



# XpressGluco+ and Beyond: A Comprehensive Comparison of Blood Glucose Monitoring Devices for its Assessing Accuracy, Ease of Use and Cost

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## ABSTRACT

This study presents a comparative analysis of several commercially available blood glucose monitoring systems. The devices were evaluated based on various parameters, including accuracy, ease of use, data management capabilities, and cost-effectiveness. While all devices demonstrated acceptable accuracy levels, differences were observed in features such as memory capacity, blood sample size, and connectivity options. The AccuChek Insta stood out as the most accurate device, offering additional features like post-meal indicators and USB connectivity. For users seeking a wider measurement range and higher memory capacity, the Xpress Gluco+ emerged as a strong contender. However, for those prioritizing simplicity and affordability, the Dr. Morepen and SD CodeFree devices may be suitable options. This comparative analysis provides valuable insights for individuals with diabetes in selecting the most appropriate blood glucose monitoring system to meet their specific needs and preferences.

**Keywords:** Electrochemistry, Enzyme, Biosensor, Accuracy.

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## INTRODUCTION

Blood glucose monitoring is an essential component of diabetes management, empowering individuals to effectively regulate their blood sugar levels and reduce the risk of serious complications such as heart disease, nerve damage, and eye problems. With the increasing availability of various glucometer models, it's crucial to select a device that is accurate, user-friendly, and cost-effective.<sup>1</sup>

This comparative analysis aims to evaluate the performance of several popular glucometers: XpressGluco+, Accucheck Insta, Oncall plus, Dr. Morepen, and SD CodeFree. By examining factors such as accuracy, ease of use, cost-effectiveness, and additional features, we aim to provide valuable insights to help individuals with diabetes make informed decisions about the best glucometer for their specific needs.<sup>2</sup>

### Key Areas of Comparison

#### Accuracy

- Correlation with Laboratory Reference Methods: How

closely do the glucometer readings align with laboratory results?

- Precision and Reliability: How consistent are the measurements, and how reliable are the test strips under various environmental conditions?

#### Ease of use

- User interface

Is the device intuitive and easy to navigate?

- Blood sample application

How easy is it to apply a blood sample to the test strip?

- Speed of results

How quickly does the device deliver accurate readings?

#### Cost-effectiveness

- Initial Purchase Cost
- What is the upfront cost of the device?

#### Cost of test strips

How much do the replacement test strips cost per test?

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• *Long-term costs*

Considering factors like battery life, durability, and the need for replacement parts, what are the overall long-term costs?

*Additional features*

• *Connectivity*

Can the device connect to smartphones or other devices for data tracking and sharing?

• *Data tracking capabilities*

Does the device offer built-in memory or data logging features?

• *Other features*

Are there any other features, such as voice guidance or automatic time/date settings, that enhance user experience?

By carefully considering these factors, individuals with diabetes can select a glucometer that meets their specific needs and preferences. Additionally, this study will explore the impact of glucometer choice on patient adherence to blood glucose monitoring regimens and overall diabetes management outcomes. By providing a comprehensive comparison of these glucometers, we hope to contribute to the body of knowledge on blood glucose monitoring devices and ultimately improve diabetes care and quality of life.<sup>3</sup>

Moreover, this study will explore the impact of glucometer choice on patient adherence to blood glucose monitoring regimens and overall diabetes management outcomes. By providing a comprehensive comparison of these glucometers, this study will contribute to the body of knowledge on blood glucose monitoring devices and assist healthcare providers and individuals with diabetes in selecting the most appropriate option for their specific needs, ultimately improving diabetes care and quality of life.<sup>4</sup>

**Experimental**

*Materials and apparatus*

Accu Chek Insta, Oncall plus, Dr. Morepen, and SD CodeFree were purchased through online portals along with the strip. A 30 gauge AccuSafe Touch lancet was used to prickle the finger and draw blood.

**RESULTS AND DISCUSSION**

**Comparison of Accuracy**

The Table 1 provides an accuracy comparison of various blood glucose monitoring systems. The accuracy of the glucometers mentioned in this study, XpressGluco+, Accu Chek Insta, Oncall plus, Dr. Morepen, and SD CodeFree, will be assessed by comparing their measurements to laboratory reference methods. A correlation analysis will be conducted to determine the degree of agreement between the glucometer

readings and laboratory values. Additionally, the variability of measurements within each glucometer will be evaluated to assess its precision and consistency. It shows that the accuracy of these devices ranges from ~95% to ~97.5%, with AccuChek Insta being the most accurate at ~97.5%.<sup>5</sup> Xpress Gluco+ comes in at ~97%, followed by On Call Plus at ~96%.<sup>6</sup> Dr. Morepen and SD CodeFree both have an accuracy of ~95%.<sup>7</sup> It's important to note that the accuracy of a blood glucose monitoring system is influenced by various factors, including the type of blood sample used (capillary or venous), the technique used to obtain the sample, and the quality of the test strips. Therefore, it's crucial to follow the manufacturer's instructions carefully to ensure the most accurate results. Accuracy was measured from 30 tests performed with three different samples from all glucometers (low, normal and high) and the accuracy is calculated from the coefficient of variation.

