$$

$$= \frac{622.3379}{11}$$

$$\sigma_2^2 = 56.5762$$

$$\sigma_2 = \sqrt{56.5762}$$

$$= 7.5217$$

$$t_2 = \frac{\bar{X}_2}{\sigma_2 \times \frac{\sqrt{n_2}}{n}}$$

$$t_2 = \frac{11.83}{7.5217 \times \frac{\sqrt{12}}{12}}$$

$$= \frac{11.83}{7.5217 \times 0.2887}$$

$$= \frac{11.83}{2.1715}$$

$$t_2 = 5.4478$$

4. Patients Details and T-test using Graphs

A. Patient details using bar graph

1) Patient details – Diabetes
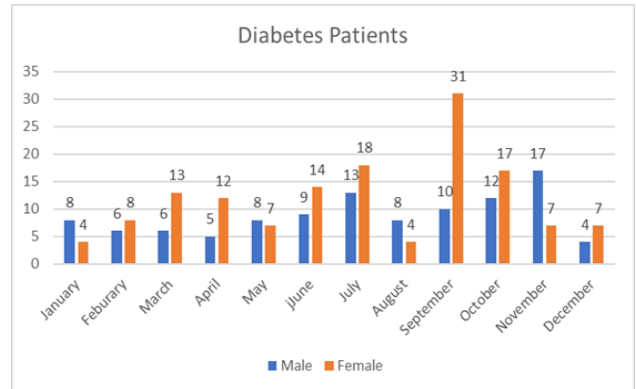
Fig. 1. Total diabetic patients' details using graph
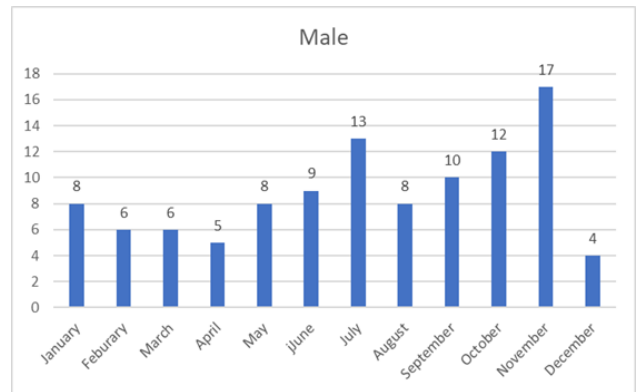
2) Patient details – Diabetes (Male)

Fig. 2. Total male diabetic patient details using graph
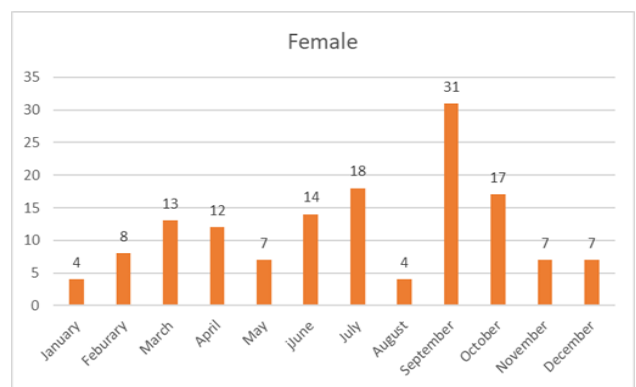
3) Patient details – Diabetes (Female)

Fig. 3. Total female diabetic patient details using graph

B. Patient details using line graph
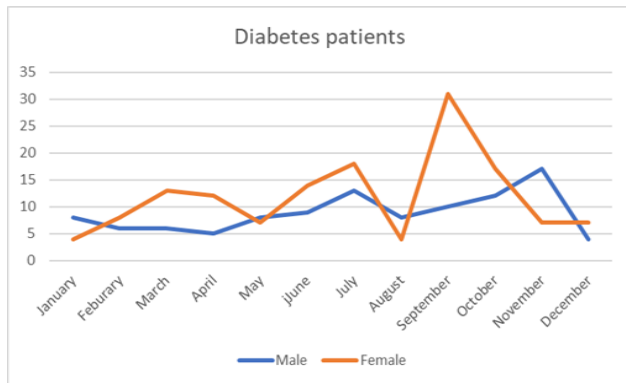
1) Patient details – Diabetes

Fig. 4. Total diabetic patient details using graph
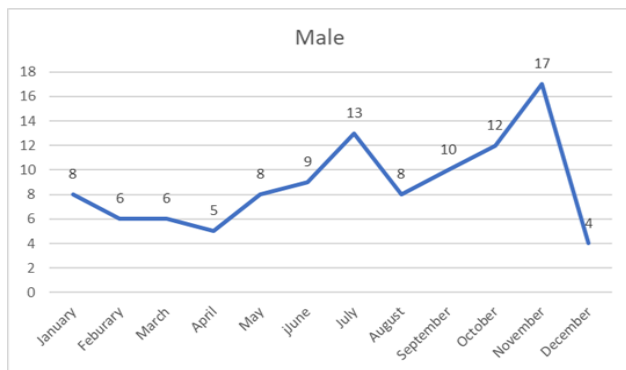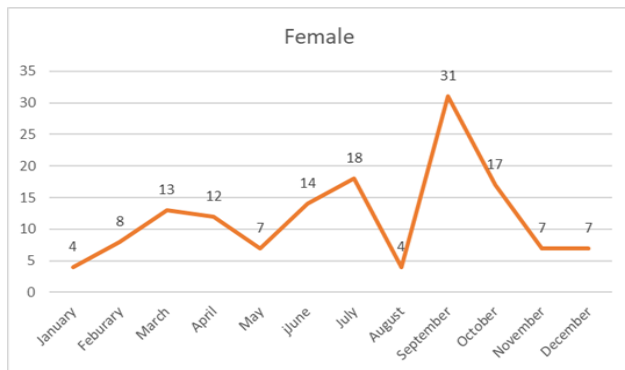
2) Patient details – Diabetes (Male)

Fig. 5. Total male diabetic patients' details using graph

3) Patient details – Diabetes (Female)

Fig. 6. Total female diabetic patients' details using graph

5. Conclusion

A. Result

According to the Mannargudi Government Hospital, the Center for Disease Control and Prevention has found that the number of people suffering from diabetes is gradually increasing by 2020-2021.

B. Reason

1) Reason for Type 1 Diabetes

Doctors do not know exactly what causes type 1 diabetes. For some reason the immune system attacks and destroys insulin - producing beta cells in the pancreas. For some, genes may play a role.

2) Reason for Type 2 Diabetes

Type 2 diabetes is caused by a combination of genetic and lifestyle factors. Being overweight or obese also increases your risk. Being overweight, especially in your stomach, makes your cells more resistant to the effects of insulin on your blood sugar.

C. Conclusion

We conclude that there is a significant difference between the male and female sample averages of diabetics.

Satisfactorily, in 2020-2021, we conclude that in the specific area where our survey was conducted, male patients are more likely to suffer from diabetes.

Fig. 7. Diabetes patients' details (2020-2021)

The [1], [2] say how to make t-test of two samples. [3] say how to find the mean value of two samples. [4], [5] say how to analyze the data using statistics. [6] say how to put a graph for our data using Excel.

References

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