Although, batch to batch variation is not discussed in this report, one single batch was used for the testings from all different models.

**Cost Comparison**

The table 2 provides a cost comparison of various blood glucose monitoring systems. It shows that the MRP (Maximum Retail Price) for these devices ranges from 1199/- to 1599/-, with Xpress Gluco+ being the most affordable at 1599/- for 100 strips. While all the devices come with 50 test strips, the Xpress Gluco+ comes with 100 strips. It's important to consider both the initial cost of the device and the ongoing cost of test strips when choosing a blood glucose monitoring system.

Here's a more detailed breakdown of the table:

*Cost*

The MRP of the devices ranges from 1199/- to 1599/-, with Xpress Gluco+ being the most affordable and AccuCheck Insta being the most expensive.

*Number of strips*

Lets bifurcate the strips from different companies for its cost. The cost per test strip varies depending on the MRP of the device. For example, Xpress Gluco+ has the lowest cost per test strip at 15.99/-.

*Make*

The devices are made by different companies from India.

It's important to note that the cost of test strips can vary depending on the brand and where you purchase them. It's also important to consider other factors when choosing a blood glucose monitoring system, such as accuracy, ease of use, and features.

If you are looking for an affordable and Made in India blood glucose monitoring system, Xpress Gluco+ is a good option. However, if you are looking for a system with more features,

**Table 1:** Comparative analysis of Accuracy of Different Blood Glucose Monitoring systems

Parameters	Xpress gluco+	Accucheck insta	On call plus	Dr. Morepen	Sd codefree
Accuracy*	97%	97.5% <sup>5</sup>	96% <sup>6,8</sup>	95%	95% <sup>7</sup>

\*Values are taken as per the reference given

**Table 2:** Comparative analysis of different Blood Glucose Monitoring systems

Parameters	Accurex	Accucheck insta	On call plus	Dr. Morepen	Sd codefree
Cost* (MRP)	1599/-	1549/-	1199/-	1514/-	1499/-
Number of Strips	100	50	50	50	50
Make	India	Germany	USA	India	S. Korea

\*Exact cost might vary

such as a larger display or data logging capabilities, you may want to consider a more expensive option.

#### Ease of use

Table 3 provides the complete comparison of ease of use of the different glucometers and its discussions are given below.

#### Make and Origin

##### Xpress gluco+

Made in India, offering features like trend indicator, high HCT range, and average data display.

##### Accucheck insta

Made in Germany, known for its beep alarm, post-meal indicator, and being the most accurate glucometer.

##### On call plus

Made in the USA, with features like one beep for sample alert and UK & ISO certification.

##### Dr. morepen

Made in India, offering alternate site testing.

##### SD Codefree

Made in South Korea, with pre and post-meal tracker.

#### Range (mg/dl)

All devices have a range of 20-600 mg/dl, except Xpress Gluco+, which has a wider range of 20-800 mg/dl.

#### Sample

- Most devices use fresh capillary whole blood.
- AccuChek Insta can also use capillary, venous, arterial, or neonatal blood.
- Other meters use capillary whole blood.

#### Test Time

- All devices have a quick test time of 5 seconds, except AccuChek Insta, which is slightly faster at <4 seconds.

#### Battery

- All devices use a CR2023, 3V battery.

#### Unit

- Most devices display results in mg/dl and mM/L.
- SD CodeFree only displays in mg/dl.
- Memory:
- Xpress Gluco+ has the highest memory capacity of 1000 tests with average data.
- AccuChek Insta has 720 tests with average data.
- On Call Plus and Dr. Morepen have 300 tests with average data.

- SD CodeFree has 500 tests.

#### Sample Volume

- All devices require a small sample volume of 0.5 µl, except SD CodeFree, which requires 0.9 µl.

#### Operating Temperature & Humidity

- All devices have almost similar operating temperature and humidity ranges.

#### HCT

- The HCT (hematocrit) range varies between devices.

#### Enzyme

All devices use the GOD (Glucose Oxidase) enzyme except for Accu Check which uses GDH (Glucose Dehydrogenase)

#### Error Display and Principle

All devices have an error display and use electrochemical principles.

#### Connectivity

Only AccuChek Insta has USB connectivity. The rest do not have connectivity options.

#### Additional Features

- Xpress Gluco+ has a trend indicator, high HCT range, and average data display.
- AccuChek Insta has a beep alarm, post-meal indicator, and is the most accurate glucometer.
- On Call Plus has a one-beep sample alert and UK & ISO certification.
- Dr. Morepen offers alternate site testing.
- SD CodeFree has a pre and post-meal tracker.

#### Overall

- If accuracy and additional features are priorities, AccuChek Insta is a good choice. But with higher cost.
- If a wider range and higher memory are important, Xpress Gluco+ is a good option.
- For a simple and affordable glucometer, Xpress Gluco+, Dr. Morepen or SD CodeFree might be suitable.

Note: It's essential to consider your specific needs and consult with your healthcare provider to determine the best glucometer for your situation.

#### Other points to remember before buying a glucometer

##### Cost

- *Initial cost*

Consider the upfront cost of the glucometer itself.

**Table 3:** Comparative analysis of functionalities of different blood glucose monitoring system

Parameters*	Xpress gluco+	Accucheck insta	On call plus <sup>8</sup>	Dr. Morepen	Sd codefree
Extra Features	Make in india, Trend indicator, High HCT range, Average data display	Beep alarm, post meal indicator, Most accurate glucometer	Beep on and off, UK and ISO certified	Alternate site for testing	Pre and post meal tracker
Make	India	Germany	USA	India	S. Korea
Range (mg/dl)	20-700	10-600	20-600	20-600 mg/dl	10-600 mg/dl
Sample	Fresh capillary whole blood, Alternative Test Sites	Capillary, venous, arterial, neonatal	Fresh capillary whole blood	Fresh capillary whole blood	Capillary Whole blood
Test Time	5 Sec	<4 Sec	10 Secs	5 Sec	5 Sec
Battery	CR2023, 3V	CR2023, 3V	CR2023, 3V	CR2023, 3V	CR2023, 3V
Unit	mg/dL & mM/L	mg/dL & mM/L	mg/dL & mM/L	mg/dL & mM/L	mg/dL
Memory	1000 (with average data)	720 (with average data)	300 Test	300 Test (with Average data)	500
Sample volume	0.5 µl	0.6 µl	1 µl	0.5 µl	0.9 µl
Operating Temperature	2-45 deg. cel.	4-30 deg. cel	5-45 deg. cel.	10-40 deg. cel.	10-45 deg. cel.
Operation Humidity	10-90%	n/a	20-90%	10-90%	10-90%
HCT	15-65%	10-65%	30-55%	35-50%	20-60%
Enzyme	GOD	GDH	GOD	GOD	GOD
Error Display	Yes	Yes	Yes	Yes	Yes
Principle	Electrochemistry	Electrochemistry	Electrochemistry	Electrochemistry	Electrochemistry
Connectivity	na	USB	na	na	na

\*Actual Spec. might vary slightly

• *Cost of test strips*

The cost of test strips can vary significantly between different brands.

• *Replacement costs*

Factor in the cost of replacing the glucometer after a certain period of use.

*Additional features*

• *Alternate site testing*

Some glucometers allow you to test your blood glucose levels on alternative sites like the forearm or upper arm, which can be less painful for frequent testing.

• *Voice guidance*

This feature can be helpful for visually impaired individuals.

• *Blood ketone testing*

Some glucometers can also measure ketone levels in your blood, which is important for people with type 1 diabetes.

*Personal preferences*

• *Size and portability*

Consider the size and weight of the glucometer, especially if you plan to carry it with you often.

• *Battery life*

A long battery life can reduce the need for frequent replacements.

• *Warranty*

A good warranty can provide peace of mind in case of any technical issues.

**CONCLUSION**

In conclusion, the manuscript provides a comprehensive comparison of various blood glucose monitoring systems. While all devices offer reliable blood glucose measurement, they differ in terms of features, accuracy, and ease of use. Factors like accuracy, test time, memory capacity, and additional features should be considered when selecting a glucometer. Users with specific needs, such as those requiring alternate site testing or a wider measurement range, may prioritize certain features over others. Accu Check Insta is the best glucometer when it comes to accuracy. But when we take the overall parameters like accuracy, cost, Extra features Xpress Gluco+ is the ideal choice. Still it is recommended to consult with a healthcare provider to determine the best glucometer for individual needs and preferences.

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